IRCA Winter Meeting 2020
Des Moines, Iowa – January 23-24, 2020

ASCE 7-16: Understanding new minimum design wind load requirements

presented by

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Topics

- ASCE 7-16
- Steel roof decks -- SDI bulletin
- Moisture in concrete roof decks
- Roof coatings
- Questions/other topics

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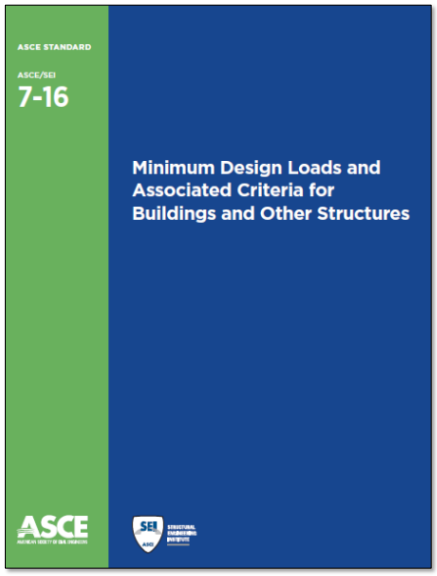

American Society of Civil Engineers Standard 7, "Minimum design loads and associated criteria for buildings and other structures" (ASCE 7-16)

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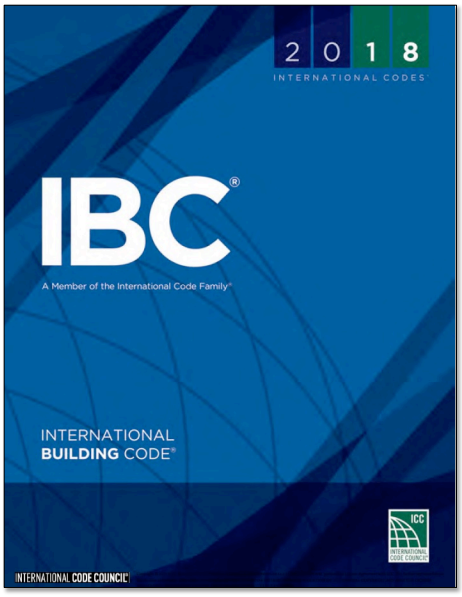

International Building Code, 2018 Edition

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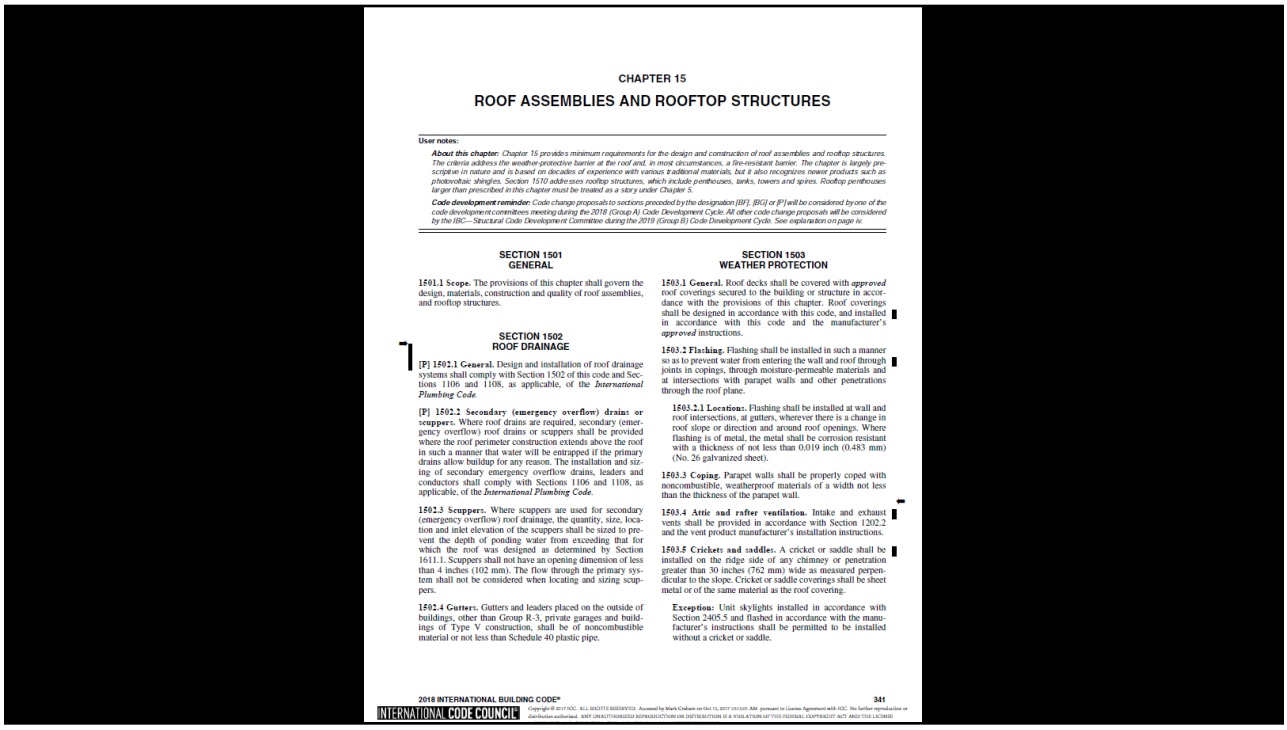

CHAPTER 15

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

User notes:

About this chapter: *Chapter 15 provides minimum requirements for the design and construction of roof assemblies and rooftop structures. The criteria address the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier. The chapter is largely prescriptive in nature and is based on decades of experience with various traditional materials, but it also recognizes newer products such as photovoltaic shingles. Section 1510 addresses rooftop structures, which include penthouses, tanks, towers and spires. Rooftop penthouses larger than prescribed in this chapter must be treated as a story under Chapter 5.*

Code development reminder: *Code change proposals to sections preceded by the designation [BF], [BG] or [P] will be considered by one of the code development committees meeting during the 2018 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the 2019 (Group B) Code Development Cycle. See explanation on page iv.*

SECTION 1501
GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

SECTION 1502
ROOF DRAINAGE

[P] 1502.1 General. Design and installation of roof drainage systems shall comply with Section 1502 of this code and Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

[P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

1502.3 Scuppers. Where scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

1502.4 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or not less than Schedule 40 plastic pipe.

SECTION 1503
WEATHER PROTECTION

1503.1 General. Roof decks shall be covered with *approved* roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed in accordance with this code, and installed in accordance with this code and the manufacturer's *approved* instructions.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent water from entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.483 mm) (No. 26 galvanized sheet).

