SECTION 1609
WIND LOADS

1609.1 Applications.

Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures. All exterior wall coverings and soffits shall be capable of resisting the design pressures specified for walls for components and cladding loads in accordance with Section 1609.1.1. Manufactured soffits shall be labeled in accordance with Section 1709.10 of this code.

1609.1.1 Determination of wind loads.

Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. 1.Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. 2.Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. 3.Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. 4.Designs using NAAMM FP 1001, Guide Specifications for Design of Metal Flagpoles.
5. 5.Designs using TIA-222 for antenna-supporting structures and antennas. Design using this standard shall be permitted for communication tower and steel antenna support structures.
6. 6.Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. 7.Wind loads for screen enclosures shall be determined in accordance with Section 2002.4.
8. 8.Exposed mechanical equipment or appliances fastened to a roof or installed on the ground in compliance with the code using rated stands, platforms, curbs, slabs, walls, or other means are deemed to comply with the wind resistance requirements of the 2007 Florida Building Code, as amended. Further support or enclosure of such mechanical equipment or appliances is not required by a state or local official having authority to enforce the Florida Building Code.

The wind speeds in Figures 1609.3(1), 1609.3(2), 1609.3(3) and 1609.3(4) are ultimate design wind speeds, V_{ult}, and shall be converted in accordance with Section 1609.3.1 to nominal design

wind speeds, V_{asd}, when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1609.1.1.1 Applicability.

The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of ICC 600, AWC WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. 1.The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;
2. 2.The maximum average slope of the hill exceeds 10 percent; and
3. 3.The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.

1609.1.2 Protection of openings.

In wind-borne debris regions, glazed openings in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of ANSI/DASMA 115 (for garage doors and rolling doors) or TAS 201, 202 and 203, AAMA 506, ASTM E1996 and ASTM E1886 referenced herein, or an approved impact-resistant standard as follows:

1. 1.Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E1996.
2. 2.Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E1996.
3. 3.Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.
4. 4.Openings in sunrooms, balconies or enclosed porches constructed under existing roofs or decks are not required to be protected provided the spaces are separated from the building interior by a wall and all openings in the separating wall are protected in accordance with Section 1609.1.2 above. Such spaces shall be permitted to be designed as either partially enclosed or enclosed structures.

Exceptions:

1. 1.Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and maximum span between lines of fasteners of 44 inches (1118 mm) shall be permitted for opening protection in Group R-3 or R-4 occupancy buildings with a mean roof height of 33 feet (10 058 mm) or less where V_{ult} is 180 mph (80 m/s) or less. Panels shall be precut to overlap the wall such that they extend a minimum of 2 inches (50.8 mm) beyond the lines

of fasteners and are attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the attachment method and secured with corrosion-resistant attachment hardware permanently installed on the building.

1. a.Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building.
2. b.As an alternative, panels shall be fastened at 16 inches (406.4 mm) on center along the edges of the opposing long sides of the panel.
    1. i.For wood frame construction, fasteners shall be located on the wall such that they are embedded into the wall framing members, nominally a minimum of 1 inch (25.4 mm) from the edge of the opening and 2 inches (50.8 mm) inward from the panel edge. Permanently installed anchors used for buildings with wood frame wall construction shall have the threaded portion that will be embedded into the wall framing based on $^1/_4$-inch (6.35 mm) lagscrews and shall be long enough to penetrate through the exterior wall covering with sufficient embedment length to provide an allowable minimum 300 pounds ASD design withdrawal capacity.
    2. ii.For concrete or masonry wall construction, fasteners shall be located on the wall a minimum of $1^1/_2$ inches (37.9 mm) from the edge of the opening and 2 inches (50.8 mm) inward of the panel edge. Permanently installed anchors in concrete or masonry wall construction shall have an allowable minimum 300 pounds ASD design withdrawal capacity and an allowable minimum 525 pounds ASD design shear capacity with a $1^1/_2$ inch edge distance. Hex nuts, washered wing-nuts, or bolts used to attach the wood structural panels to the anchors shall be minimum $^1/_4$-inch (6.4 mm) hardware and shall be installed with or have integral washers with a minimum 1-inch (25 mm) outside diameter.
    3. iii.Vibration-resistant alternative attachments designed to resist the component and cladding loads determined in accordance with provisions of ASCE 7 shall be permitted.
2. 2.Glazing in Risk Category I buildings, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. 3.Glazing in Risk Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

Table 1609.1.2 Wind-Borne Debris Protection Fastening Schedule for Wood Structural Panels. Reserved.

