TABLE 7.2
GROUND SNOW LOAD ADJUSTMENT

REGION	GROUND SNOW ADJUSTMENT LOADS (psf per foot of elevation gain)
Oregon Coast Mountains	0.07
Interior and Willamette Valleys	0.04
Cascade Mountains	0.07
Siskiyou and Kalmiopsis Mountains	0.04
Plains east of the Cascades	0.007
Klamath Basin	0.008
Eastern Oregon Mountains	0.04

1608.2.3 ASCE 7, Section 7.3.4. Modify ASCE 7, Section 7.3.4, *Minimum Snow Load for Low-Slope Roofs, p_m,* to read as follows:

The roof snow load for monoslope, hip and gable roofs with slopes less than 15 degrees and for curved roofs where the vertical angle from the eaves to the crown is less than 10 degrees shall be not less than 20 psf times the importance factor, I_s, plus the rain-on-snow surcharge determined from Section 7.10. This minimum roof snow load is a separate uniform load case and need not be used in determining or in combination with drift, sliding, unbalanced or partial loads.

1608.2.4 ASCE 7, Section 7.4. Modify ASCE 7, Section 7.4, *Sloped Roof Snow Loads, p_s,* to add the following:

The sloped roof snow load, p_s, used for design shall be not less than 20 psf times the importance factor, I_s, plus the rain-on-snow surcharge determined from Section 7.10. This minimum sloped roof snow load is a separate uniform load case and need not be used in determination of or in combination with drift, sliding, unbalanced or partial loads.

1608.2.5 ASCE 7, Section 7.10. Modify ASCE 7, Section 7.10, *Rain-on-Snow Surcharge Load,* to read as follows:

A 5 psf rain-on-snow surcharge shall be added to the minimum roof snow load determined from Sections 7.3.4 and 7.4 where any of the following conditions exist:

1. All roofs having a slope less than or equal to 1 unit vertical in 12 units horizontal (1:12).
2. Roofs of any slope that constrain runoff of the drainage system by parapets or other physical obstructions and are capable of accumulating more than 1 inch of standing water on any part of the roof. Structures with a continuous gutter at the low-point eave or comparable system shall not be considered as having constrained runoff.

   Exception: The 5 psf rain-on-snow surcharge need not apply to roofs, of any slope, where all of the following conditions exist:

   1. The roof drainage is not constrained.
   2. The mapped ground snow load, p_g, is less than 15 psf.
   3. The structure lies west of the Coast Range crest or east of the Cascade Range crest. At the most northern point of the Coast Range crest, the dividing line shall be the county line between Clatsop and Columbia counties.

1608.3 Site-specific snow load study. Where ground snow loads determined from Section 1608.2.2 exceed the location-specific threshold loads in Table 1608.3, an *approved* site-specific snow load study is required to determine the ground snow load used for design. The ground snow load determination from a site-specific study shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval).

TABLE 1608.3
LOCATIONS AND CRITERIA FOR
SITE-SPECIFIC GROUND SNOW LOAD STUDY REQUIREMENT

LOCATION	GROUND SNOW THRESHOLD LOADS FOR SITE-SPECIFIC STUDY (psf)
Oregon Coast Mountains	100
Cascade Mountains	350
Siskiyou and Kalmiopsis Mountains	200
Eastern Oregon Mountains	200

1608.4 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7.

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.

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 using the basic design wind speed, V, as determined by Section 1609.3. The exposure category for a site is permitted to be determined in accordance with Section 1609 or 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. 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. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001. The wind speed used for the design shall be determined by Section 1609.3.

5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment. The wind speed used for the design shall be determined by Section 1609.3.
6. Wind tunnel tests in accordance with ASCE 49 and Chapter 31 of ASCE 7.

The wind speeds in Table 1609.3 are basic design wind speeds, V, and shall be converted in accordance with Section 1609.3.1 to allowable stress 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 all of the following conditions:

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. The maximum average slope of the hill exceeds 10 percent.
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 2 miles (3.22 km), whichever is greater.

1609.2 Reserved.

1609.3 Basic design wind speed. The basic design wind speed, V, in mph, for the determination of the wind loads shall be determined by Table 1609.3.

1609.3.1 Wind speed conversion. Where required, the basic design wind speeds of Table 1609.3 shall be converted to allowable stress design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-33.

$$V_{asd} = V\sqrt{0.6} \qquad \textbf{(Equation 16-33)}$$

where:

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

V = Basic design wind speeds determined from Table 1609.3.

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 following categories, 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 not less than 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 not less than 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 not less than 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall 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.