1503.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

1503.4 Attic and rafter ventilation. Intake and exhaust vents shall be provided in accordance with Section 1202.2 and the vent product manufacturer's installation instructions.

1503.5 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Unit skylights installed in accordance with Section 2405.5 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

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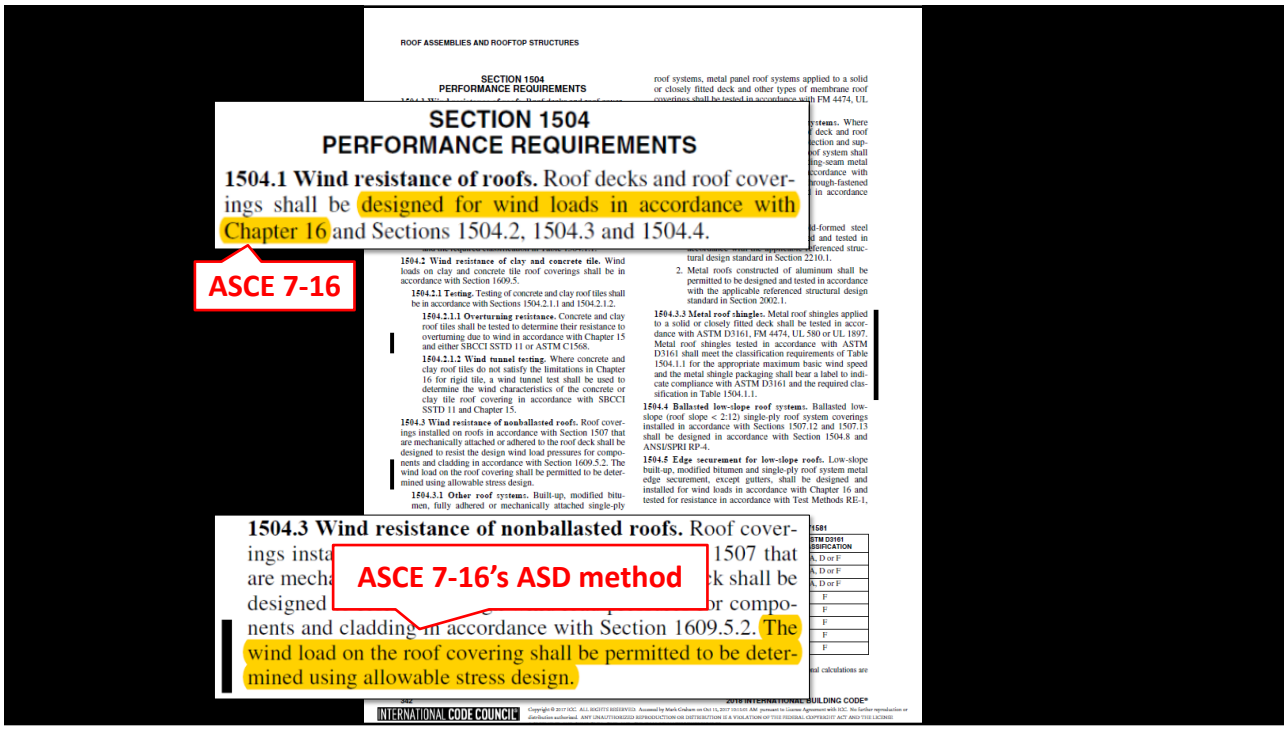

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1504
PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

ASCE 7-16

1504.2 Wind resistance of clay and concrete tile. Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.5.

1504.2.1 Testing. Testing of concrete and clay roof tiles shall be in accordance with Sections 1504.2.1.1 and 1504.2.1.2.

1504.2.1.1 Overturning resistance. Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with Chapter 15 and either SBCCI SSTD 11 or ASTM C1568.

1504.2.1.2 Wind tunnel testing. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11 and Chapter 15.

1504.3 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.5.2. The wind load on the roof covering shall be permitted to be determined using allowable stress design.

1504.3.1 Other roof systems. Built-up, modified bitumen, fully adhered or mechanically attached single-ply roof systems, metal panel roof systems applied to a solid or closely fitted deck and other types of membrane roof coverings shall be tested in accordance with FM 4474, UL

1504.3 Wind resistance of nonballasted roofs. Roof coverings insta… 1507 that are mecha… k shall be designed … or components and cladding in accordance with Section 1609.5.2. The wind load on the roof covering shall be permitted to be determined using allowable stress design.

ASCE 7-16's ASD method

…ystems. Where … deck and roof …ection and support system shall …ing-seam metal …ccordance with …rough-fastened … in accordance

…d-formed steel …d and tested in …ferenced structural design standard in Section 2210.1.

2. Metal roofs constructed of aluminum shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2002.1.

1504.3.3 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 1504.1.1 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 1504.1.1.

1504.4 Ballasted low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with Section 1504.8 and ANSI/SPRI RP-4.

1504.5 Edge securement for low-slope roofs. Low-slope built-up, modified bitumen and single-ply roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1,

…1581 …STM D3161 …SSIFICATION
…A, D or F
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…al calculations are

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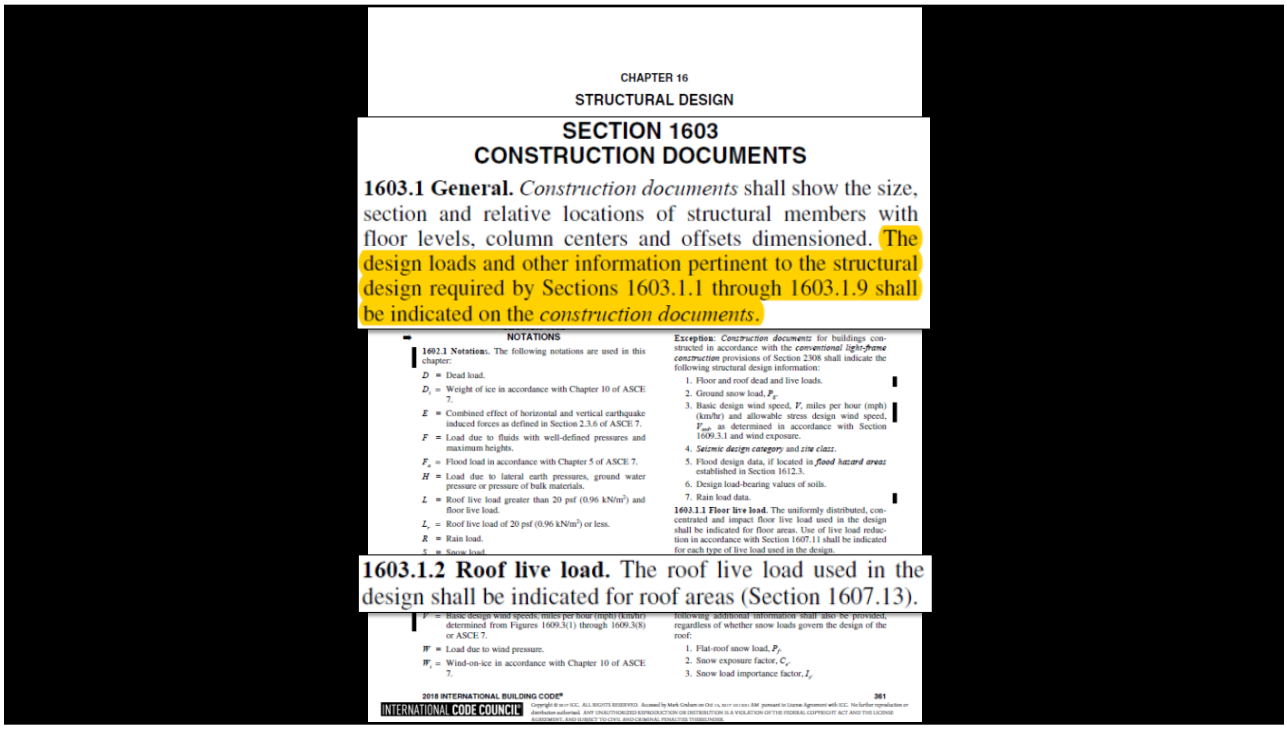

