

The 2021 International Residential Code®: A Compilation of Wind Resistant Provisions

This document contains excerpts of the wind provisions from the 2021 edition of the IRC.

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Usage Note

This document provides the wind resistant provisions of the 2021 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 2021 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]*



FEMA

The IRC is a prescriptive-oriented (specification) code with some examples of performance code language.

[partial shown]

It is important to understand that the IRC contains coverage for what is conventional and common in residential construction practice. *[partial shown]*

Sections such as R301.1.3, R301.2.2.1.1, R320.1, M1301.1, G2401.1 and P2601.1 refer to other codes either as an alternative to the provisions of the IRC or where the IRC lacks coverage for a particular type of structure, design, system, appliance, or method of construction. *[partial shown]*

User Note: Wind related provisions and prescriptive requirements of the IRC are not to be used in areas where wind design is required as shown in Figure R301.2(5)B – hurricane prone areas with a design wind speed of 130mph or greater located south of the Virginia-North Carolina border and areas with a design wind speed of 140 mph or greater in the Northeastern US and Alaska.

Figure R301.2(5)B defines regions where specific wind design is required that is beyond the wind provisions of the IRC. The IRC does provide a list of other standards that are acceptable for higher design winds and provides guidance on their higher windspeed limitations of application.

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

Chapter 1 Scope and Administration. This chapter contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview. *[partial shown]*

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 for 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 activity.

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 AE 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 AH Patio Covers. Appendix AH 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 AR 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 AS 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 1 SCOPE AND ADMINISTRATION

SECTION R101 GENERAL

R101.2 Scope. The provisions of this code shall apply to the construction, *alteration*, movement, enlargement, replacement, *repair*, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and *townhouses* not more than three stories above *grade plane* in height with a separate means of egress and their *accessory structures* not more than three stories above *grade plane* in height. *[partial shown]*

SECTION R102 APPLICABILITY

R102.1 General. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

User Note: [Section R102.1 has proven useful in resolving conflicts between provisions of this code as well as between this code and other codes, including conflicts over wind load requirements.](#)

R102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections R102.4.1 and R102.4.2.

Exception: Where enforcement of a code provision would violate the conditions of the *listing* of the *equipment* or *appliance*, the conditions of the *listing* and manufacturer's instructions shall apply.

R102.4.1 Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

R102.4.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

User Note: Reference standards frequently include wind related provisions, and some provide both performance and prescriptive design requirements for areas where design wind speeds exceed the limits of applicability for IRC prescriptive provisions.

CHAPTER 2 DEFINITIONS

SECTION R202 DEFINITIONS

[RB]¹ ADDITION. An extension or increase in floor area, number of stories or height of a building or structure. *[partial shown]*

[RB] ALTERATION. Any construction, retrofit or renovation to an existing structure other than *repair* or *addition* that requires a *permit*. *[partial shown]*

[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(5)A.

[RB] BRACED WALL LINE. A straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.

[RB] BRACED WALL LINE, CONTINUOUSLY SHEATHED. A *braced wall line* with structural sheathing applied to all sheathable surfaces including the areas above and below openings.

[RB] BRACED WALL PANEL. A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors. The panel's length meets the requirements of its particular bracing method, and contributes toward the total amount of bracing required along its *braced wall line* in accordance with Section R602.10.1.

[RB] BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

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

¹ The "[RB]" indicates that the Building Code Development Committee is responsible for this portion of the code.

[RB] CRIPPLE WALL. A framed wall extending from the top of the foundation to the underside of the floor framing of the first story *above grade plane*.

[RB] DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements. Where the term “*diaphragm*” is used, it includes horizontal bracing systems.

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

[RB] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS). EIFS are nonstructural, nonload-bearing exterior wall cladding systems that consist of an insulation board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

[RB] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE. An EIFS that incorporates a means of drainage applied over a *water-resistive barrier*.

[RB] EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resistive barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural *trim* and embellishments such as cornices, soffits, and fascias.

[RE] FENESTRATION. Products classified as either vertical fenestration or *skylights and sloped glazing*, installed in such a manner as to preserve the weather-resistant barrier of the wall or roof in which they are installed. Fenestration includes products with glass or other transparent or translucent materials. *[partial shown]*

[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 US 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] IMPACT PROTECTIVE SYSTEM. Construction that has been shown by testing to withstand the impact of test missiles and that is applied, attached, or locked over exterior glazing.

[RB] LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an *approved agency* and that indicates that the representative sample of the product or material has been tested and evaluated by an *approved agency*. (See also “*Manufacturer’s designation*” and “*Mark.*”)

[RB] LABELED. Equipment, materials or products to which have been affixed a *label*, seal, symbol or other identifying *mark* of a nationally recognized testing laboratory, *approved agency* or other organization concerned with product evaluation that maintains periodic inspection of the production of such *labeled* items and whose labeling indicates either that the *equipment*, material or product meets identified standards or has been tested and found suitable for a specified purpose. For the definition applicable in Chapter 11, see Section N1101.6.

[RB] LIGHT-FRAME CONSTRUCTION. Construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

[RB] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of *listed equipment* or materials or periodic evaluation of services and whose listing states either that the *equipment*, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. For the definition applicable in Chapter 11, see Section N1101.6.

[RB] MANUFACTURER'S INSTALLATION INSTRUCTIONS. Printed instructions included with equipment as part of the conditions of their *listing* and *labeling*.

[RB] MEAN ROOF HEIGHT. The average of the roof eave height and the height to the highest point on the roof surface, except that eave height shall be used for roof angle of less than or equal to 10 degrees (0.18 rad).

[RB] METAL ROOF PANEL. An interlocking metal sheet having an installed weather exposure of not less than 3 square feet (0.28 m²) per sheet.

[RB] METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.28 m²) per sheet.

[RB] MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an *approved* ballast layer.

[RB] NAILABLE SUBSTRATE. A product or material such as framing, sheathing or furring, composed of wood or wood-based materials, or other materials and fasteners providing equivalent fastener withdrawal resistance.

[RB] PERFORMANCE CATEGORY. A designation of wood structural panels as related to the panel performance used in Chapters 4, 5, 6 and 8.

[RB] PHOTOVOLTAIC SHINGLES. A *roof covering* that resembles shingles and that incorporates *photovoltaic modules*.

[RB] POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for the loading deflections of the *roof deck*, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

[RB] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage. *[partial shown]*

[RB] REROOFING. The process of recovering or replacing an existing *roof covering*. See “Roof recover.” *[partial shown]*

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

[RB] ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a *roof covering* and *roof deck* or a single component serving as both the *roof covering* and the *roof deck*. A *roof assembly* can include an underlayment, thermal barrier, ignition barrier, insulation or a vapor retarder. *[partial shown]*

[RB] ROOF COATING. A fluid-applied, adhered coating used for roof maintenance or *roof repair*, or as a component of a *roof covering* system or *roof assembly*.

[RB] ROOF COVERING. The covering applied to the *roof deck* for weather resistance, fire classification or appearance.

[RB] ROOF COVERING SYSTEM. See “*Roof assembly*.”

[RB] ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

[RB] ROOF RECOVER. The process of installing an additional *roof covering* over a prepared existing roof covering without removing the existing roof covering. *[partial shown]*

[RB] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance. *[partial shown]*

[RB] ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*. *[partial shown]*

[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] SHINGLE FASHION. A method of installing roof or wall coverings, *water-resistive barriers*, flashing or other building components such that upper layers of material are placed overlapping lower layers of material to provide drainage and protect against water intrusion at unsealed penetrations and joints or in combination with sealed joints.

[RB] SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

[RB] SKYLIGHT, UNIT. A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the *roof assembly* while preserving the weather-resistant barrier of the roof.

[RB] SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. *Unit skylights, tubular daylighting devices* and glazing materials in solariums, *sunrooms*, roofs and sloped walls are included in this definition. *[partial shown]*

[RB] STACK BOND. The placement of *masonry units* in a bond pattern is such that head joints in successive courses are vertically aligned. For the purpose of this code, requirements for stack bond shall apply to all masonry laid in other than *running bond*.

[RB] STORM SHELTER. A building, structure or portion thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.

[RB] UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt, or other *approved* material over which a roof covering, with a slope of 2 units vertical in 12 units horizontal (17-percent slope) or greater, is applied.

[RB] VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used to cover exterior walls of buildings.

[RB] WALLS. Walls shall be defined as follows:

Load-bearing wall. A wall supporting any vertical load in addition to its own weight.

Nonbearing wall. A wall which does not support vertical loads other than its own weight.

[RB] WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

[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 an Exposure D condition exists upwind at the waterline and the ultimate design wind speed, V_{ult} , is 140 mph (63.6 m/s) or greater; or Hawaii.

[RB] WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are plywood, orientated strand board (OSB) or composite panels.

CHAPTER 3 BUILDING PLANNING

SECTION R301 DESIGN CRITERIA

R301.1 Application. Buildings and structures, and parts thereof, shall be constructed to safely support all loads, including dead loads, *live loads*, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures in accordance with the provisions of this code shall result in a system that provides a complete load path that meets the requirements for the transfer of loads from their point of origin through the load-resisting elements to the foundation. *[partial shown]*

R301.1.1 Alternative provisions. As an alternative to the requirements in Section R301.1, the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards, the design shall comply with the International Building Code.

1. AWC *Wood Frame Construction Manual* (WFCM).
2. AISI *Standard for Cold-Formed Steel Framing— Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).
3. ICC *Standard on the Design and Construction of Log Structures* (ICC 400).

R301.1.2 Construction systems. The requirements of this code are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

R301.1.3 Engineered design. Where a building of otherwise conventional construction contains structural elements exceeding the limits of Section R301 or otherwise not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the *International Building Code* is permitted for buildings and structures, and parts thereof, included in the scope of this code.

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.

Table R301.2. Provides the climatic and geographic design criteria.