1609.1.2.1 Louvers.

Louvers protecting the exterior wall opening that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 540 or shall be protected by an impact-resistant cover

complying with the large missile test of ASTM E1996 or an approved impact-resistance standard. Louvers required to be open for life safety purposes such as providing a breathable atmosphere shall meet the requirements of AMCA 540.

1609.1.2.2 Application of ASTM E1996.

The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

- 6.2.2 Unless otherwise specified, select the wind zone based on the strength design wind speed, V_{ult}, as follows:
- 6.2.2.1 Wind Zone 1—130 mph ≤ ultimate design wind speed, V_{ult} < 140 mph.
- 6.2.2.2 Wind Zone 2—140 mph ≤ ultimate design wind speed, V_{ult} < 150 mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.
- 6.2.2.3 Wind Zone 3—150 mph (58 m/s) ≤ ultimate design wind speed, V_{ult} ≤ 170 mph (63 m/s), or 140 mph (54 m/s) ≤ ultimate design wind speed, V_{ult} ≤ 170 mph (63 m/s) and within one 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 (63 m/s).

1609.1.2.3 Garage doors.

Garage door glazed opening protection for wind-borne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

1609.1.2.4 Impact-resistant coverings.

1609.1.2.4.1

Impact-resistant coverings shall be tested at 1.5 times the design pressure (positive or negative) expressed in pounds per square feet as determined by the Florida Building Code, Building Section 1609 or ASCE 7, for which the specimen is to be tested. The design pressures, as determined from ASCE 7, are permitted to be multiplied by 0.6.

1609.1.2.4.2 Impact-resistant coverings.

Impact-resistant coverings shall be labeled in accordance with the provisions of Section 1709.9.

1609.1.3 Testing to allowable or nominal loads.

Where testing for wind load resistance is based on allowable or nominal wind loads, the design wind loads determined in accordance with ASCE 7 or Section 1609 are permitted to be multiplied by 0.6 for the purposes of the wind-load-resistance testing.

1609.2 Definitions.

For the purposes of Section 1609 and as used elsewhere in this code, the following terms are defined in Chapter 2.

HURRICANE-PRONE REGIONS.

WIND-BORNE DEBRIS REGION.

WIND SPEED, V_{ult}.

WIND SPEED, V_{asd}.

1609.3 Ultimate design wind speed.

The ultimate design wind speed, V_{ult}, in mph, for the determination of the wind loads shall be determined by Figures 1609.3(1), 1609.3(2), 1609.3(3) and 1609.3(4). The ultimate design wind speed, V_{ult}, for use in the design of Risk Category II buildings and structures shall be obtained from Figure 1609.3(1). The ultimate design wind speed, V_{ult}, for use in the design of Risk Category III buildings and structures shall be obtained from Figure 1609.3(2). The ultimate design wind speed, V_{ult}, for use in the design of Risk Category IV buildings and structures shall be obtained from Figure 1609.3(3). The ultimate design wind speed, V_{ult}, for use in the design of Risk Category I buildings and structures shall be obtained from Figure 1609.3(4). The ultimate design wind speed, V_{ult}, for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The ultimate design wind speeds, V_{ult}, determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7. The exact location of wind speed lines shall be established by local ordinance using recognized physical landmarks such as major roads, canals, rivers and lake shores wherever possible.

FIGURE 1609.3(1)

ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES

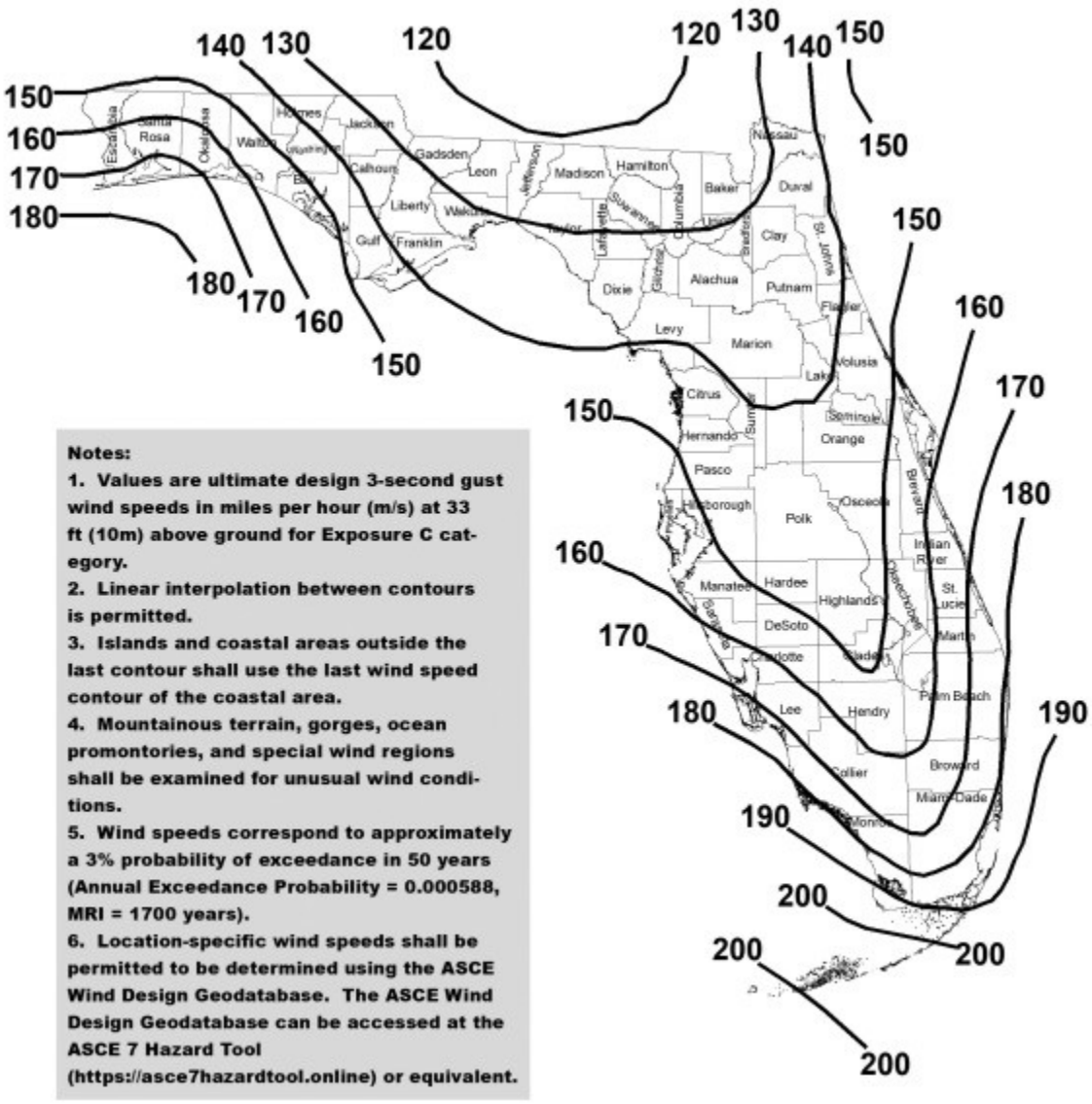

FIGURE 1609.3(2)

ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES

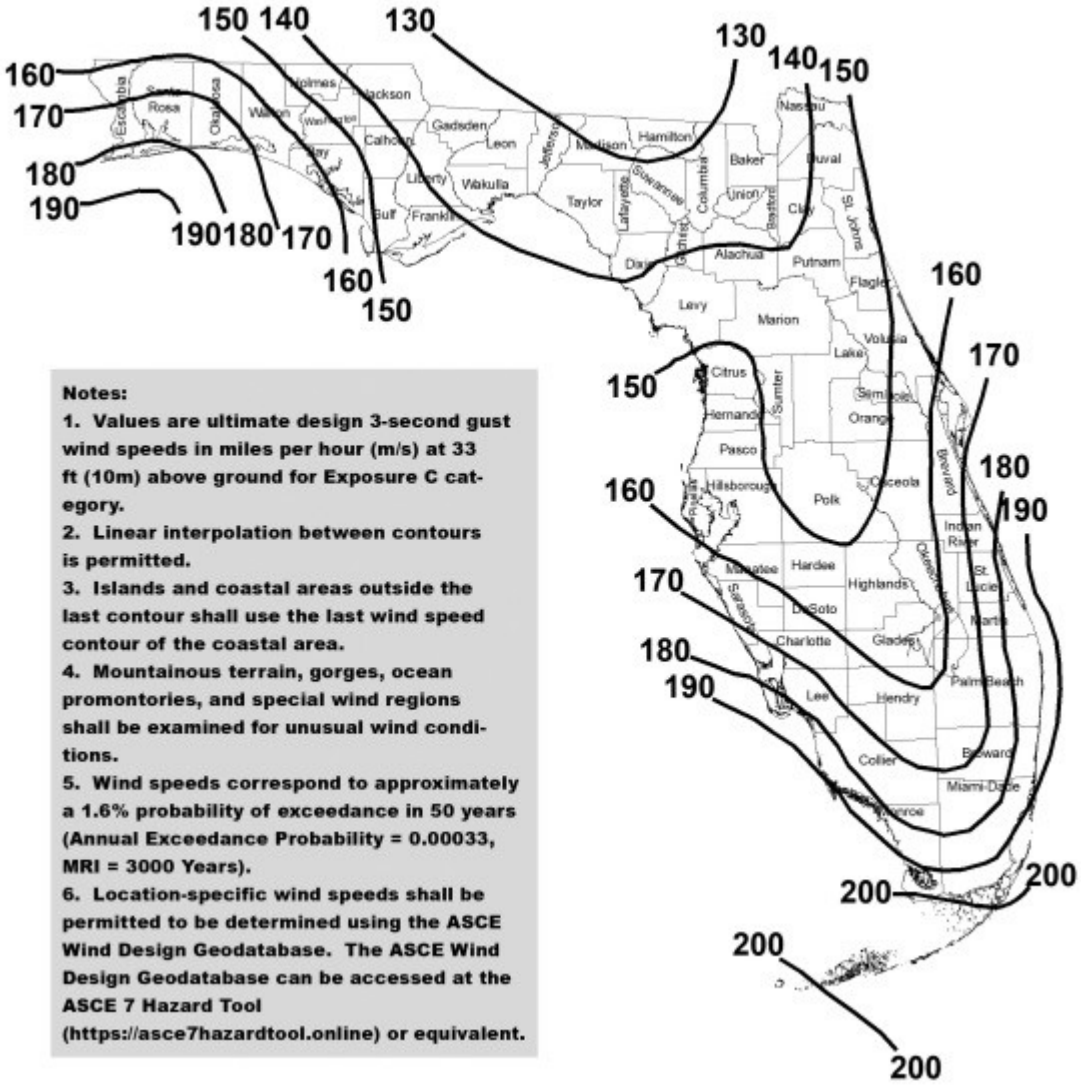

FIGURE 1609.3(3)

ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES

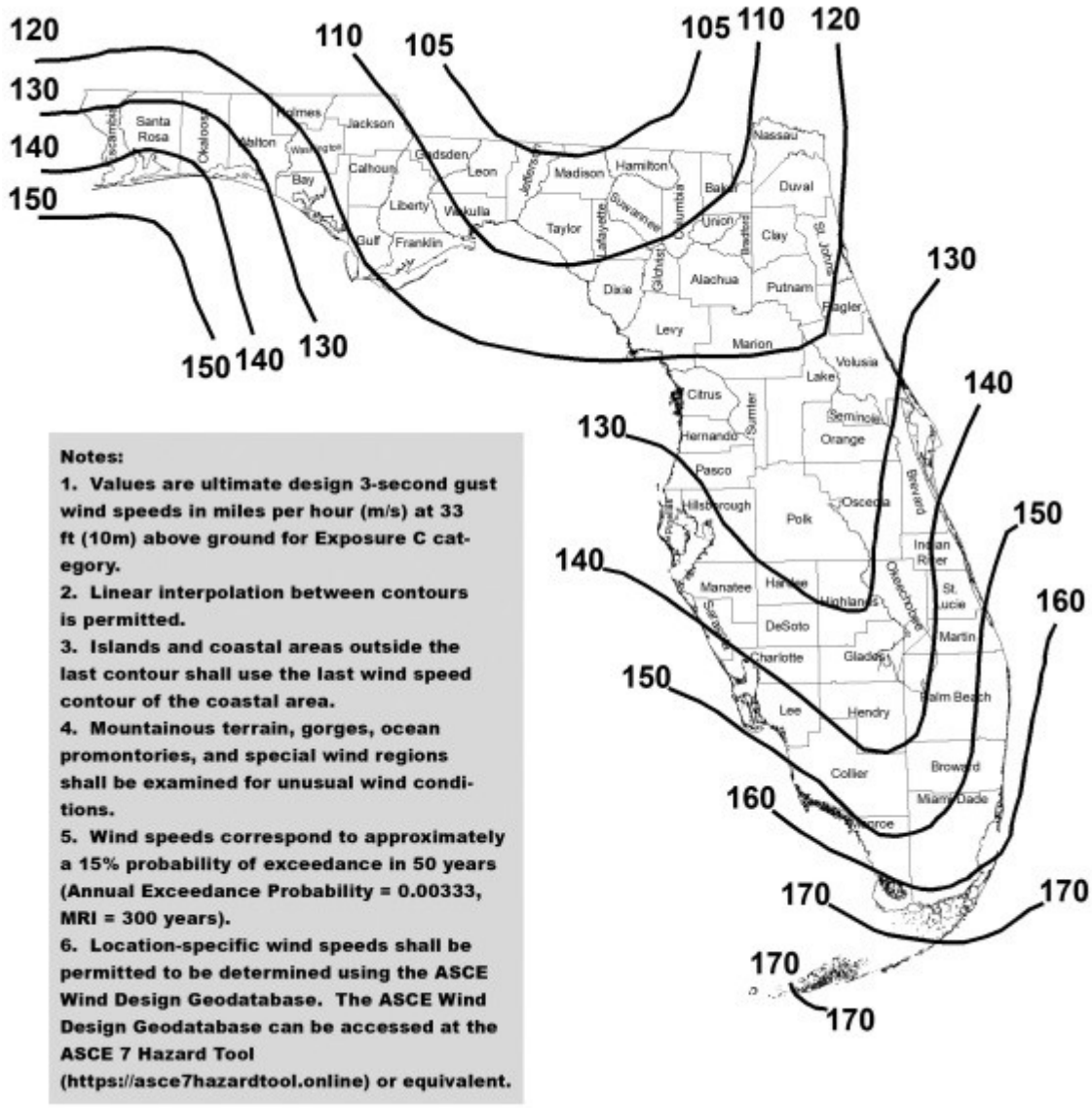

FIGURE 1609.3(4)

ULTIMATE DESIGN WIND SPEEDS, V_{ULT}, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES

1609.3.1 Wind speed conversion.

Where required, the ultimate design wind speeds of Figures 1609.3(1), 1609.3(2), 1609.3(3) and 1609.3(4) shall be converted to nominal design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-17.

$$V_{asd} = V_{ult}\sqrt{0.6}$$

(Equation 16-17)

where:

V_{asd} = Nominal design wind speed applicable to methods specified in Exceptions 4 and 5 of Section 1609.1.1.

V_{ult} = Ultimate design wind speed determined from Figure 1609.3(1), 1609.3(2), 1609.3(3) or 1609.3(4).

1609.4 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. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

1609.4.1 Wind directions and sectors.

For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories.

A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

- Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
- Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.
- Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

1609.4.3 Exposure categories.

An exposure category shall be determined in accordance with the following:

- Exposure B. For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.
- Exposure C. Exposure C shall apply for all cases where Exposure B or D does not apply.
- Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall also apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an Exposure D condition as defined in the previous sentence.

1609.5 Tornado loads.

The design and construction of Risk Category III and IV buildings and other structures shall be in accordance with Chapter 32 of ASCE 7, except as modified by this code.

1609.6 Roof systems.

Roof systems shall be designed and constructed in accordance with Sections 1609.6.1 through 1609.6.3, as applicable.

1609.6.1 Roof deck.

The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7. Where design for tornado loads is required, the roof deck shall be designed to withstand the greater of wind pressures or tornado pressures determined in accordance with ASCE 7.

1609.6.2 Roof coverings.

Roof coverings shall comply with Section 1609.6.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.6.1 are permitted to be designed in accordance with Section 1609.6.3.

1609.6.2.1 Asphalt shingles.

Asphalt shingles installed over a roof deck complying with Section 1609.6.1 shall comply with the wind-resistance requirements of Section 1504.1.1.