TABLE 1609.3
BASIC DESIGN WIND SPEED, *V*, FOR RISK CATEGORY I, II, III AND IV BUILDINGS AND OTHER STRUCTURES

COUNTY	RISK CATEGORY I BASIC DESIGN WIND SPEED (MPH)	RISK CATEGORY II BASIC DESIGN WIND SPEED (MPH)	RISK CATEGORY III BASIC DESIGN WIND SPEED (MPH)	RISK CATEGORY IV BASIC DESIGN WIND SPEED (MPH)
Baker	97	103	110	114
Benton	90	96	102	107
Clackamas Clackamas special wind region[a]	92 115	98 120	105 130	109 130
Clatsop Clatsop special wind region[a]	91 125	96 135	102 145	107 145
Columbia Columbia special wind region[a]	91 115	97 120	103 130	107 130
Coos Coos special wind region[a, b]	89 115[b]	95 120[b]	101 130[b]	106 130[b]
Crook Crook special wind region[a]	93 100	100 110	106 115	111 115
Curry Curry special wind region[a]	88 125	94 135	101 145	105 145
Deschutes Deschutes special wind region[a]	93 100	99 110	106 115	110 115
Douglas Douglas special wind region[a, b]	91 115[b]	97 120[b]	103 130[b]	108 130[b]
Gilliam[d]	94[d]	100[d]	107[d]	111[d]
Grant	95	101	108	113
Harney	94	101	108	112
Hood River[c] Hood River N.45.5° special wind region[a, c] Hood River S.45.5° special wind region[a]	92[c] 115[c] 100	98[c] 120[c] 110	105[c] 130[c] 115	109[c] 130[c] 115
Jackson	90	96	103	107
Jefferson Jefferson special wind region[a]	93 100	99 110	106 115	110 115
Josephine	89	95	102	106
Klamath Klamath special wind region[a]	91 100	98 110	104 115	108 115
Lake	93	99	106	111
Lane Lane special wind region[a, b]	91 115[b]	98 120[b]	105 130[b]	110 130[b]
Lincoln Lincoln special wind region[a]	90 125	96 135	102 145	106 145
Linn	92	98	104	108
Malheur	96	102	109	113
Marion	92	98	104	108
Morrow[d]	94[d]	101[d]	108[d]	112[d]
Multnomah[c] Multnomah special wind region[a, c]	92[c] 115[c]	98[c] 120[c]	105[c] 130[c]	110[c] 130[c]
Polk	90	97	103	107

(continued)

TABLE 1609.3—continued
BASIC DESIGN WIND SPEED, *V*, FOR RISK CATEGORY I, II, III AND IV BUILDINGS AND OTHER STRUCTURES

COUNTY	RISK CATEGORY I BASIC DESIGN WIND SPEED (MPH)	RISK CATEGORY II BASIC DESIGN WIND SPEED (MPH)	RISK CATEGORY III BASIC DESIGN WIND SPEED (MPH)	RISK CATEGORY IV BASIC DESIGN WIND SPEED (MPH)
Sherman[d]	93[d]	99[d]	106[d]	111[d]
Tillamook Tillamook special wind region[a]	91 125	96 135	102 145	107 145
Umatilla[c]	95[c]	102[c]	109[c]	113[c]
Union	96	102	109	113
Wallowa	97	103	110	115
Wasco[d] Wasco special wind region[a]	93[d] 100	99[d] 110	106[d] 115	110[d] 115
Washington	91	97	103	107
Wheeler	94	100	107	111
Yamhill	91	97	103	107

For SI: 1 mile per hour = 0.45 m/s.

a. Refer to Figure 1609.3 for mapped special wind regions.

b. The basic design wind speed for buildings and structures in this region with full exposure (wind exposure category D) to Ocean winds shall be 125 mph for Risk Category I, 135 mph for Risk Category II, and 145 mph for Risk Categories III and IV.

c. The basic design wind speed for buildings and structures in this region with full exposure (wind exposure category D) to Columbia River Gorge winds shall be 125 mph for Risk Category I, 135 mph for Risk Category II, and 145 mph for Risk Categories III and IV.

d. The basic design wind speed for buildings and structures in this region with full exposure (wind exposure category D) to Columbia River Gorge winds shall be 115 mph for Risk Category I, 120 mph for Risk Category II, and 130 mph for Risk Categories III and IV.

1609.5 Roof systems. Roof systems shall be designed and constructed in accordance with Sections 1609.5.1 through 1609.5.3, as applicable.

1609.5.1 Roof deck. The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

1609.5.2 Roof coverings. Roof coverings shall comply with Section 1609.5.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall comply with the wind-resistance requirements of Section 1504.1.1.

1609.5.3 Rigid tile. Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \qquad \textbf{(Equation 16-34)}$$

For SI:

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

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.

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. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.

FIGURE 1609.3
OREGON SPECIAL WIND REGIONS[a, b]

a. Sites on the periphery of the identified special wind regions shall be verified using https://hazards.atcouncil.org.
b. Basic design wind speeds shall be obtained from Table 1609.3; see Notes b, c and d for buildings and structures with full exposure (wind exposure category D) to Ocean or Columbia River Gorge winds.

TABLE 1609.3.1
WIND SPEED CONVERSIONS[a, b, c]

V	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.
a. Linear interpolation is permitted.
b. V_{asd} = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.
c. V = basic design wind speeds determined from Table 1609.3.

4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have not less than two-thirds of the tile's area free of mortar or adhesive contact.

SECTION 1610
SOIL LATERAL LOADS

1610.1 General. Foundation walls and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils at the site are expansive or the retaining wall will support an ascending backfill slope. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805.4.2 and 1805.4.3.

Exception: Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

SECTION 1611
RAIN LOADS

1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow. The design rainfall shall be based on the 100-year hourly rainfall rate indicated in Figure 1611.1.

$$R = 5.2(d_s + d_h) \qquad \textbf{(Equation 16-35)}$$

For SI: $R = 0.0098(d_s + d_h)$

TABLE 1610.1
LATERAL SOIL LOAD

DESCRIPTION OF BACKFILL MATERIAL[c]	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD[a] (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.

b. Unsuitable as backfill material.

c. The definition and classification of soil materials shall be in accordance with ASTM D2487.