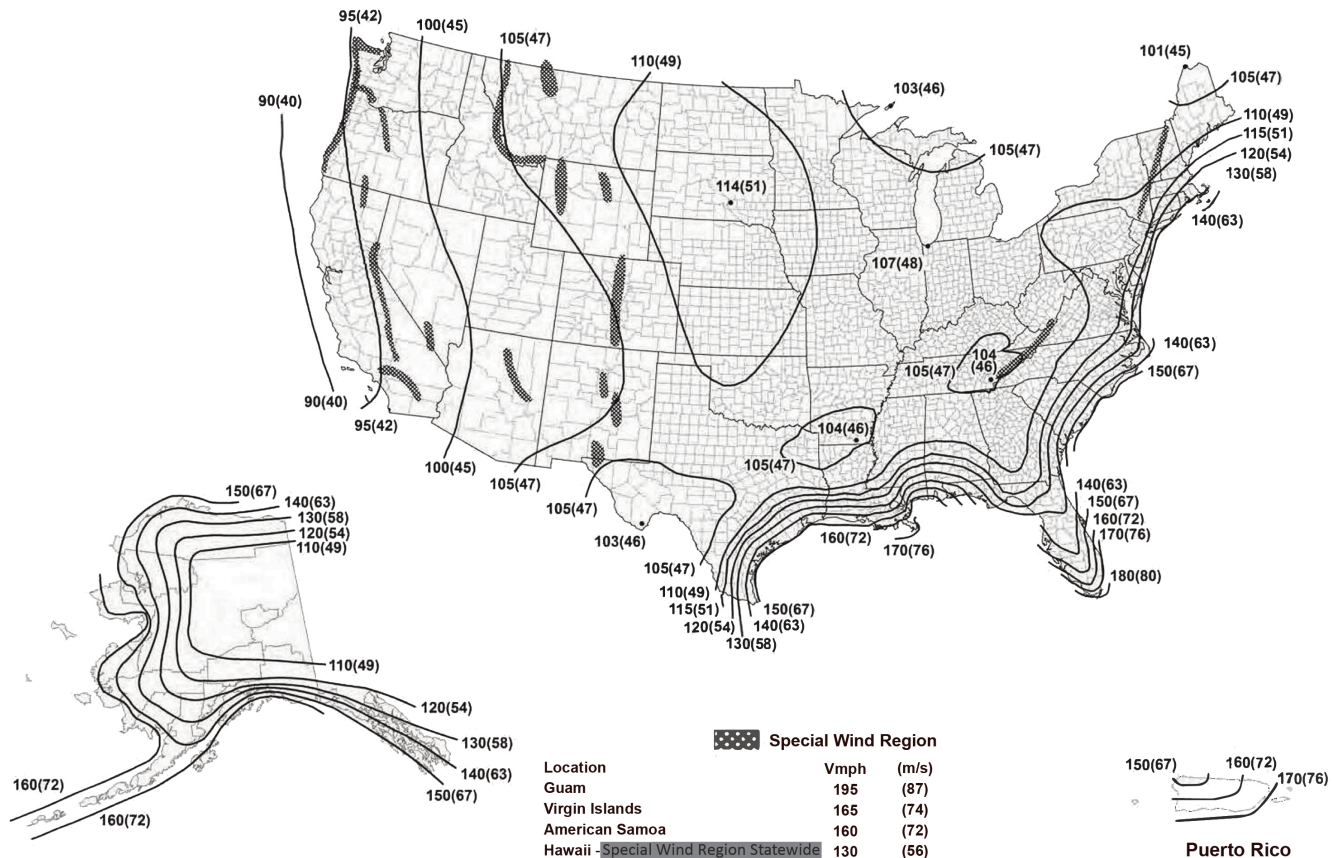
Table R301.2.1(1). Provides component and cladding loads for a building with a mean roof height of 30 feet located in exposure B. Figure R301.2.1, defines the wind pressure zones corresponding to the design pressures listed in Table R301.2.1(1).

User Note: There are errors in the values of the ULTIMATE DESIGN WIND SPEED, V_{ult} , listed across the top of Table R301.2.1(1) in the 1st printing of the 2021 IRC. The values in order from left to right should be: 90.0, 95.0, 100.0, 105.0, 110.0, 115.0, 120.0, 130.0, 140.0, 150.0, 160.0, 170.0, 180.0.

Table R301.2.1(2). Provides height and exposure adjustment coefficients for Table R301.2.1(1).

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 as determined from Figure R301.2(2). 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 R301.2.1(1) adjusted for height and exposure using Table

R301.2.1(2) 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. *Metal roof shingles* shall be designed for wind speeds in accordance with Section R905.4.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11 from the *roof assembly* to the foundation. Where ultimate design wind speeds in Figure R301.2(2) are less than the lowest wind speed indicated in the prescriptive provisions of this code, the lowest wind speed indicated in the prescriptive provisions of this code shall be used.



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation 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.atccouncil.org/windspeed.

FIGURE R301.2(2). 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 301.2.1.1, or where the ultimate design wind speed, V_{ult} , in Figure R301.2(2) equals or exceeds 140 miles per hour (225kph) 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 R301.2.1.1, or where the ultimate design wind speed, V_{ult} , in Figure R301.2(2) equals or exceeds 140 miles per hour (225 kph) 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.

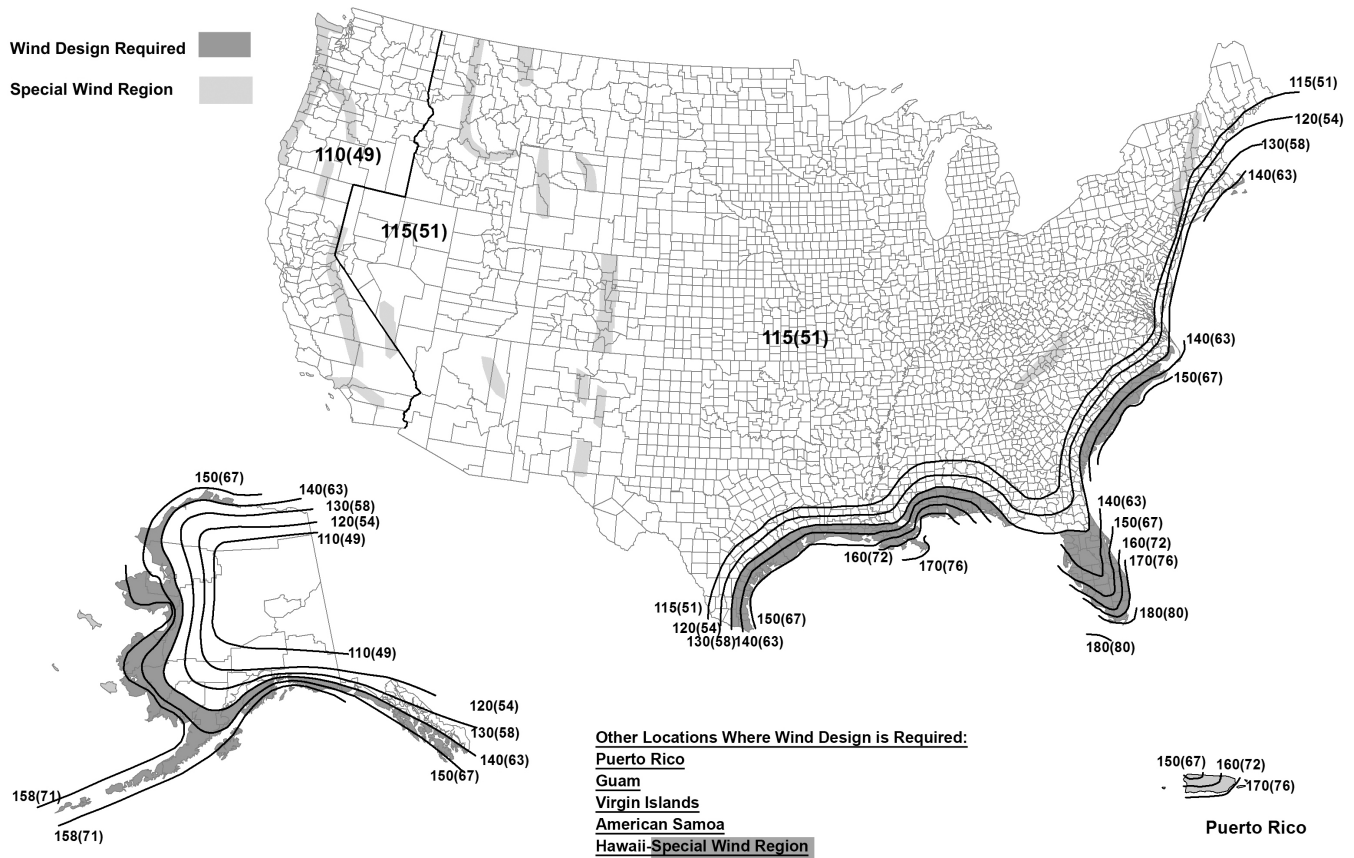


FIGURE 301.2.1.1 REGIONS WHERE WIND DESIGN IS REQUIRED

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 0.5mm (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 1886 and ASTM E 1996 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 R301.2.1(1) 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 (67 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(2) shall be converted to nominal design wind speeds, V_{asd} , using Table R301.2.1.3.

TABLE R301.2.1.3. WIND SPEED CONVERSIONS^a

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 *dwelling*s, 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 on 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 1 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 *dwelling*s 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 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 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 highside 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.

R301.2.2.7 Height limitations. Wood-framed buildings shall be limited to three *stories* above *grade plane* or the limits given in Table R602.10.3(3). Wood-framed buildings in Seismic Design Category D₂ exceeding two *stories* shall be designed for wind and seismic loads in accordance with accepted engineering practice. Cold-formed steel-framed buildings shall be limited to less than or equal to three *stories* above *grade plane* in accordance with AISI S230. *Mezzanines* as defined in Section R202 that comply with Section R325 shall not be considered as *stories*. *Structural insulated panel* buildings shall be limited to two *stories* above *grade plane*.

User Note: Section R301.2.4 (below) 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, and substantial improvement and *repair* 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).

Exception: A *story height* not exceeding 13 feet 7 inches (4140 mm) is permitted provided that the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10. Studs shall be laterally supported at the top and bottom plate in accordance with Section R602.3.

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 not be more than 11 feet 7 inches (3531 mm) and the bearing wall height per story as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

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

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.

SECTION R308 GLAZING

R308.6.9.1 Comparative analysis for glass-glazed unit skylights. Structural wind load design pressures for glass-glazed *unit skylights* different than the size tested in accordance with Section R308.6.9 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:

1. Structural wind load design pressures for glass glazed *unit skylights* smaller than the size tested in accordance with Section R308.6.9 shall be permitted to be higher than the design value of the tested unit provided that such higher pressures are determined by accepted engineering analysis. Components of the smaller unit shall be the same as those of the tested unit. Such calculated design pressures shall be validated by an additional test of the glass-glazed *unit skylight* having the highest allowable design pressure.
2. In accordance with WDMA I.S.11.

SECTION R316 FOAM PLASTIC

R316.8 Wind resistance. Foam plastic insulation complying with ASTM C578 and ASTM C1289 and used as exterior wall sheathing on framed wall assemblies shall comply with SBCA FS 100 for wind pressure resistance unless installed directly over a sheathing material that is separately capable of resisting the wind load or otherwise exempted from the scope of SBCA FS 100.

[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 and substantial improvement and *repair* 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.

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 and shall comply with the following:

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) and pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling.
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.

R322.3.5 Walls below required elevation. Walls and partitions are permitted below the elevation required in Section R322.3.2, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and

2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a *registered design professional* that:
 - 4.1. The walls and partitions below the required elevation have been designed to collapse from a water load less than that which would occur during the base flood.
 - 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.
5. Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.

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 500.