1609.6.3 Rigid tile.

Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h K_d C_L b L L_a [1.0 - GC_p]$$

(Equation 16-18)

For SI:

$$M_a = \frac{q_h K_d C_L b L L_a [1.0 - GC_p]}{1,000}$$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1504.2.1.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

K_d = Wind directionality factor determined from Chapter 26 of ASCE 7.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m^2) determined from Section 26.10.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. 1.The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. 2.The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.
3. 3.An underlayment shall be installed in accordance with Chapter 15.
4. 4.The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. 5.The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. 6.The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. 7.The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. 8.Roof tiles using mortar set or adhesive set systems shall have at least two-thirds of the tile's area free of mortar or adhesive contact.

1609.6.3.1 Tornado loads.

Where design for tornado loads is required, tornado loads on rigid tile roof coverings shall be determined in accordance with Section 1609.6.3, replacing q_h with q_{hT} and GC_p with $KvT(GC_p)$ in Equation 16-18, where:

q_{hT} = Tornado velocity pressure, psf (kN/m) determined in accordance with Section 32.10 of ASCE 7.

K_{vT} = Tornado pressure coefficient adjustment factor for vertical winds, determined in accordance with Section 32.14 of ASCE 7.

1609.7 Garage doors and rolling doors.

Pressures from Table 1609.7(1) for wind loading actions on garage doors and rolling doors for buildings designed as enclosed shall be permitted.

TABLE 1609.7(1)

NOMINAL (ASD) GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (PSF)[1, 2, 3, 4, 5]

ULTIMATE DESIGN WIND SPEED (V_{ult}) DETERMINED IN ACCORDANCE WITH SECTION 1609.3 (MPH - 3 SECOND GUST)

Width (ft)	Height (ft)	100 MPH	110 MPH	120 MPH	130 MPH	140 MPH	150 MPH	160 MPH	170 MPH	180 MPH	190 MPH	200 MPH
Roof Angle 0 – 10 degrees												

		+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–
8	8	10.0	10.0	10.5	11.9	12.5	14.2	14.7	16.6	17.1	19.3	19.6	22.2	22.3	25.2	25.1	28.5	28.2	31.9	31.4	35.5	34.8	39.4
10	10	10.0	10.0	10.2	11.4	12.1	13.6	14.2	16.0	16.5	18.5	18.9	21.2	21.5	24.2	24.3	27.3	27.3	30.6	30.4	34.1	33.7	37.8
14	14	10.0	10.0	10.0	10.8	11.5	12.8	13.5	15.0	15.7	17.4	18.0	20.0	20.5	22.8	23.1	25.7	25.9	28.8	28.9	32.1	32.0	35.6
Roof Angle > 10 degrees																							
9	7	+10.0	– 10.9	+ 11.4	– 12.9	+ 13.7	– 15.5	+ 16.1	– 18.2	+ 18.5	– 20.9	+ 21.3	– 24.1	+ 24.3	– 27.5	+ 27.6	– 31.2	+ 30.6	– 34.6	+ 34.2	– 38.6	+ 38.0	– 43.0
16	7	+10.0	– 10.3	+ 10.9	– 12.2	+ 13.1	– 14.6	+ 15.5	– 17.2	+ 17.7	– 19.7	+ 20.4	– 22.7	+ 23.3	– 26.0	+ 26.4	– 29.4	+ 29.3	– 32.6	+ 32.7	– 36.5	+ 36.4	– 40.6
		78 MPH		85 MPH		93 MPH		101 MPH		108 MPH		116 MPH		124 MPH		132 MPH		139 MPH		147 MPH		155 MPH	

For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 psf = 47.88 N/m^2.

Nominal Design Wind Speed (V_{asd}) converted from Ultimate Design Wind Speed per Section 1609.3.1.

1. 1.For door sizes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower door size.
2. 2.Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 1609.7(2). Minimum positive wind load shall be 10 psf and minimum negative wind load shall be 10 psf.
3. 3.Plus and minus signs signify pressures acting toward and away from the building surfaces.
4. 4.Negative pressures assume door has 2 feet of width in building's end zone.
5. 5.Table values include the 0.6 load reduction factor.

TABLE 1609.7(2)

ADJUSTMENT FACTOR FOR BUILDING HEIGHT AND EXPOSURE, (λ)

MEAN ROOF HEIGHT (feet)	EXPOSURE		
	B	C	D
15	0.82	1.21	1.47
20	0.89	1.29	1.55
25	0.94	1.35	1.61

30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.06	1.49	1.74
45	1.10	1.53	1.78
50	1.13	1.56	1.81
55	1.16	1.59	1.84
60	1.19	1.62	1.8