CHAPTER 16

STRUCTURAL DESIGN

SECTION 1603
CONSTRUCTION DOCUMENTS

1603.1 General. *Construction documents* shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the *construction documents*.

NOTATIONS

1602.1 Notations. The following notations are used in this chapter:

D = Dead load.

D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.

E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 2.3.6 of ASCE 7.

F = Load due to fluids with well-defined pressures and maximum heights.

F_a = Flood load in accordance with Chapter 5 of ASCE 7.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Roof live load greater than 20 psf (0.96 kN/m^2) and floor live load.

L_r = Roof live load of 20 psf (0.96 kN/m^2) or less.

R = Rain load.

S = Snow load.

V = Basic design wind speeds, miles per hour (mph) (km/hr) determined from Figures 1609.3(1) through 1609.3(8) or ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

Exception: *Construction documents* for buildings constructed in accordance with the *conventional light-frame construction* provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof dead and live loads.
2. Ground snow load, P_g.
3. Basic design wind speed, V, miles per hour (mph) (km/hr) and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1 and wind exposure.
4. *Seismic design category* and *site class*.
5. Flood design data, if located in *flood hazard areas* established in Section 1612.3.
6. Design load-bearing values of soils.
7. Rain load data.

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.11 shall be indicated for each type of live load used in the design.

1603.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas (Section 1607.13).

following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, P_f.
2. Snow exposure factor, C_e.
3. Snow load importance factor, I_s.

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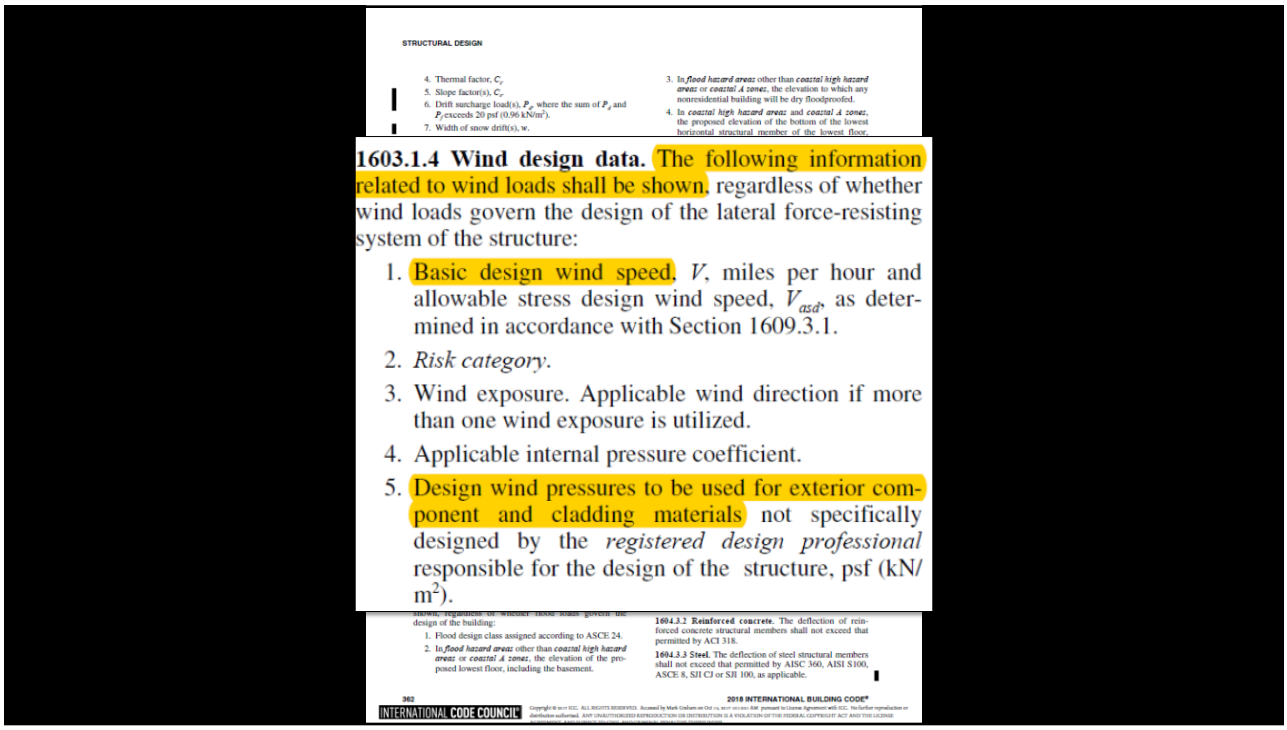

STRUCTURAL DESIGN

4. Thermal factor, C_t.
5. Slope factor(s), C_s.
6. Drift surcharge load(s), P_d, where the sum of P_d and P_f exceeds 20 psf (0.96 kN/m^2).
7. Width of snow drift(s), w.

3. In *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*, the elevation to which any nonresidential building will be dry floodproofed.
4. In *coastal high hazard areas* and *coastal A zones*, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor,

1603.1.4 Wind design data. The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

1. Basic design wind speed, V, miles per hour and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1.
2. *Risk category*.
3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
4. Applicable internal pressure coefficient.
5. Design wind pressures to be used for exterior component and cladding materials not specifically designed by the *registered design professional* responsible for the design of the structure, psf (kN/m^2).

design of the building:

1. Flood design class assigned according to ASCE 24.
2. In *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*, the elevation of the proposed lowest floor, including the basement.