R323.1.1 Sealed documentation. The *construction documents* for all structural components and *impact protective systems* of the *storm shelter* shall be prepared and sealed by a *registered design professional* indicating that the design meets the criteria of ICC 500.

Exception: *Storm shelters*, structural components and impact-protective systems that are *listed* and *labeled* to indicate compliance with ICC 500.

SECTION R324 SOLAR ENERGY SYSTEMS

R324.4 Rooftop-mounted photovoltaic systems. Rooftop-mounted *photovoltaic panel systems* installed on or above the roof covering shall be designed and installed in accordance with this section.

R324.4.1.2 Wind load. Rooftop-mounted *photovoltaic panel or module systems* and their supports shall be designed and installed to resist the component and cladding loads specified in Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2).

R324.5 Building-integrated photovoltaic systems. Building-integrated photovoltaic (BIPV) systems that serve as roof coverings shall be designed and installed in accordance with Section R905.

R324.5.1 Photovoltaic shingles. Photovoltaic shingles shall comply with Section R905.16.

[User Note: Sections R905 and R905.16 specify wind design requirements for these systems.](#)

CHAPTER 4 FOUNDATIONS

SECTION R401 GENERAL

R401.2 Requirements. Foundation construction shall be capable of accommodating all loads in accordance with Section R301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice.

SECTION R403 FOOTINGS

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems that shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. *[partial shown]*

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 R501 GENERAL

R501.2 Requirements. Floor construction shall be capable of accommodating all loads in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

SECTION R502 WOOD FLOOR FRAMING

R502.11 Wood trusses.

R502.11.4 Truss design drawings. *Truss design drawings* shall include, at a minimum, the information specified as follows: *[partial shown]*

4. Design loads as applicable:

4.6. Controlling wind and earthquake loads.

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 140 miles per hour (63 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).

R505.3 Floor construction. Cold-formed steel floors shall be constructed in accordance with this section.

R505.3.1 Floor-to-foundation or load-bearing wall connections. Cold-formed steel-framed floors shall be anchored to foundations, wood sills or *load-bearing walls* in accordance with Table R505.3.1(1) and Figure R505.3.1(1), R505.3.1(2), R505.3.1(3), R505.3.1(4), R505.3.1(5) or R505.3.1(6). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Continuous cold-formed steel joists supported by interior *load-bearing walls* shall be constructed in accordance with Figure R505.3.1(7). Lapped cold-formed steel joists shall be constructed in accordance with Figure R505.3.1(8). End floor joists constructed on foundation walls parallel to the joist span shall be doubled unless a C-shaped bearing stiffener, sized in accordance with Section R505.3.4, is installed web-to-web with the floor joist beneath each supported wall stud, as shown in Figure R505.3.1(9). Fastening of cold-formed steel joists to other framing members shall be in accordance with Section R505.2.5 and Table R505.3.1(2).

Table R505.3.1(1). Specifies floor-to-foundation or bearing wall connection requirements based on basic ultimate wind speed (mph) and exposure.

SECTION R507 EXTERIOR DECKS

R507.3 Footings. *[partial shown]* Decks shall be supported on concrete footings or other *approved* structural systems designed to accommodate all loads in accordance with Section R301. Deck footings shall be sized to carry the imposed loads from the deck structure to the ground as shown in Figure R507.3.

R507.8 Vertical and lateral supports. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. For decks with cantilevered framing members, connection to exterior walls or other framing members shall be designed and constructed to resist uplift resulting from the full *live load* specified in Table R301.5 acting on the cantilevered portion of the deck. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting.

R507.9.2 Lateral connection. Lateral loads shall be transferred to the ground or to a structure capable of transmitting them to the ground. Where the lateral load connection is provided in accordance with Figure R507.9.2(1), hold-down tension devices shall be installed in not less than two locations per deck, within 24 inches (610 mm) of each end of the deck. Each device shall have an allowable stress design capacity of not less than 1,500 pounds (6672 N). Where the lateral load connections are provided in accordance with Figure R507.9.2(2),

the hold-down tension devices shall be installed in not less than four locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds (3336 N).

[Figures R507.9.2\(1\) and R507.9.2\(2\)](#). Illustrate a deck attachment for lateral loads.

CHAPTER 6 WALL CONSTRUCTION

SECTION R601 GENERAL

R601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

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 Figures 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 R301.2.1(1) adjusted for height and exposure using Table R301.2.1(2) 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 ground 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 140 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 (305 mm) on center. Studs shall be No. 2 grade lumber or better.

3. Exterior load-bearing studs not exceeding 12 feet (3658 mm) in height provided in accordance with Table R602.3(6). The minimum number of full-height studs adjacent to openings shall be in accordance with Section R602.7.5. The building shall be located in Exposure B, the roof *live load* shall not exceed 20 psf (0.96 kPa), and the ground snow load shall not exceed 30 psf (1.4 kPa). Studs and plates shall be No. 2 grade lumber or better.

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

Table R602.3(6). Provides alternate wood bearing wall stud size, height and spacing.

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.

R602.7.5 Supports for headers. Headers shall be supported on each end with one or more jack studs or with *approved* framing anchors in accordance with Table R602.7(1) or R602.7(2). The full-height stud adjacent to each end of the header shall be end nailed to each end of the header in accordance with Table R602.3(1). The minimum number of full-height studs at each end of a header shall be in accordance with Table R602.7.5.

Table R602.7.5. Specifies minimum number of full-height studs at each end of headers in exterior walls based on ultimate design wind speed and exposure category.

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, *braced wall lines* shall be designated as straight lines in the building plan placed in accordance with this section.

R602.10.1.1 Length of a braced wall line. The length of a *braced wall line* shall be the distance between its ends. The end of a *braced wall line* shall be the intersection with a perpendicular *braced wall line*, an angled *braced wall line* as permitted in Section R602.10.1.4 or an exterior wall as shown in Figure R602.10.1.1.

R602.10.1.2 Location of braced wall lines and permitted offsets. Each *braced wall line* shall be located such that no more than two-thirds of the required *braced wall panel* length is located to one side of the *braced wall line*. Braced wall panels shall be permitted to be offset up to 4 feet (1219 mm) from the designated *braced wall line*. Braced wall panels parallel to a *braced wall line* shall be offset not more than 4 feet (1219 mm) from the designated *braced wall line* location as shown in Figure R602.10.1.1.

Exterior walls parallel to a *braced wall line* shall be offset not more than 4 feet (1219 mm) from the designated *braced wall line* location as shown in Figure R602.10.1.1.

Interior walls used as bracing shall be offset not more than 4 feet (1219 mm) from a *braced wall line* through the interior of the building as shown in Figure R602.10.1.1.

Figure R602.10.1.1. Provides illustrations concerning maximum allowable offsets between braced wall segments in order for them to be included in a braced wall line that is consistent with the prescriptive provisions of the IRC.

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 R602.10.1.3. Provides maximum limits for spacing between braced wall lines and indicates that there are no limits to the maximum spacing of 60 feet based on wind loading provided the design wind speed is less than 140 mph.

R602.10.1.4 Angled walls. Any portion of a wall along a *braced wall line* shall be permitted to angle out of plane for a maximum diagonal length of 8 feet (2438 mm). Where the angled wall occurs at a corner, the length of the *braced wall line* shall be measured from the projected corner as shown in Figure R602.10.1.4. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered to be a separate *braced wall line* and shall be braced in accordance with Section R602.10.1.

Figure R602.10.1.4. Illustrates the projected length of braced wall segments for angled walls.

R602.10.2 Braced wall panels. *Braced wall panels* shall be full-height sections of wall that shall not have vertical or horizontal offsets. *Braced wall panels* shall be constructed and placed along a *braced wall line* in accordance with this section and the bracing methods specified in Section R602.10.4.

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.

R602.10.2.2 Locations of braced wall panels. A *braced wall panel* shall begin within 10 feet (3810 mm) from each end of a *braced wall line* as determined in Section R602.10.1.1. The distance between adjacent edges of braced wall panels along a *braced wall line* shall be not greater than 20 feet (6096 mm) as shown in Figure R602.10.2.2. *[partial shown]*

Figure 602.10.2.2 illustrates acceptable locations of braced wall panels.

R602.10.2.3 Minimum number of braced wall panels. *Braced wall lines* with a length of 16 feet (4877 mm) or less shall have not less than two *braced wall panels* of any length or one *braced wall panel* equal to 48 inches (1219 mm) or more. *Braced wall lines* greater than 16 feet (4877 mm) shall have not less than two *braced wall panels*.

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(1). Provides bracing requirements based on wind speed.

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

User Note: Tables R602.10.3(3) and R602.10.3(4) provide bracing lengths and adjustment factors depending on seismic design category.

R602.10.4 Construction methods for braced wall panels. Intermittent and continuously sheathed *braced wall panels* shall be constructed in accordance with this section and the methods listed in Table R602.10.4.

Table 602.10.4 Provides descriptions of various intermittent and continuous wall bracing methods including abbreviations used to describe them and construction details including bracing material thickness and connection criteria.

R602.10.4.1 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.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a *braced wall line* shall be permitted. Intermittent methods ABW, PFH and PFG shall be permitted to be used along a *braced wall line* with continuous sheathed methods, provided that the length of required bracing for that *braced wall line* is determined in accordance with Table R602.10.3(1) or R602.10.3(3) using the highest value of the bracing methods used.

R602.10.4.2 Continuous sheathing methods. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a *braced wall line* including areas above and below openings and gable end walls and shall meet the requirements of Section R602.10.7.

User Note: Sections R602.10.4.3 and R602.10.4.4 provide generic prescriptive guidance for braced wall panel interior finish material and panel joint construction and have not been reproduced here.

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.

R602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Tables R602.10.3(1) and R602.10.3(3), the contributing length of each *braced wall panel* shall be as specified in Table R602.10.5.

R602.10.6 Construction of Methods ABW, PFH, PFG, CS-PF and BV-WSP². Methods ABW, PFH, PFG, CS-PF and BV-WSP shall be constructed as specified in Sections R602.10.6.1 through R602.10.6.5.

² 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

R602.10.6.1 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.

R602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH *braced wall panels* shall be constructed in accordance with Figure R602.10.6.2.

R602.10.6.3 Method PFG: Portal frame at garage door openings in Seismic Design Categories A, B and C. Where supporting a roof or one story and a roof, a Method PFG *braced wall panel* constructed in accordance with Figure R602.10.6.3 shall be permitted on either side of garage door openings.

R602.10.6.4 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.

Figures R602.10.6.2, R602.10.6.3 and R602.10.6.4. Provide details for methods PFH, PFG, and CS-PF, continuously sheathed portal frame panel construction, respectively.

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 Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D₀, D₁ and D₂. [partial shown]

Where stone and masonry veneer are installed in accordance with Section R703.8, wall bracing on exterior *braced wall lines* and *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supporting veneered walls shall comply with this section.

R602.10.6.5.4 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 either with Table R602.10.6.5.4 when using Method BV-WSP, or Table R602.10.3(3) as adjusted by the factors in Table R602.10.3(4) when using Method WSP or CS-WSP. [partial shown]

R602.10.7 Ends of braced wall lines with continuous sheathing. Each end of a *braced wall line* with continuous sheathing shall have one of the conditions shown in Figure R602.10.7.

Figure R602.10.7 Illustrates required bracing requirements for braced wall lines constructed using the continuous sheathing option.

R602.10.10 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively, except that the length of cripple wall bracing shall

be multiplied by a factor of 1.15. Where gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables R602.10.3(2) and R602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase.

R602.10.10.3 Redesignation of cripple walls. Where all cripple wall segments along a *braced wall line* do not exceed 48 inches (1219 mm) in height, the cripple walls shall be permitted to be redesignated as a first story wall for purposes of determining wall bracing requirements. Where any cripple wall segment in a *braced wall line* exceeds 48 inches (1219 mm) in height, the entire cripple wall shall be counted as an additional story. If the cripple walls are redesignated, the stories above the redesignated story shall be counted as the second and third stories, respectively.

R602.11 Wall anchorage. *Braced wall line* sills shall be anchored to concrete or masonry foundations in accordance with Sections R403.1.6 and R602.11.1.

[User Note: Section R602.11.1 addresses seismic limitations.](#)

R602.12 Simplified wall bracing. Buildings meeting all of the following conditions shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of Section R602.10, except as specified herein, shall not be permitted. [partial shown]

3. Wall height shall not be greater than 10 feet (3048 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
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.

R602.12.1 Circumscribed rectangle. The bracing required for each building shall be determined by circumscribing a rectangle around the entire building on each floor as shown in Figure R602.12.1. The rectangle shall surround all enclosed offsets and projections such as sunrooms and attached garages. Open structures, such as carports and decks, shall be permitted to be excluded. The rectangle shall not have a side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be not greater than 3:1.

Figure R602.12 Illustrates rectangle circumscribing of an enclosed building.

R602.12.2 Sheathing materials. The following sheathing materials installed on the exterior side of exterior walls shall be used to construct a bracing unit as defined in Section R602.12.3. Mixing materials is prohibited.

1. Wood structural panels with a minimum thickness of 3/8 inch (9.5 mm) fastened in accordance with Table R602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of 1/2 inch (12.7 mm) fastened in accordance with Table R602.3(1).

R602.12.3 Bracing unit. A bracing unit shall be a full-height sheathed segment of the exterior wall without openings or vertical or horizontal offsets and a minimum length as specified herein. Interior walls shall not contribute toward the amount of required bracing. Mixing of Items 1 and 2 is prohibited on the same story.

1. Where all framed portions of all exterior walls are sheathed in accordance with Section R602.12.2, including wall areas between bracing units, above and below openings and on gable end walls, the minimum length of a bracing unit shall be 3 feet (914 mm).
2. Where the exterior walls are braced with sheathing panels in accordance with Section R602.12.2 and areas between bracing units are covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

R602.12.4 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 R602.12.1 Illustrates a rectangle circumscribing an enclosed building.

Table R602.12.4. Provides minimum number of bracing units on each side of the circumscribed rectangle as a function of design wind speed.

SECTION R603 COLD-FORMED STEEL WALL FRAMING

R603.1.1 Applicability limits. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 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). [partial shown]

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 as a function of design wind speed and exposure category.

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(1) or R603.3.1.1(2).

Tables R603.3.1.1(1) and R603.3.1.1(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 ground 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 for 24, 28, 32, 36 and 40 Foot-Wide buildings (respectively) supporting roof and ceiling only.

Tables R603.3.2(7), (8), (9), (10) and (11). Provides detail for 24, 28, 32, 36 and 40-Foot-Wide buildings (respectively) supporting one floor, roof and ceiling.

Tables R603.3.2(12), (13), (14), (15) and (16). Provides detail for 24, 28, 32, 36 and 40-Foot-Wide buildings (respectively) 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 details on gable endwall to floor connection requirements.

Table R603.3.1.1(2). Provides details 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.

R603.7 Jack and king studs. The number of jack and king studs installed on each side of a header shall comply with Table R603.7(1). King, jack and cripple studs shall be of the same dimension and thickness as the adjacent wall studs. Headers shall be connected to king studs in accordance with Table R603.7(2). [partial shown]

Table R603.7(2) Provides header to king stud connection requirements as a function of design wind speed and exposure category.

R603.8 Head and sill track. Head track spans above door and window openings and sill track spans beneath window openings shall comply with Table R603.8. For openings less than 4 feet (1219 mm) in height that have both

a head track and a sill track, multiplying the spans by 1.75 shall be permitted in Table R603.8. For openings less than or equal to 6 feet (1829 mm) in height that have both a head track and a sill track, multiplying the spans in Table R603.8 by 1.50 shall be permitted.

Table R603.8 provides allowable head and sill track span as a function of design wind speed and exposure category.

R603.9 Structural sheathing. Structural sheathing shall be installed in accordance with Figure R603.9 and this section on all sheathable exterior wall surfaces, including areas above and below openings.

Figure R603.9 Illustrates definitions used to describe structural sheathing fastener patterns.

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 details on the minimum percentage of full-height structural sheathing on exterior walls as a function of design wind speed and exposure category.

Table R603.9.2(2) Provides full-height sheathing length adjustment factors.

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 Uplift connection requirements. Uplift connections shall be provided in accordance with this section.

R603.9.4.1 Ultimate design wind speeds greater than 130 mph. Where ultimate design wind speeds exceed 130 miles per hour (58 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 F8.2, as required for 140 miles per hour (63 m/s), Exposure Category C.

SECTION R606 GENERAL MASONRY CONSTRUCTION

R606.4.4 Parapet walls. Unreinforced solid masonry parapet walls shall be not less than 8 inches (203 mm) thick and their height shall not exceed four times their thickness. Unreinforced hollow unit masonry parapet walls shall be not less than 8 inches (203 mm) thick, and their height shall not exceed three times their thickness. Masonry parapet walls in areas subject to wind loads of 30 pounds per square foot. [partial shown]

R606.11 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in Figure R606.11(1), R606.11(2) or R606.11(3). Footings shall be permitted to be considered as points of lateral support.

Figure R606.11(1). Provides anchorage requirements for masonry walls located in seismic design category A, B, or C and where wind loads are less than 30 psf.

SECTION R607 GLASS UNIT MASONRY

R607.4 Isolated panels. Isolated panels of glass unit masonry shall conform to the requirements of this section.

R607.4.1 Exterior standard-unit panels. The maximum area of each individual standard-unit panel shall be 144 square feet (13.4 m²) where the design wind pressure is 20 pounds per square foot (958 Pa). The maximum area of such panels subjected to design wind pressures other than 20 pounds per square foot (958 Pa) shall be in accordance with Figure R607.4.1. The maximum panel dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

Figure R607.4.1 Provides a curve indicating the maximum allowable area of the panel, in square feet, versus design wind speed for glass unit masonry.

R607.4.2 Exterior thin-unit panels. The maximum area of each individual thin-unit panel shall be 85 square feet (7.9 m²). The maximum dimension between structural supports shall be 15 feet (4572 mm) in width or 10 feet (3048 mm) in height. Thin units shall not be used in applications where the design wind pressure as stated in Table R301.2.1(1) exceeds 20 pounds per square foot (958 Pa).

SECTION R608 EXTERIOR CONCRETE WALL CONSTRUCTION

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ACI 318 or ACI 332. *[partial shown]*

R608.2 Applicability limits. *[partial shown]* Walls constructed in accordance with the provisions of this section shall be limited to buildings subjected to a maximum design wind speed of 160 mph (72 m/s) Exposure B, 136 mph (61 m/s) Exposure C and 125 mph (56 m/s) Exposure D. *[partial shown]*

Buildings that are not within the scope of this section shall be designed in accordance with PCA 100 or ACI 318.

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). *[partial shown]*

Tables R608.6(1), R608.6(2), R608.6(3) and R608.6(4). Provide minimum vertical reinforcement for various types of concrete walls as a function of design wind speed and exposure category.

R608.7 Solid walls for resistance to lateral forces.

R608.7.1 Length of solid wall. Each exterior wall line in each story shall have a total length of solid wall required by Section R608.7.1.1. A solid wall is a section of flat, waffle-grid or screen-grid wall, extending the full story height without openings or penetrations, except those permitted by Section R608.7.2. Solid wall segments that contribute to the total length of solid wall shall comply with Section R608.7.2.

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 R608.7.1.1(1) through (3) to determine the unreduced total length, UR , of solid wall required in each exterior endwall line and sidewall line. For buildings with a mean roof height of less than 35 feet (10 668 mm), the unreduced values determined from Tables R608.7.1.1(1) through (3) are permitted to be reduced by multiplying by the applicable factor, R_1 , from Table R608.7.1.1(4); however, reduced values shall be not less than the minimum values in Tables R608.7.1.1(1) through (3). *[partial shown]*

Tables R608.7.1.1(1) through (3). Provide unreduced length of solid wall required in endwalls as a function of design wind speed and exposure category.

Table R608.7.1.1(4). Provides reduction factors for buildings with mean roof height less than 35 feet for different wind exposure categories.

Table R608.7.1.1(5). Provides reduction factors for floor-to-ceiling wall heights less than 10 feet based on wind perpendicularity or parallelism with ridge.

R608.9.1 Connections between concrete walls and light-framed floor, ceiling and roof systems. Connections between concrete walls and light-framed floor, ceiling and roof systems using the prescriptive details of Figures R608.9(1) through R608.9(12) shall comply with this section and Sections R608.9.2 and R608.9.3.

Figures R608.9(1) through R608.9(12). Provide prescriptive details for connections between concrete walls and light-framed floor, ceiling and roof systems. Accompanying Tables with the same numbers (R608.9(1) through R608.9(12)) provide limitations of use of the details based on design wind speed and exposure category.

R608.9.2 Connections between concrete walls and light-frame floor systems. Connections between concrete walls and light-frame floor systems shall be in accordance with one of the following. *[partial shown]*

User Note: The options provide a variety of codes and standards related to the materials being connected to the concrete walls.

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

User Note: The options provide a variety of codes and standards related to the materials being connected to the concrete walls.

R608.10 Floor, roof and ceiling diaphragms. Floors and roofs in buildings with exterior walls of concrete shall be designed and constructed as diaphragms. Where gable-end walls occur, ceilings shall be designed and constructed as diaphragms. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as diaphragms shall comply with the applicable requirements of this code, or AWC WFCM or AISI S230, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

SECTION R609 EXTERIOR WINDOWS AND DOORS

R609.2 Performance. Exterior windows and doors shall be capable of resisting the design wind loads specified in Table R301.2.1(1) adjusted for height and exposure in accordance with Table R301.2.1(2) or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. For exterior windows and doors tested in accordance with Sections R609.3 and R609.5, required design wind pressures determined from ASCE 7 using the ultimate strength design (USD) are permitted to be multiplied by 0.6. 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*. Design wind loads for exterior glazing not a part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code*.