1604.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI CJ or SJI 100, as applicable.

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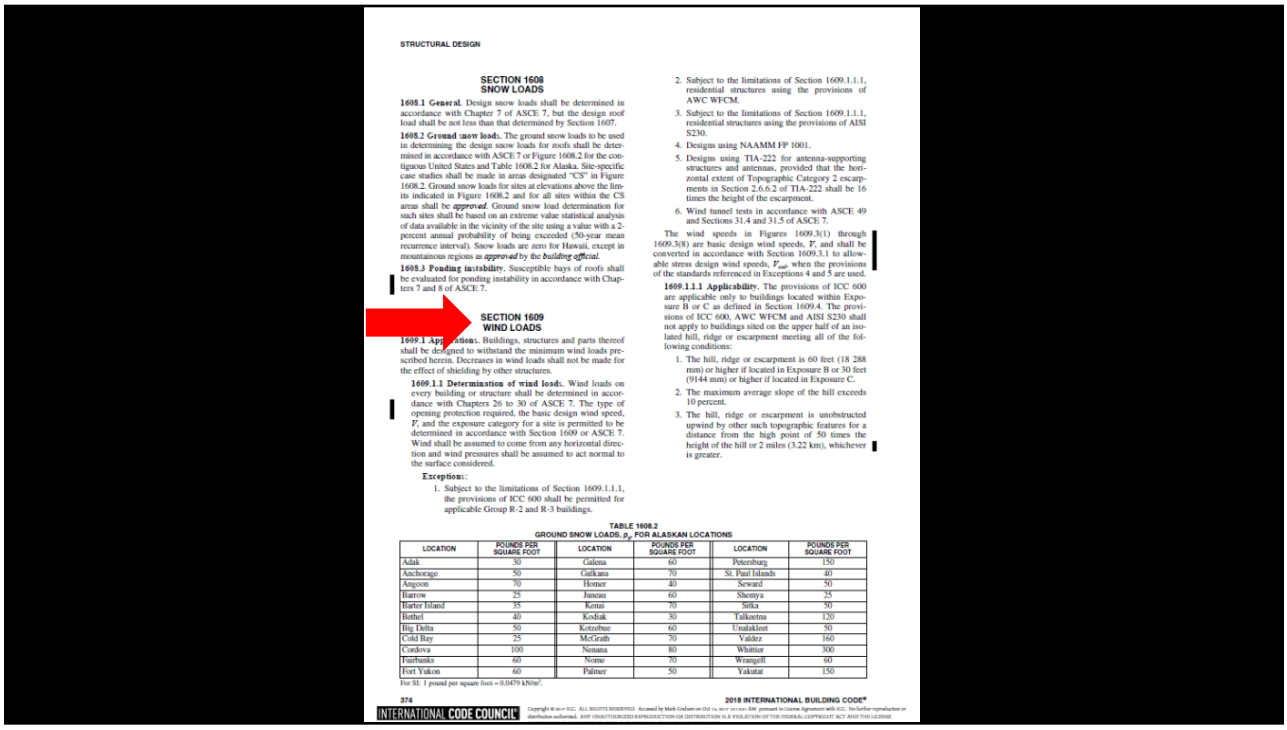

STRUCTURAL DESIGN

SECTION 1608
SNOW LOADS

1608.1 General. Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall be not less than that determined by Section 1607.

1608.2 Ground snow loads. The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figure 1608.2 for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be made in areas designated "CS" in Figure 1608.2. Ground snow loads for sites at elevations above the limits indicated in Figure 1608.2 and for all sites within the CS areas shall be *approved*. Ground snow load determination for such sites 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). Snow loads are zero for Hawaii, except in mountainous regions as *approved* by the *building official*.

1608.3 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 Application. 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. The type of opening protection required, the basic design wind speed, V, and 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.
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.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.

The wind speeds in Figures 1609.3(1) through 1609.3(8) 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.

TABLE 1608.2
GROUND SNOW LOADS, p_g, FOR ALASKAN LOCATIONS

LOCATION	POUNDS PER SQUARE FOOT	LOCATION	POUNDS PER SQUARE FOOT	LOCATION	POUNDS PER SQUARE FOOT
Adak	30	Galena	60	Petersburg	150
Anchorage	50	Gulkana	70	St. Paul Islands	40
Angoon	70	Homer	40	Seward	50
Barrow	25	Juneau	60	Shemya	25
Barter Island	35	Kenai	70	Sitka	70
Bethel	40	Kodiak	30	Talkeetna	120
Big Delta	50	Kotzebue	60	Unalakleet	50
Cold Bay	25	McGrath	70	Valdez	160
Cordova	100	Nenana	80	Whittier	300
Fairbanks	60	Nome	70	Wrangell	60
Fort Yukon	60	Palmer	50	Yakutat	150

For SI: 1 pound per square foot = 0.0479 kN/m².

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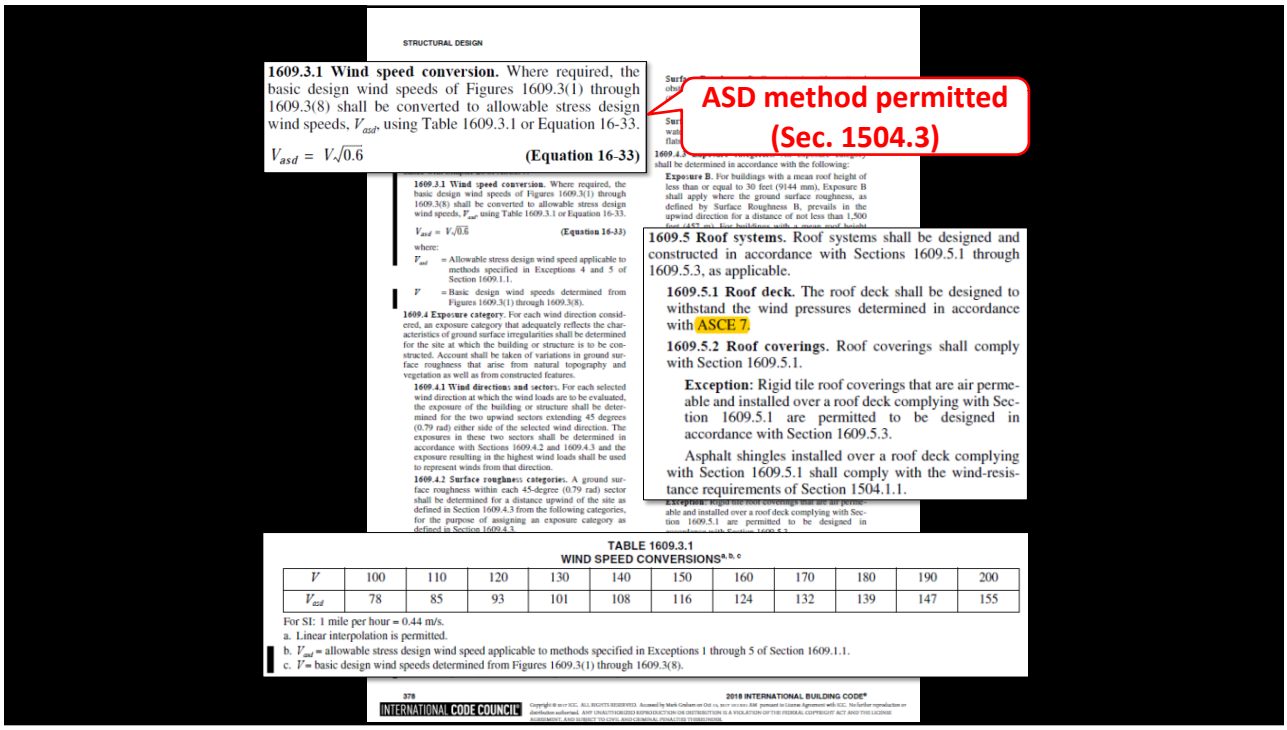