R609.3 Testing and labeling. Exterior windows and sliding doors shall be tested by an *approved* independent laboratory, and bear a *label* identifying manufacturer, performance characteristics and *approved* inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and *labeled* as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or AMD 100, or comply with Section R609.5. *[partial shown]*

R609.3.1 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:

1. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section R609.3 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. Components of the smaller unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.
2. In accordance with WDMA I.S.11.

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

R609.4.1 Garage door labeling. Garage doors shall be *labeled* with a permanent *label* provided by the garage door 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.

R609.5 Other exterior window and door assemblies. Exterior windows and door assemblies not included within the scope of Section R609.3 or R609.4 shall be tested in accordance with ASTM E330. Glass in assemblies covered by this exception shall comply with Section R308.5.

R609.6 Windborne debris protection. Protection of exterior windows, glass doors and doors with glass 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 the manufacturer, performance characteristics and an *approved* inspection agency to indicate compliance with the requirements of the following specification(s):

1. ASTM E1886 and ASTM E1996; or
2. AAMA 506.

R609.6.2 Impact protective systems testing and labeling. *Impact protective systems* shall be tested for impact resistance by an *approved* independent laboratory for compliance with ASTM E1886 and ASTM E1996. *Impact protective systems* shall be tested for design wind pressure by an *approved* independent laboratory for compliance with ASTM E330. Required design wind pressures shall be determined in accordance with Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2) or determined in accordance with ASCE 7. For the purposes of this section, design wind pressures determined in accordance with ASCE 7 are permitted to be multiplied by 0.6.

Impact protective systems bear a *label* identifying the manufacturer, performance characteristics and an *approved* inspection agency. *Impact protective systems* shall have a permanent *label* providing traceability to the manufacturer, product designation and performance characteristics. The permanent *label* shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

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.

R609.8 Mullions. Mullions shall be tested by an *approved* testing laboratory in accordance with AAMA 450, or be engineered in accordance with accepted engineering practice. Mullions tested as stand-alone units or qualified by

engineering shall use performance criteria cited in Sections R609.8.1, R609.8.2 and R609.8.3. Mullions qualified by an actual test of an entire assembly shall comply with Sections R609.8.1 and R609.8.3.

R609.8.1 Load transfer. Mullions shall be designed to transfer the design pressure loads applied by the window and door assemblies to the rough opening substrate.

R609.8.2 Deflection. Mullions shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without deflecting more than $L/175$, where L is the span of the mullion in inches.

R609.8.3 Structural safety factor. Mullions shall be capable of resisting a load of 1.5 times the design pressure loads applied by the window and door assemblies to be supported without exceeding the appropriate material stress levels. If tested by an *approved* laboratory, the 1.5 times the design pressure load shall be sustained for 10 seconds, and the permanent deformation shall not exceed 0.4 percent of the mullion span after the 1.5 times design pressure load is removed.

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) in 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).

Framing shall be attached in accordance with Table R602.3(1) unless otherwise provided for in Section R610.

Tables R610.5(1) and R610.5(2). Provide minimum wall thickness as a function of design wind speed and exposure category.

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

CHAPTER 7 WALL COVERING

SECTION R702 INTERIOR COVERING

R702.3.6 Horizontal gypsum board diaphragm ceilings. Gypsum board and gypsum panel products shall be permitted on wood joists to create a horizontal diaphragm in accordance with Table R702.3.6. *[partial shown]*

User Note: Shear capacity values listed in Table R702.3.6 are not cumulative with other horizontal *diaphragm* values and are for short-term loading caused by wind or seismic. Values shall be reduced by 25 percent for normal loading.

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 R301.2.1(1) and R301.2.1(2). Wind-pressure resistance of the siding and backing materials shall be determined by ASTM E330 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, soffit 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, soffit and the backing material resist wind load as an assembly, use of the design capacity of the assembly shall be permitted.

R703.3 Wall covering nominal thickness and attachments. The nominal thickness and attachment of exterior wall coverings shall be in accordance with Table R703.3(1), the wall covering material requirements of this section, and the wall covering manufacturer's installation instructions. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Sections R703.15 through R703.17. *[partial shown]*

R703.3.2 Wind limitations. Where the design wind pressure exceeds 30 psf or where the limits of Table R703.3.2 are exceeded, the attachment of wall coverings and soffits shall be designed to resist the component and cladding loads specified in Table R301.2.1(1) for walls, adjusted for height and exposure in accordance with Table R301.2.1(2). For the determination of wall covering and soffit attachment, component and cladding loads shall be determined using an effective wind area of 10 square feet (0.93 m²).

Table R703.3.2. Limits for attachment per table R703.3(1)

R703.8 Anchored stone and masonry veneer, general. Anchored stone and masonry veneer shall be installed in accordance with this chapter, Table R703.3(1) and Figures R703.8(1) and R703.8(2). *[partial shown]*

R703.8.4 Anchorage. Masonry veneer shall be anchored to the supporting wall studs with corrosion-resistant metal ties embedded in mortar or grout and extending into the veneer a minimum of 1 ½ inches (38 mm), with not less than 5/8-inch (15.9 mm) mortar or grout cover to outside face. Masonry veneer shall conform to Table R703.8.4(1). Where the masonry veneer tie attachment is fastened to wood structural panel not less than 7/16 performance category through insulating sheathing not greater than 2 inches (51 mm) in thickness, see Table R703.8.4(2). Where Table R703.8.4(2) is used, attachment to the studs behind the sheathing is not required.

Table R703.8.4(1). Provides tie attachment and airspace requirements.

Table R703.8.4(2). Provides required tie spacing for direct application to wood structural panel sheathing by design wind speed and exposure category.

R703.8.4.1 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 m²) of wall area.

R703.11 Vinyl siding. Vinyl siding shall be certified and *labeled* as conforming to the requirements of ASTM D3679 by an *approved* quality control agency.

R703.11.2 Installation over foam plastic sheathing. Where *vinyl siding* or *insulated vinyl siding* is installed over foam plastic sheathing, the vinyl siding shall comply with Section R703.11 and shall have a wind load design pressure rating in accordance with Table R703.11.2.

Exceptions:

1. 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 Sections R703.3.3 and R703.11.1.
2. Where the vinyl siding manufacturer's product specifications provide an *approved* wind load design pressure rating for installation over foam plastic sheathing, use of this wind load design pressure rating shall be permitted and the siding shall be installed in accordance with the *manufacturer's installation instructions*.
3. Where the foam plastic sheathing and its attachment have a design wind pressure resistance complying with Sections R316.8 and R301.2.1, the vinyl siding shall be installed in accordance with Sections R703.3.3 and R703.11.1.

Table R703.11.2. Provides adjusted minimum design wind pressure requirements for vinyl siding.

R703.17 Cladding attachment over foam sheathing to masonry or concrete wall construction. Cladding shall be specified and installed in accordance with Section 703.3 and the cladding manufacturer's instructions or an *approved* design. Foam sheathing shall be attached to masonry or concrete construction in accordance with the insulation manufacturer's installation instructions or an *approved* design. Furring and furring attachments through foam sheathing into concrete or masonry substrate shall be designed to resist design loads determined in accordance with Section R301, including support of cladding weight as applicable. Fasteners used to attach cladding or furring through foam sheathing to masonry or concrete substrates shall be *approved* for application into masonry or concrete material and shall be installed in accordance with the fastener manufacturer's instructions.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing and connection to a masonry or concrete substrate, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section R703.8.

SECTION R704 SOFFITS

R704.1 General wind limitations. Where the design wind pressure is 30 pounds per square foot (1.44 kPa) or less, soffits shall comply with Section R704.2. Where the design wind pressure exceeds 30 pounds per square foot (1.44 kPa), 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 R301.2.1(1) for walls using an effective wind area of 10 square feet (0.93 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2).

R704.2 Soffit installation where the design wind pressure is 30 psf or less. Where the design wind pressure is 30 pounds per square foot (1.44 kPa) or less, soffit installation shall comply with Section R704.2.1, R704.2.2, R704.2.3 or R704.2.4. Soffit materials not addressed in Sections R704.2.1 through 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(1). Where the unsupported span of soffit panels is greater than 16 inches (406 mm), intermediate nailing strips shall be provided in accordance with Figure R704.2.1(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.

Figures R704.2.1(1) and (2). Illustrate typical single-span and double-span, respectively, vinyl soffit panel support.

R704.2.2 Fiber-cement soffit panels. Fiber-cement soffit panels shall be a minimum of ¼ inch (6.4 mm) 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 not less than 7/16 inch (11.11 mm) in thickness and shall be fastened to framing or nailing strips with 2 ½-inch by 0.113-inch (64 mm by 2.9 mm) siding nails spaced not more than 6 inches (152 mm) on center at panel edges and 12 inches (305 mm) 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 by 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. Where the design wind pressure is greater than 30 psf, soffit installation shall comply with Section R704.3.1, R704.3.2, R704.3.3 or 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 R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2). 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(1). Where the unsupported span of soffit panels is greater than 12 inches (305 mm), intermediate nailing strips shall be provided in

accordance with Figure R704.2.1(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 R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2).

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 R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2).

R704.3.4 Wood structural panel soffit. Wood structural panel soffits shall be capable of resisting wind loads specified in Table R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2). Alternatively, wood structural panel soffits shall be installed in accordance with Table R704.3.4.

Table R704.3.4. Provides prescriptive alternative for wood structural panel soffit.

CHAPTER 8 ROOF-CEILING CONSTRUCTION

SECTION R801 GENERAL

R801.2 Requirements. Roof and ceiling construction shall be capable of accommodating all loads imposed in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

SECTION R802 WOOD ROOF FRAMING

R802.2 Design and construction. The roof and ceiling assembly shall provide continuous ties across the structure to prevent roof thrust from being applied to the supporting walls. The assembly shall be designed and constructed in accordance with the provisions of this chapter and Figures R606.11(1), R606.11(2) and R606.11(3) or in accordance with AWC NDS.

R802.3 Ridge. A ridge board used to connect opposing rafters shall be not less than 1 inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. Where ceiling joist or rafter ties do not provide continuous ties across the structure as required by Section R802.5.2, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice and supported on each end by a wall or column.

R802.4 Rafters. Rafters shall be in accordance with this section.

R802.4.2 Framing details. Rafters shall be framed opposite from each other to a ridge board, shall not be offset more than 1 ½ inches (38 mm) from each other and shall be connected with a collar tie or ridge strap in accordance with Section R802.4.6 or directly opposite from each other to a gusset plate in accordance with

Table R602.3(1). Rafters shall be nailed to the top wall plates in accordance with Table R602.3(1) unless the *roof assembly* is required to comply with the uplift requirements of Section R802.11.

User Note: Section R802.11 deals with wind uplift resistance.

R802.4.6 Collar ties. Where collar ties are used to connect opposing rafters, they shall be located in the upper third of the attic space and fastened in accordance with Table R602.3(1). Collar ties shall be not less than 1 inch by 4 inches (25 mm × 102 mm) nominal, spaced not more than 4 feet (1219 mm) on center. Ridge straps shall be permitted to replace collar ties. Ridge straps shall be not less than 1 ¼-inch (32 mm) × 20 gage and shall be nailed to the top edge of each rafter with not fewer than three 10d common (3" × 0.148") nails with the closest nail not closer than 2 3/8 inches (60.3 mm) from the end of the rafter.

User Note: Collar ties or ridge straps are used interchangeably to resist wind loads on roof structures built using rafters.

R802.10 Wood trusses.

R802.10.1 Truss design drawings. *Truss design drawings*, prepared in conformance to Section R802.10.1, shall be provided to the *building official* and *approved* prior to installation. *Truss design drawings* shall be provided with the shipment of trusses delivered to the job site. *Truss design drawings* shall include, at a minimum, the following information:

4. Design loads as applicable.
 - 4.6. Controlling wind and earthquake loads. *[partial shown]*

R802.10.2 Design. Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The *truss design drawings* shall be prepared by a *registered design professional* where required by the statutes of the *jurisdiction* in which the project is to be constructed in accordance with Section R106.1.

R802.10.2.1 Applicability limits. The provisions of this section shall control the design of truss roof framing when snow controls for buildings that are 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: $0.7 p_g$.

R802.11 Roof tie uplift resistance. *Roof assemblies* shall have uplift resistance in accordance with Sections R802.11.1 and R802.11.2.

Exceptions: Rafters or trusses shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1) where either of the following occur:

1. Where the uplift force per rafter or truss does not exceed 200 pounds (90.8 kg) as determined by Table R802.11.
2. Where the basic wind speed does not exceed 115 miles per hour (51.4 m/s), the wind exposure category is B, the roof pitch is 5 units vertical in 12 units horizontal (42-percent slope) or greater, the roof span is 32 feet (9754 mm) or less, and rafters and trusses are spaced not more than 24 inches (610 mm) on center.

R802.11.1. 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(2) and listed in Table R301.2 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.

User Note: In the continuation of Table R802.11 on page 8-29 of the 1st printing of the 2021 Edition of the IRC, Exposure B is indicated – the values in Table R802.11 on this page are actually for Exposure C.

R802.11.2 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.

User Note: See user note above for correction related to Table R802.11 on Page 8-29 of the 1st printing of the 2021 Edition of the IRC.

SECTION R803 ROOF SHEATHING

R803.2 Wood structural panel sheathing.

R803.2.2 Allowable spans. The maximum allowable spans for *wood structural panel* roof sheathing shall not exceed the values set forth in Table R503.2.1.1(1) or APA E30.

User Note: The spans information provided in Table R503.2.1.1(1) is primarily based on live and dead load limitations. These work for wind within the limits of allowable design wind speeds used to develop the IRC prescriptive limits. The AWC WFCM provides engineering design and prescriptive guidance on appropriate sheathing properties for high wind applications.

R803.2.3 Installation. *Wood structural panel* used as roof sheathing shall be installed with joints staggered or not staggered in accordance with Table R602.3(1), APA E30 for wood roof framing or with Table R804.3 for cold-formed steel roof framing. Wood structural panel roof sheathing in accordance with Table R503.2.1.1(1) shall not cantilever more than 9 inches (229 mm) beyond the gable endwall unless supported by gable overhang framing.

User Note: Gable roof overhangs that are not adequately supported and fastened have been a frequent point of initiation of wind damage.

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 140 miles per hour (63 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 allowable 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.

R804.3.8 Roof tie-down. *Roof assemblies* shall be connected to walls below in accordance with Table R804.3. A continuous load path shall be provided to transfer uplift loads to the foundation.

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 R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2).

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

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen underlayment bearing a label indicating compliance with ASTM D1970
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane bearing a label indicating compliance with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering for areas where wind design is not required in accordance with Figure R301.2.1.1 shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips. Underlayment shall be applied in accordance with Table R905.1.1(2) using the application requirements for areas where wind design is not required in accordance with Figure R301.2.1.1. Underlayment shall be attached in accordance with Table R905.1.1(3).

User Note: The two exceptions listed are intended to provide more windstorm resistant underlayment options by improving the roof's resistance to water intrusion if the roof cover or a portion of the cover is blown off. The 2021 IBC, Section 1507.1.1, includes exception 2 above as a substantially similar exception 1 and adds a different exception instead of exception 1 above as its second exception. The second IBC exception is developed around applying two layers of heavy-duty underlayment in the overlapping pattern specified for low-slope roofs with a more stringent fastening schedule.

Table 905.1.1(1). Lists acceptable underlayment types based on whether wind design is required or not required (i.e., more stringent requirements for high wind areas).

Table 905.1.1(2). Provides general underlayment application requirements and more stringent requirements for areas where wind design is required.

Table R905.1.1(3). Provides general underlayment attachment requirements and more stringent requirements for areas where wind design is required.

R905.2 Asphalt shingles *[partial shown]*

R905.2.4.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a *label* to indicate compliance with ASTM D7158 and the required classification in Table R905.2.4.1.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and *labeled* in accordance with ASTM D3161. Asphalt shingle packaging shall bear a *label* to indicate compliance with ASTM D 3161 and the required classification in Table R905.2.4.1.

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

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer's *approved* installation instructions, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12, 175-percent slope), shingles shall be installed in accordance with the manufacturer's *approved* installation instructions.

R905.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

R905.3.3. Underlayment. *Underlayment* shall comply with Section R905.1.1.

R905.3.7 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/m²) 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 requirements for areas with design wind speeds of 130 mph or less.

User Note: The Tile Roofing Institute in conjunction with the Florida Roofing, Sheet Metal and Air Conditioning Contractors Association, Inc. (FRSA) maintain a high-wind installation guide based on code wind loads that can be useful for design of applications in higher wind areas.

R905.4 Metal roof shingles. *[partial shown]*

R905.4.4.1 Wind resistance of metal roof shingles. *Metal roof shingles* applied to a solid or closely fitted deck shall be tested in accordance with ASTM D3161, FM 4474, UL 580 or UL 1897. *Metal roof shingles* tested in accordance with ASTM D3161 shall meet the classification requirements of Table R905.4.4.1 for the appropriate maximum basic wind speed and the metal shingle packaging shall bear a *label* to indicate compliance with ASTM D3161 and the required classification in Table R905.2.4.1.

Table R905.4.4.1 Provides classification of steep slope metal roof shingles tested in accordance with ASTM D3161.

User Note: ASTM D3161 is a test developed for asphalt shingles where winds are blown over the surface of an inclined panel covered with the shingle product. The classifications provided in Table R905.2.4.1 are the same as for wind speed and duration applied to asphalt shingles in Table R905.4.4.1.

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

R905.5 Mineral-surfaced roll roofing. *[partial shown]*

R905.5.5 Application. Mineral-surfaced roll roofing shall be installed in accordance with this chapter and the manufacturer's instructions.

R905.6 Slate shingles. *[partial shown]*

R905.6.5 Application. Minimum headlap for slate shingles shall be in accordance with Table R905.6.5. Slate shingles shall be secured to the roof with two fasteners per slate. Slate shingles shall be installed in accordance with this chapter and the manufacturer's instructions.

Table R605.6.5 provides shingle headlap requirement as a function of roof slope.

R905.7 Wood shingles. *[partial shown]*

R905.7.5 Application. Wood shingles shall be installed in accordance with this chapter and the manufacturer's instructions. Weather exposure for wood shingles shall not exceed those set in Table R905.7.5(1). *[partial shown]*

Table R905.7.5(1). Provides maximum wood shingle weather exposure as a function of shingle length and roof slope.

R905.8 Wood shakes. *[partial shown]*

R905.8.6 Application. Wood shakes shall be installed in accordance with this chapter and the manufacturer's installation instructions. Weather exposures for wood shakes shall not exceed those set in Table R905.8.6. *[partial shown]*

Table R905.8.6. Provides maximum wood shake weather exposure as a function of shake length and product grade.

R905.9 Built-up roofs. *[partial shown]*

R905.9.3 Application. Built-up roofs shall be installed in accordance with this chapter and the manufacturer's instructions.

R905.10 Metal roof panels. *[partial shown]*

R905.10.4 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.

R905.11 Modified bitumen roofing. *[partial shown]*

R905.11.3 Application. Modified bitumen roofs shall be installed in accordance with this chapter and the manufacturer's instructions.

R905.12 Thermoset single-ply roofing. *[partial shown]*

R905.12.3 Application. Thermoset single-ply roofs shall be installed in accordance with this chapter and the manufacturer's instructions.

R905.13 Thermoplastic single-ply roofing. *[partial shown]*

R905.13.3 Application. Thermoplastic single-ply roofs shall be installed in accordance with this chapter and the manufacturer's instructions.

R905.14 Sprayed polyurethane foam roofing. *[partial shown]*

R905.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with this chapter and the manufacturer's instructions. A liquid-applied protective coating that complies with Table R905.14.3 shall be applied not less than 2 hours nor more than 72 hours following the application of the foam.

Table R905.14.3. Provides acceptable protective coating material standards.

R905.15 Liquid-applied roofing. *[partial shown]*

R905.15.3 Application. Liquid-applied roofing shall be installed in accordance with this chapter and the manufacturer's installation instructions.

R905.16 Photovoltaic shingles. The installation of *photovoltaic shingles* shall comply with the provisions of this section, Section R324 and NFPA 70.

R905.16.5 Attachment. *Photovoltaic shingles* shall be attached in accordance with the manufacturer's installation instructions.

R905.16.6 Wind resistance. *Photovoltaic shingles* shall comply with the classification requirements of Table R905.16.6 for the appropriate maximum basic wind speed.

Table R905.16.6. Provides wind rating classification of photovoltaic shingles using basic design wind speeds consistent with Table R301.2.1.3.

User Note: Because these ratings use the ASTM D3161 test standard, the ratings are consistent with those for asphalt shingles.

R905.17 Building-integrated photovoltaic (BIPV) roof panels applied directly to the roof deck. *[partial shown]*

R905.17.6 Attachment. *BIPV roof panels* shall be attached in accordance with the manufacturer's installation instructions.

SECTION R907 ROOFTOP-MOUNTED PHOTOVOLTAIC PANEL SYSTEMS

R907.1 Rooftop-mounted photovoltaic panel systems. Rooftop-mounted *photovoltaic panel systems* shall be designed and installed in accordance with R324 and NFPA 70.

SECTION R908 REROOFING

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

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

R908.3.1 Roof recover. The installation of anew roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs where applied in accordance with Section R908.4.