STRUCTURAL DESIGN

1609.3.1 Wind speed conversion. Where required, the basic design wind speeds of Figures 1609.3(1) through 1609.3(8) shall be converted to allowable stress design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-33.

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

ASD method permitted (Sec. 1504.3)

1609.3.1 Wind speed conversion. Where required, the basic design wind speeds of Figures 1609.3(1) through 1609.3(8) shall be converted to allowable stress design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-33.

$V_{asd} = V\sqrt{0.6}$ **(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 Figures 1609.3(1) through 1609.3(8).

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.

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

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.

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

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 Figures 1609.3(1) through 1609.3(8).

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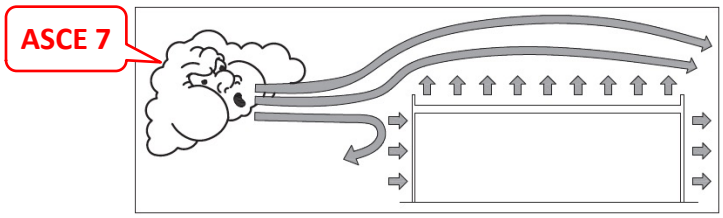
The fundamental concept



Wind creates pressures/forces
on building elements

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Fundamental concept -- continued

Adhesion or attachment ≥ Uplift pressure

- FM rating
- UL classification ≥ ASCE 7
- Engineering

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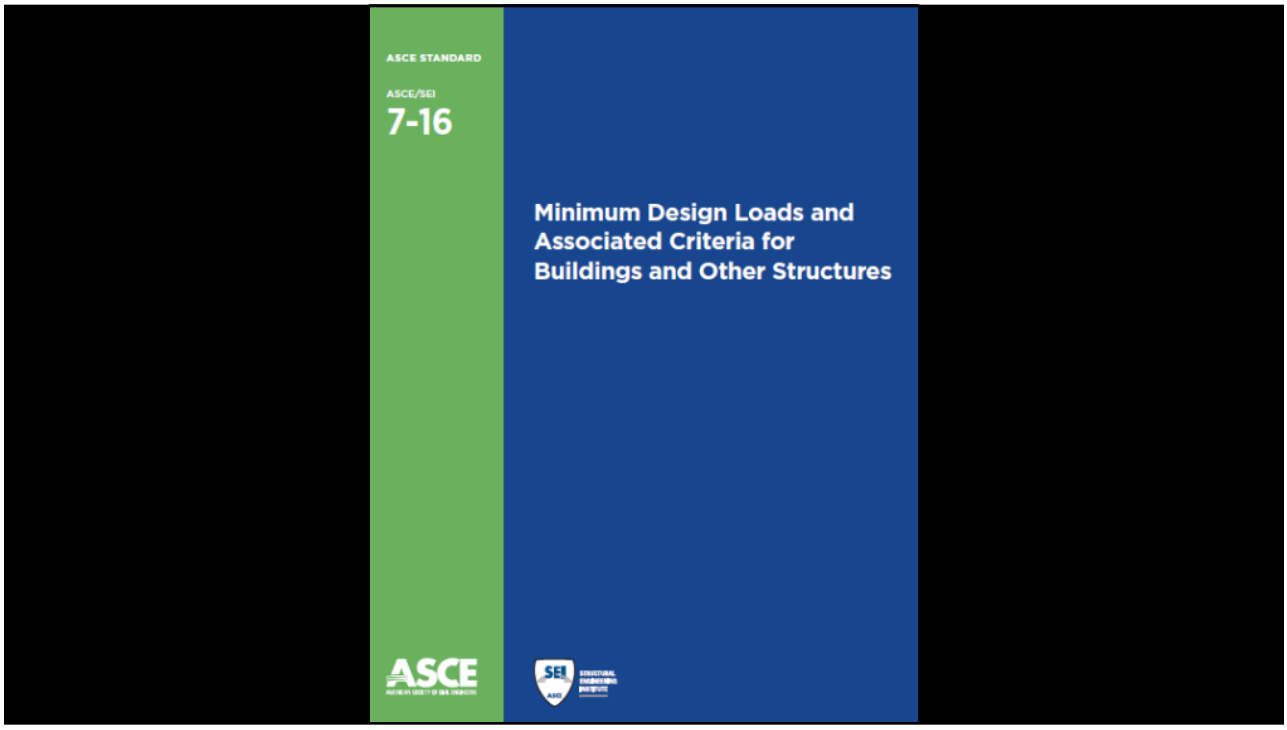
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Minimum Design Loads and Associated Criteria for Buildings and Other Structures
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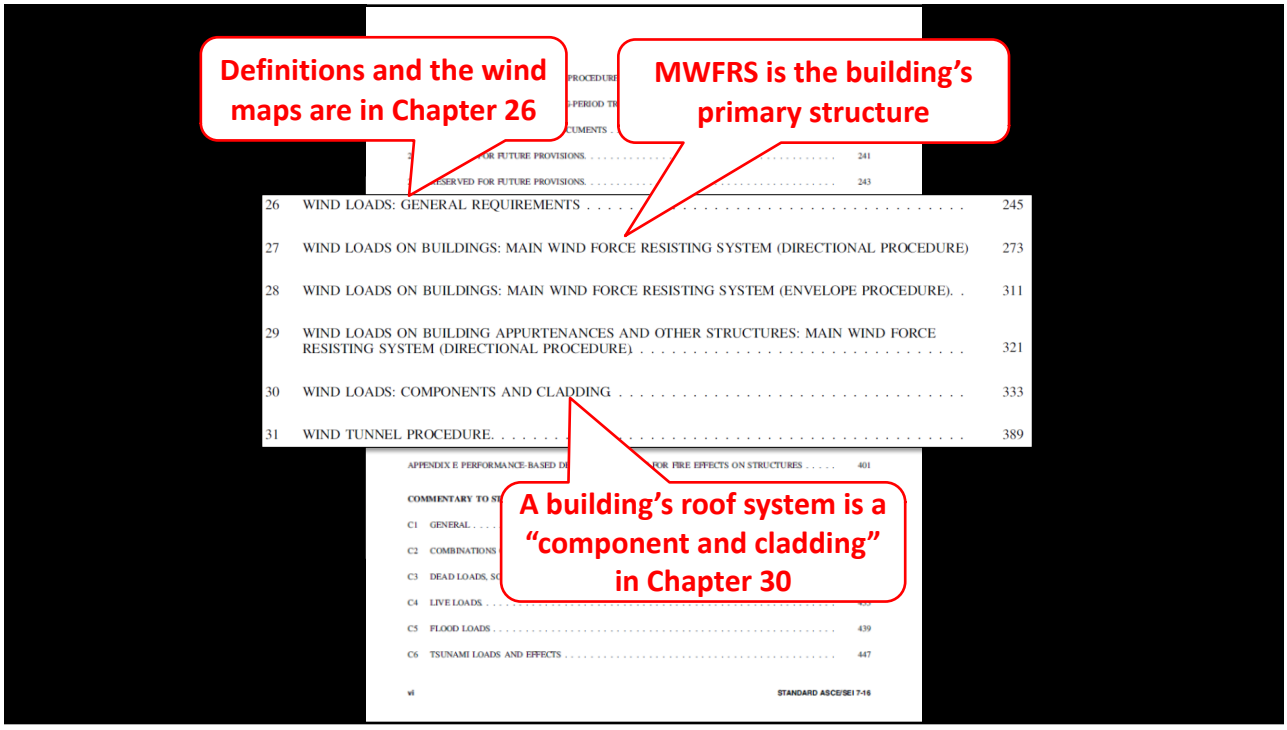
Definitions and the wind maps are in Chapter 26
MWFRS is the building's primary structure
26 WIND LOADS: GENERAL REQUIREMENTS 245
27 WIND LOADS ON BUILDINGS: MAIN WIND FORCE RESISTING SYSTEM (DIRECTIONAL PROCEDURE) 273
28 WIND LOADS ON BUILDINGS: MAIN WIND FORCE RESISTING SYSTEM (ENVELOPE PROCEDURE). 311
29 WIND LOADS ON BUILDING APPURTENANCES AND OTHER STRUCTURES: MAIN WIND FORCE RESISTING SYSTEM (DIRECTIONAL PROCEDURE) 321
30 WIND LOADS: COMPONENTS AND CLADDING 333
31 WIND TUNNEL PROCEDURE. 389
A building's roof system is a "component and cladding" in Chapter 30