4. The application of a new protective *roof coating* over an existing protective *roof coating*, *metal roof panel*, *metal roof shingle*, mineral surfaced roll roofing, built-up roof, modified bitumen roofing, thermoset and thermoplastic single-ply roofing and spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

CHAPTER 11 ENERGY EFFICIENCY

SECTION N1102 (R402) BUILDING THERMAL ENVELOPE

User Note: A modification in the maximum U-factor (maximum U-factor = 0.32) is allowed for vertical fenestration products in certain climate zones for areas within the windborne debris region where opening protection is required by Section R301.2.1.2.

SECTION N1103 (R403) SYSTEMS

N1103.4 (R403.4) Mechanical system piping insulation. *[partial shown]*

N1103.4.1 (R403.4.1) Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind. *[partial shown]*

CHAPTER 24 FUEL GAS

SECTION G2404 (301) GENERAL

G2404.6 (301.10) Wind resistance. Appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with this code.

CHAPTER 31 VENTS

SECTION P3103 VENT TERMINALS

P3103.1 Vent pipes terminating outdoors. *[partial shown]*

P3103.1.3 Roof extension covered. Where an open vent pipe terminates above a sloped roof and is covered by either a roof-mounted panel (such as a solar collector or *photovoltaic panel* mounted over the vent opening) or a roof element (such as an architectural feature or a decorative shroud), the vent pipe shall terminate not less than 2 inches (51 mm) above the roof surface. Such roof elements shall be designed to prevent the adverse effects of snow accumulation and wind on the function of the vent. *[partial shown]*

CHAPTER 44 REFERENCED STANDARDS

User notes:

About this chapter: *[partial shown]* 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.

Standard Reference Number	Title	Referenced in Code Section Number
AAMA	American Architectural Manufacturers Association	1900 E. Golf Road, Suite 1250 Schaumburg, IL 60173
506—16	Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products	R609.6.1
ACI	American Concrete Institute	38800 Country Club Drive Farmington Hills, MI 48331
318—19	Building Code Requirements for Structural Concrete	R608.2, R608.9.2, R608.9.3
AISI	American Iron and Steel Institute	25 Massachusetts Avenue, NW Suite 800 Washington, DC 20001
S230-18	Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, 2018	R301.1.1, R301.2.1.1, R603.9.4.1, R608.9.2, R608.9.3, Figure 608.9(11), R608.10
ASCE/SEI	American Society of Civil Engineers, Structural Engineering Institute	Reston, VA 20191-4400

7-16 with Supplement 1	Minimum Design Loads and Associated Criteria for Buildings and Other Structures	R301.2.1.1, R301.2.1.2, R301.2.1.2.1, R301.2.1.5, R301.2.1.5.1, Table R608.6(1), Table R608.6(2), Table R608.6(3), Table R608.6(4), Table R608.7(1A), Table R608.7(1B), Table R608.7(1C), R608.9.2, R608.9.3, R609.2, R609.6.2 User Note: Roof design wind pressures provided in Table R301.2(2) were not updated for ASCE 7-16 provisions and are lower than required by ASCE 7-16
ASTM	ASTM International	100 Barr Harbor Drive West, P.O. Box C700 West Conshohocken, PA 19428
D3161/D3161M—2016A	Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan Induced Method)	R905.2.4.1, Table R905.2.4.1, R905.16.6
D3679-2017	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding	R703.11
D7158—D7158M—2019	Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)	R905.2.4.1, Table R905.2.4.1
E330/E330M—14	Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference	R609.4, R609.5, R609.6.2, R703.1.2
E1886—2013A	Test Method for Performance Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials	R301.2.1.2, R609.6.1, R609.6.2, Table R703.11.2

E1996—2017	Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes	R301.2.1.2, R301.2.1.2.1, R609.6.1, R609.6.2
AWC	American Wood Council	222 Catoctin Circle SE, Suite 201 Leesburg, VA 20175
ANSI/AWC WFCM—2018	Wood Frame Construction Manual for One- and Two-family Dwellings	R301.1.1, R301.2.1.1, R608.9.2, Figure R608.9(9), R608.9.3, R608.10
DASMA	Door and Access Systems Manufacturers Association International	1300 Summer Avenue Cleveland, OH 44115-2851
108—2017	Standard Method for Testing Garage Doors, Rolling Doors and Flexible Doors; Determination of Structural Performance Under Uniform Static Air Pressure Difference	R609.4
115—2017	Standard Method for Testing Garage Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure	R301.2.1.2
FM	FM Approvals	Headquarters Office Norwood, MA 02062

4474—2011	American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures	R905.4.4.1
ICC	International Code Council, Inc.	500 New Jersey Avenue NW, 6 th Floor, Washington, DC 20001
ICC 500-2020	ICC/NSSA Standard on the Design and Construction of Storm Shelters	R323.1
ICC 600-2020	Standard for Residential Construction in High-wind Regions	R301.2.1.1
PCA	Portland Cement Association	5420 Old Orchard Road Skokie, IL 60077
100—17	Prescriptive Design of Exterior Concrete Walls for One- and Two-family Dwellings (Pub. No. PCA 100.3)	R608.9.2, R608.9.3
SBCA	Structural Building Components Association	6300 Enterprise Lane Madison, WI 53719
ANSI/FS100—12 (R2018)	Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies	R316.8
WDMA	Window and Door Manufacturers Association	2025 M Street NW, Suite 800 Washington, DC 20036-3309

AAMA/WDMA/CSA 101/I.S.2/A440—17	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	R609.3
I.S. 11—16	Industry Standard Analytical Method for Design Pressure (DP) Ratings of Fenestration Products	R609.3.1

APPENDIX AE MANUFACTURED HOUSING USED AS DWELLINGS

SECTION AE115 SKIRTING AND PERIMETER ENCLOSURES

AE115.1 Skirting and permanent perimeter enclosures. *[partial shown]*

Skirting shall be installed in accordance with the skirting manufacturer's installation instructions. Skirting shall be adequately secured to ensure stability, minimize vibration and susceptibility to wind damage, and compensate for possible frost heave.

SECTION AE122 PIER CONSTRUCTION

AE122.1 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 AE124 ANCHORAGE INSTALLATIONS

AE124.1 Ground anchors. Ground anchors shall be designed and installed to transfer the anchoring loads to the ground. *[partial shown]*

Each *approved* ground anchor, when installed, shall be capable of resisting an allowable working load not less than 3,150 pounds (14 kN) in the direction of the tie plus a 50- percent overload [4,725 pounds (21 kN) total] without failure. Failure shall be considered to have occurred when the anchor moves more than 2 inches (51 mm) at a load of 4,725 pounds (21 kN) in the direction of the tie installation. Those ground anchors that are designed to be installed so that loads on the anchor are other than direct withdrawal shall be designed and installed to resist an applied design load of 3,150 pounds (14 kN) at 40 to 50 degrees from vertical or within the angle limitations specified by the home manufacturer without displacing the tie end of the anchor more than 4 inches (102 mm) horizontally. Anchors designed for the connection of multiple ties shall be capable of resisting the combined working load and overload consistent with the intent expressed herein.

Where it is proposed to use ground anchors and the *building official* has reason to believe that the soil characteristics at a given site are such as to render the use of ground anchors advisable, or where there is doubt regarding the ability of the ground anchors to obtain their listed capacity, the *building official* has the authority to require that a representative field installation be made at the site in question and tested to demonstrate ground-anchor capacity. The building official shall approve the test procedures.

User Note: Industry installation guidance does not include deflection limits and installations other than those that trigger consideration as a permanent installation (foundation) do not fall under the building code. In most cases, installation falls under HUD rules and may be evaluated by a different state agency.

AE124.2 Anchoring equipment. Anchoring equipment, where installed as a permanent installation, shall be capable of resisting all loads as specified within these provisions. Where the stabilizing system is designed by an engineer or architect licensed by the state to practice, such alternative designs shall include anchoring equipment capable of withstanding a load equal to 1.5 times the calculated load. Anchoring equipment shall be *listed* and *labeled* as being capable of meeting the requirements of these provisions. Anchors as specified in this code shall be attached to the main frame of the *manufactured home* by an *approved* 3/16-inch-thick (4.76 mm) slotted steel plate anchoring device. Other anchoring devices or methods meeting the requirements of these provisions shall be subject to the evaluation and *approval* of the *building official*. Anchoring systems shall be so installed as to be permanent.

Anchoring equipment shall be so designed to prevent self-disconnection with no hook ends used.

SECTION AE125 TIES, MATERIALS AND INSTALLATION

AE125.1 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). Where 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, such ties [\[shall be\]](#) connected to a single anchor that 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 AH 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/m²), 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.

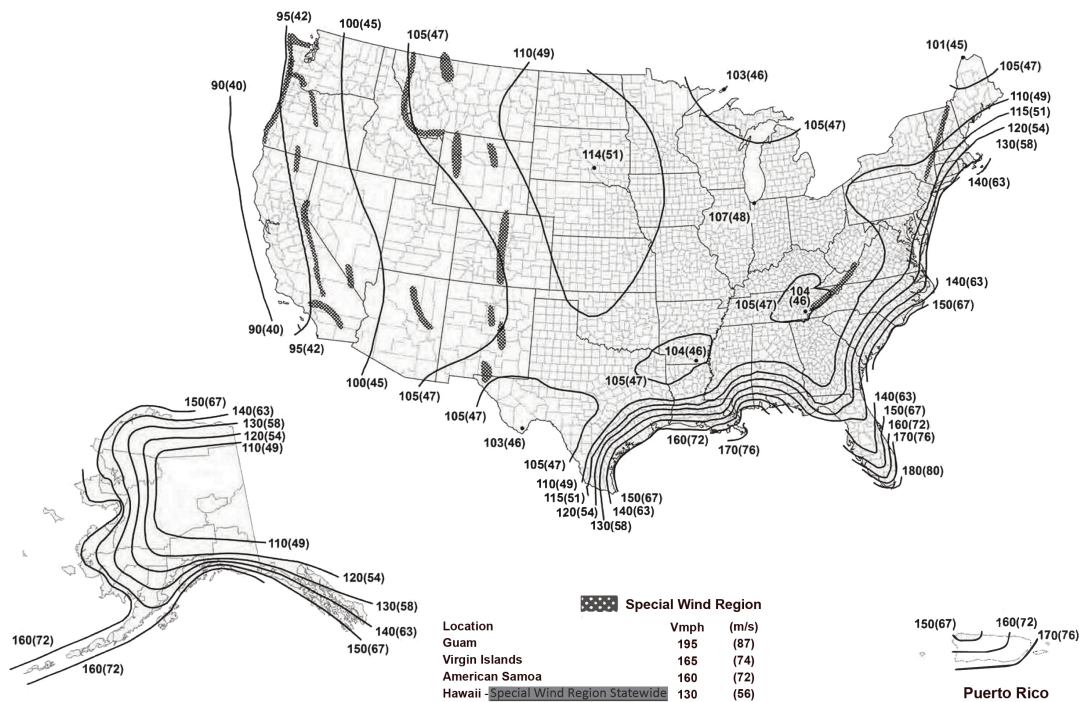
AH106.3 Screen enclosures. Screen enclosures shall comply with Sections AH106.3.1 and AH106.3.2.