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CHAPTER 26
WIND LOADS: GENERAL REQUIREMENTS

26.1 PROCEDURES

26.1.1 Scope. Buildings and other structures, including the main wind force resisting system (MWFRS) and all components and cladding (C&C) thereof, shall be designed and constructed to resist the wind loads determined in accordance with Chapters 26 through 31. The provisions of this chapter define basic wind parameters for use with other provisions contained in this standard.

26.1.2 Permitted Procedures. The design wind loads for buildings and other structures, including the MWFRS and C&C elements thereof, shall be determined using one of the procedures as specified in this section. An outline of the overall process for the determination of the wind loads, including section references, is provided in Fig. 26.1-1.

26.1.2.2 Components and Cladding. Wind loads on C&C on all buildings and other structures shall be designed using one of the following procedures:

1. Analytical Procedures provided in Parts 1 through 6, as appropriate, of Chapter 30; or
2. Wind Tunnel Procedure as specified in Chapter 31.

26.2 DEFINITIONS

The following definitions apply to the provisions of Chapters 26 through 31:

APPROVED: Acceptable to the Authority Having Jurisdiction.

ATTACHED CANOPY: A horizontal (maximum slope of 2%) patio cover attached to the building wall at any height; it is different from an overhang, which is an extension of the roof surface.

BASIC WIND SPEED, *V*: Three-second gust speed at 33 ft (10 m) above the ground in Exposure C (see Section 26.7.3) as determined in accordance with Section 26.5.1.

BUILDING, ENCLOSED: A building that has the total area of openings in each wall, that receives positive external pressure, less than or equal to 4 sq ft (0.37 m^2) or 1% of the area of that wall, whichever is smaller. This condition is expressed for each wall by the following equation:

$A_o < 0.01A_g$, or 4 sqft (0.37 m^2), whichever is smaller,

where A_o and A_g are as defined for Open Buildings.

BUILDING, LOW-RISE: Enclosed or partially enclosed building that complies with the following conditions:

1. Mean roof height h less than or equal to 60 ft (18 m)

2. The total area of openings in a wall that receives positive external pressure exceeds 4 ft^2 (0.37 m^2) or 1% of the area of that wall, whichever is smaller, and the percentage of openings in the balance of the building envelope does not exceed 20%.

These conditions are expressed by the following equations:

$$A_o > 1.10A_{oi}$$

$A_o > 4$ ft^2(0.37 m^2) or

$> 0.01A_g$, whichever is smaller, and $A_{oi}/A_{gi} \le 0.20$

where A_o and A_g are as defined for Open Building;

A_{oi} = sum of the areas of openings in the building envelope (walls and roof) not including A_o, in ft^2 (m^2); and

A_{gi} = sum of the gross surface areas of the building envelope (walls and roof) not including A_g, in ft^2 (m^2).

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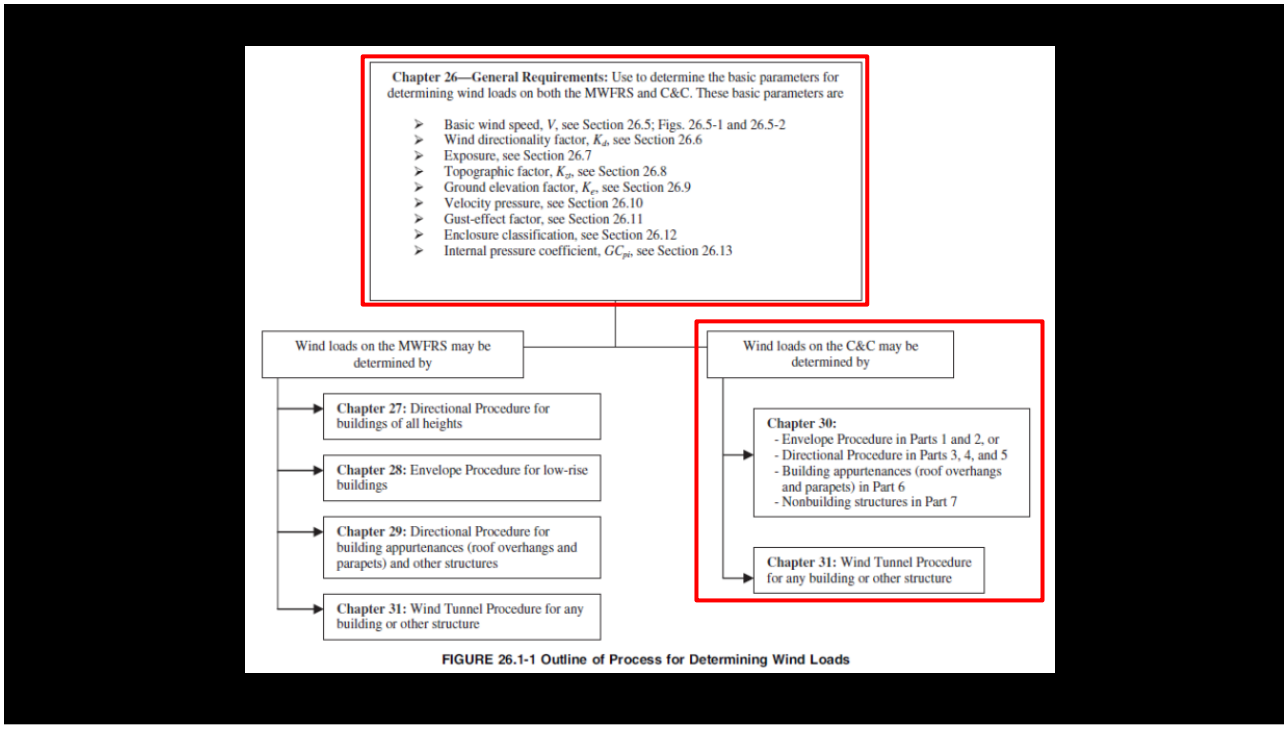

FIGURE 26.1-1 Outline of Process for Determining Wind Loads

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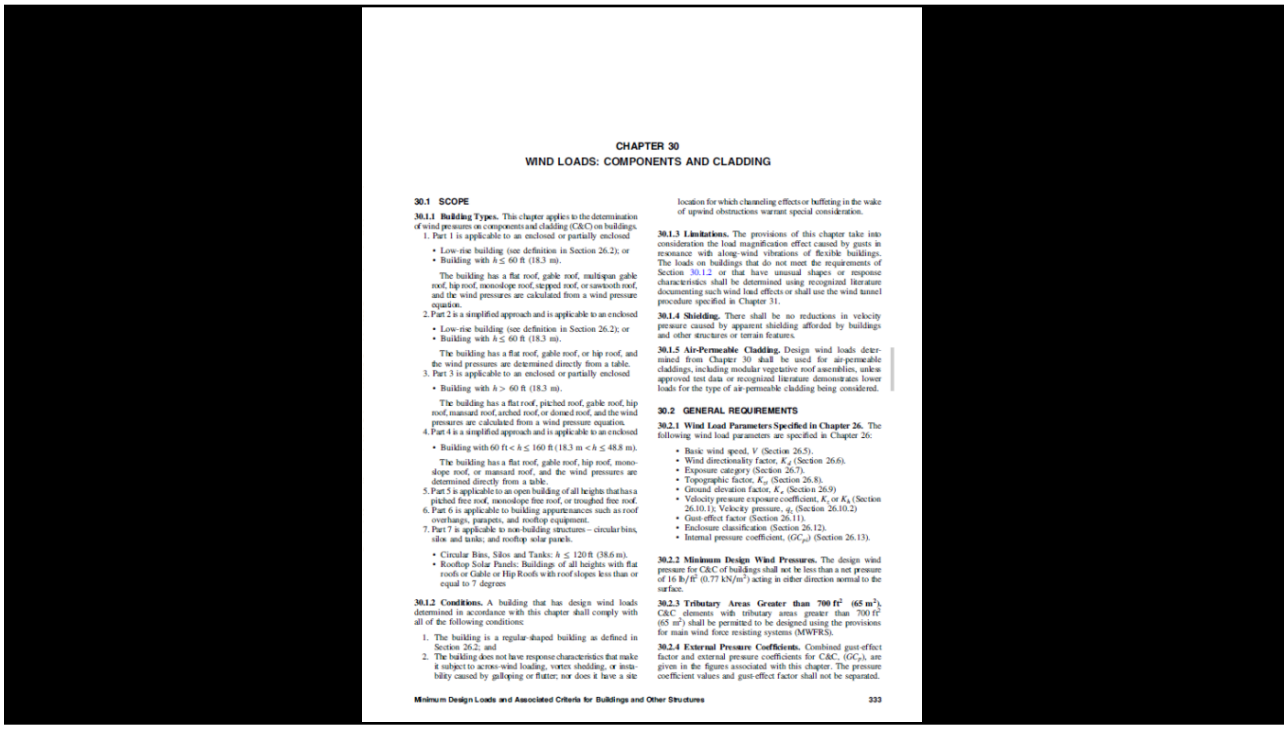

CHAPTER 30
WIND LOADS: COMPONENTS AND CLADDING

30.1 SCOPE

30.1.1 Building Types. This chapter applies to the determination of wind pressures on components and cladding (C&C) on buildings.

1. Part 1 is applicable to an enclosed or partially enclosed
   - Low-rise building (see definition in Section 26.2); or
   - Building with $h \leq 60$ ft (18.3 m).

   The building has a flat roof, gable roof, multispan gable roof, hip roof, monoslope roof, stepped roof, or sawtooth roof, and the wind pressures are calculated from a wind pressure equation.
2. Part 2 is a simplified approach and is applicable to an enclosed
   - Low-rise building (see definition in Section 26.2); or
   - Building with $h \leq 60$ ft (18.3 m).

   The building has a flat roof, gable roof, or hip roof, and the wind pressures are determined directly from a table.
3. Part 3 is applicable to an enclosed or partially enclosed
   - Building with $h > 60$ ft (18.3 m).

   The building has a flat roof, pitched roof, gable roof, hip roof, mansard roof, arched roof, or domed roof, and the wind pressures are calculated from a wind pressure equation.
4. Part 4 is a simplified approach and is applicable to an enclosed
   - Building with 60 ft $< h \leq 160$ ft (18.3 m $< h \leq 48.8$ m).