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(1) and AH106.4.1(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/m²) use 10 pounds per squarefoot (0.479 kN/m²).

Table AH106.4.1(1). Provides the design wind pressures for screen enclosure framing.

Table AH106.4.1(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 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation 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 AH106.4.1. ULTIMATE DESIGN WIND SPEEDS FOR PATIO COVERS AND SCREEN ENCLOSURES

APPENDIX AR LIGHT STRAW-CLAY CONSTRUCTION

SECTION AR103 NONBEARING LIGHT STRAW-CLAY CONSTRUCTION

AR103.1 General. Light straw-clay shall be limited to infill between or around structural and nonstructural wall framing members.

AR103.2.2 [Structure] Bracing. Bracing for buildings with light straw-clay infill shall be in accordance with Section R602.10. Walls with light straw-clay infill shall use the Method LIB shall not be sheathed with solid sheathing. Walls without light straw-clay infill shall comply with any bracing method prescribed by this code.

APPENDIX AS STRAWBALE CONSTRUCTION

SECTION AS102 DEFINITIONS

AS102.1. Definitions. The following words and terms shall, for the purposes of this appendix, have the following meanings shown herein. Refer to Chapter 2 of the *International Residential Code* for general definitions. [partial shown]

SHEAR WALL. A *strawbale* wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AS106.13. This term is synonymous with “Braced wall panel.”

SECTION AS105 STRAWBALE WALLS—GENERAL

AS105.4 Out-of-plane resistance methods and unrestrained wall dimension limits. *Strawbale* walls shall employ a method of out-of-plane load resistance in accordance with Table AS105.4, and comply with its associated limits and requirements.

AS105.4.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AS105.4 shall be in terms of the ultimate design wind speed and seismic design category as determined in accordance with Sections R301.2.1 and R301.2.2. An engineered design in accordance with Section R301.2.1 shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2(2) and Section R301.2.1.1, respectively.

Table AS105.4. Provides, among other limits, ultimate design wind speed limits for the out-of-plane resistance and unrestrained wall dimensions.

SECTION AS106 STRAWBALE WALLS—STRUCTURAL

AS106.9 Mesh. Mesh in plasters on *strawbale* structural walls, and where required by Table AS105.4, and where used to resist wind uplift in accordance with Section AS106.14, shall be installed in accordance with Sections AS106.9.1 through AS106.9.4.

AS106.9.1 Mesh laps. Mesh required by Table AS105.4 or AS106.12 shall be installed with not less than 4-inch (102 mm) laps. Mesh required by Table AS106.13(1) or in walls designed to resist wind uplift of more than 100 plf (1459 N/m) in accordance with Section AS106.14, shall run continuous vertically from sill plate to the top plate or roof-bearing element, or shall lap not less than 8 inches (203 mm). Horizontal laps in such mesh shall be not less than 4 inches (102 mm).

AS106.12.3 Roof-bearing assembly. Roof-bearing assemblies shall be of nominal 2-inch by 6-inch (51 mm by 152 mm) lumber with 15/35-inch (12 mm) plywood or OSB panels fastened with 8d nails at 6 inches (152 mm) on center in accordance with Figure AS105.1(3) and Items 1 through 6, or be of an *approved* engineered design. *[partial shown]*

3. Discontinuous lumber shall be spliced with a metal strap with not less than a 500-pound (2224 N) allowable wind or seismic load tension capacity. Where the wall line includes a braced wall panel the strap shall have not less than a 2,000-pound (8896 N) capacity.

AS106.13 Braced wall panels. Plastered *strawbale* walls used as braced wall panels for one-story *buildings* shall be in accordance with Section R602.10 and Tables AS106.13(1), AS106.13(2) and AS106.13(3). Wind design criteria shall be in accordance with Section R301.2.1. *[partial shown]*

Table AS106.13(2). Provides bracing requirements for strawbale braced wall panels based on wind speed.

AS106.14 Resistance to wind uplift forces. Plaster mesh in *skins* of *strawbale* walls that resist uplift forces from the *roof assembly*, as determined in accordance with Section R802.11, shall be in accordance with all of the following:

1. Plaster shall be any type and thickness allowed in Section AS104.
2. Mesh shall be any type allowed in Table AS106.13(1), and shall be attached to top plates or roof-bearing elements and to sill plates in accordance with Section AS106.9.2.
3. Sill plates shall be not less than nominal 2-inch by 4-inch (51 mm by 102 mm) with anchoring complying with Section R403.1.6.
4. Mesh attached with staples at 4 inches (51 mm) on center shall be considered to be capable of resisting uplift forces of 100 plf (1459 N/m) for each plaster skin.
5. Mesh attached with staples at 2 inches (51 mm) on center shall be considered to be capable of resisting uplift forces of 200 plf (2918 N/m) for each plaster skin.

AS106.15 Post-and-beam with strawbale infill. Post-and-beam with *strawbale* infill systems shall be in accordance with Figure AS105.1(4) and Items 1 through 7, or be of an *approved* engineered design. *[partial shown]*

3. Discontinuous beam ends shall be spliced with a metal strap with not less than 1,000-pound (454 kg) wind or seismic load tension capacity. Where the wall line includes a braced wall panel, the strap shall have not less than a 4,000-pound (1814 kg) capacity.

APPENDIX AU COB CONSTRUCTION (MONOLITHIC ADOBE)

SECTION AU101 GENERAL

AU101.5 Definitions. The words and terms in Section AU102 shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

SECTION AU102 DEFINITIONS

[partial shown]

SHEAR WALL. A cob wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AU106.11. Synonymous with “*Braced wall panel*.”

SECTION AU105 COB WALLS—GENERAL

AU105.3 Out-of-plane resistance methods and unrestrained wall height limits. Cob walls shall employ a method of out-of-plane load resistance in accordance with Table AU105.3, and comply with its associated height limits and requirements.

Table AU105.3. Specifies out-of-plane resistance methods and unrestrained wall height limits.

AU105.3.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AU105.3 shall be in accordance with the ultimate design wind speed and seismic design category requirements of Sections R301.2.1 and R301.2.2, respectively. An *approved* engineered design shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2.1.1.

AU105.4.5 Installation of windows and doors. Windows and doors shall be installed in accordance with the manufacturer's instructions to a wooden frame of not less than nominal 2-inch by 4-inch (51 mm by 102 mm) wood members anchored into the *cob* wall with 16d galvanized nails half-driven at a maximum 6-inch (152 mm) spacing, with the protruding half embedded in the *cob*. The wood frame shall be embedded not less than 1 ½ inches (38 mm) in the *cob* and shall be set in from each face of the wall not less than 3 inches (76 mm). Alternative window and door installation methods shall be capable of resisting the wind loads in Table R301.2.1(1). Windows and doors in *cob* walls shall be installed so as to mitigate the passage of air or moisture into or through the wall system. Window sills shall comply with Section AU105.4.2.

SECTION AU106 COB WALLS—STRUCTURAL

AU106.2 Requirements for cob structural walls. In addition to the requirements of Section AU105.2, *cob* structural walls shall be subject to the following:

1. Wall height: shall be in accordance with Table AU105.3 for load-bearing *cob* walls or Table AU106.11(1) for *cob braced wall panels*, as applicable and most restrictive.
2. Wall thickness: shall be in accordance with Sections AU105.2, Item 5 and Section AU106.8.1 for load-bearing *cob* walls or Table AU106.11(1) for *cob braced wall panels*, as applicable and most restrictive.
3. *Braced wall panel* lengths: for buildings using *cob braced wall panels*, the greater of the values determined in accordance with Table AU106.11(2) for wind loads and Table AU106.11(3), AU106.11(4) or AU106.11(5) for seismic loads shall be used.

AU106.9.1.2 Discontinuity. Discontinuous wood bond beams shall be spliced on top with a metal strap with not less than the allowable wind or seismic load tension capacity in accordance with the following, whichever is more restrictive:

1. For *seismic design categories*: A, 2,500 pounds (11 kN); B, 4,500 pounds (20 kN); C, 6,000 pounds (26.7 kN).
2. For braced wall line lengths, when wind governs: 10 feet, 2,500 pounds (11 kN); 20 feet, 3,400 pounds (15.1 kN); 30 feet, 5,000 pounds (22.2 kN).

AU106.9.6 Bond beams and connections at gable and shed roof end walls. Bond beams and connections at end walls of buildings with gable or shed roofs shall comply with Figure AU106.9.6 and the following:

1. End walls shall not exceed 20 feet (6096 mm) in length.
2. Bond beams shall be continuous and straight for the entire wall line.

3. Wood bond beams shall comply with the following:

3.1. Not less than nominal 4 inches by 8 inches (102 mm by 203 mm) where wind design governs in accordance with Table AU106.11(2) and where seismic design governs in accordance with Table AU106.11(3), AU106.11(4) or AU106.11(5) for wall lengths less than or equal to 20 feet (6096 mm) in *Seismic Design Category A* or wall lengths less than or equal to 10 feet (3048 mm) in *Seismic Design Categories B and C*.

3.2. Not less than nominal 4 inches by 10 inches (102 mm by 254 mm) for wall lengths less than or equal to 20 feet (6096 mm) in *Seismic Design Category B*.

3.3. Not less than nominal 6 inches by 12 inches (152 mm by 305 mm) or 4 inches by 16 inches (102 mm by 406 mm) for wall lengths less than or equal to 20 feet (6096 mm) in *Seismic Design Category C*.

3.4. Corners shall be connected in accordance with Section AU106.9.3.

4. Concrete bond beams when used shall be in accordance with Section AU106.9.2 in *Seismic Design Categories A, B and C* and for ultimate design wind speeds less than or equal to 140 mph (63.6 m/s).

5. Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602. The ratio of its greatest height to its length shall not exceed 1:2. The wall shall not contain openings.

AU106.11 Cob braced wall panels. *Cob braced wall panels* shall be in accordance with Section R602.10 and Tables AU106.11(1), AU106.11(2), AU106.11(3), AU106.11(4) and AU106.11(5). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An *approved* engineered design shall be required in accordance with Section R301.2.1 where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2.1.1.

Table AU106.11(2). Provides bracing requirements for cob braced wall panels based on wind speed.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved *cob* walls shall contain two *braced wall lines* in two orthogonal directions. The spacing of the *braced wall lines* for wind design in Table AU106.11(2) and the spacing and length of the *braced wall lines* for seismic design in Tables AU106.11(3), AU106.11(4) and AU106.11(5) shall be the maximum widths of the building in the two orthogonal directions.

Table AU106.12. Specifies anchorage of bond beams for wind uplift.