   The building has a flat roof, gable roof, hip roof, monoslope roof, or mansard roof, and the wind pressures are determined directly from a table.
5. Part 5 is applicable to an open building of all heights that has a pitched free roof, monoslope free roof, or troughed free roof.
6. Part 6 is applicable to building appurtenances such as roof overhangs, parapets, and rooftop equipment.
7. Part 7 is applicable to non-building structures – circular bins, silos and tanks; and rooftop solar panels.
   - Circular Bins, Silos and Tanks: $h \leq 120$ ft (38.6 m).
   - Rooftop Solar Panels: Buildings of all heights with flat roofs or Gable or Hip Roofs with roof slopes less than or equal to 7 degrees

30.1.2 Conditions. A building that has design wind loads determined in accordance with this chapter shall comply with all of the following conditions:

1. The building is a regular-shaped building as defined in Section 26.2; and
2. The building does not have response characteristics that make it subject to across-wind loading, vortex shedding, or instability caused by galloping or flutter; nor does it have a site location for which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.

30.1.3 Limitations. The provisions of this chapter take into consideration the load magnification effect caused by gusts in resonance with along-wind vibrations of flexible buildings. The loads on buildings that do not meet the requirements of Section 30.1.2 or that have unusual shapes or response characteristics shall be determined using recognized literature documenting such wind load effects or shall use the wind tunnel procedure specified in Chapter 31.

30.1.4 Shielding. There shall be no reductions in velocity pressure caused by apparent shielding afforded by buildings and other structures or terrain features.

30.1.5 Air-Permeable Cladding. Design wind loads determined from Chapter 30 shall be used for air-permeable claddings, including modular vegetative roof assemblies, unless approved test data or recognized literature demonstrates lower loads for the type of air-permeable cladding being considered.

30.2 GENERAL REQUIREMENTS

30.2.1 Wind Load Parameters Specified in Chapter 26. The following wind load parameters are specified in Chapter 26:

- Basic wind speed, V (Section 26.5).
- Wind directionality factor, K_d (Section 26.6).
- Exposure category (Section 26.7).
- Topographic factor, K_{zt} (Section 26.8).
- Ground elevation factor, K_e (Section 26.9)
- Velocity pressure exposure coefficient, K_z or K_h (Section 26.10.1); Velocity pressure, q_z (Section 26.10.2)
- Gust-effect factor (Section 26.11).
- Enclosure classification (Section 26.12).
- Internal pressure coefficient, (GC_{pi}) (Section 26.13).

30.2.2 Minimum Design Wind Pressures. The design wind pressure for C&C of buildings shall not be less than a net pressure of 16 lb/ft^2 (0.77 kN/m^2) acting in either direction normal to the surface.

30.2.3 Tributary Areas Greater than 700 ft^2 (65 m^2). C&C elements with tributary areas greater than 700 ft^2 (65 m^2) shall be permitted to be designed using the provisions for main wind force resisting systems (MWFRS).

30.2.4 External Pressure Coefficients. Combined gust-effect factor and external pressure coefficients for C&C, (GC_p), are given in the figures associated with this chapter. The pressure coefficient values and gust-effect factor shall not be separated.

Minimum Design Loads and Associated Criteria for Buildings and Other Structures 333

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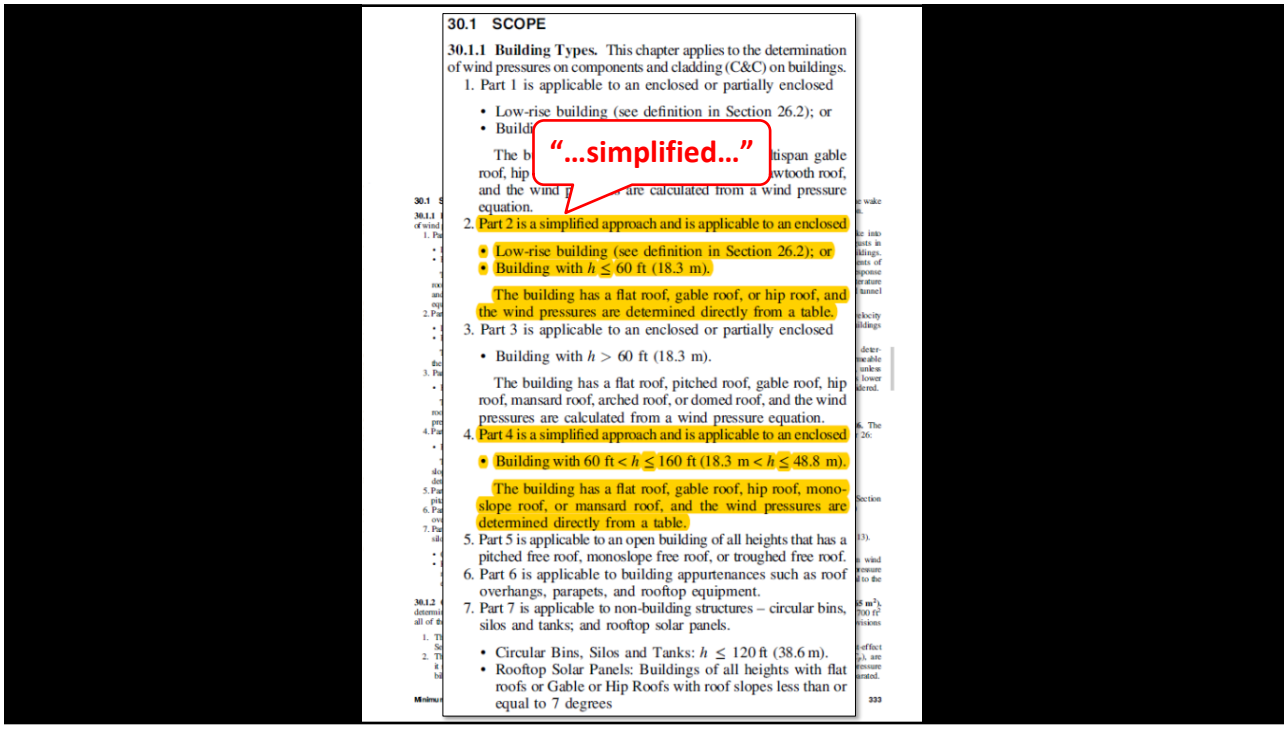

30.1 SCOPE

30.1.1 Building Types. This chapter applies to the determination of wind pressures on components and cladding (C&C) on buildings.

1. Part 1 is applicable to an enclosed or partially enclosed
   - Low-rise building (see definition in Section 26.2); or
   - Build

   The b ltispan gable roof, hip wtooth roof, and the wind p are calculated from a wind pressure equation.
2. Part 2 is a simplified approach and is applicable to an enclosed
   - Low-rise building (see definition in Section 26.2); or
   - Building with $h \leq 60$ ft (18.3 m).

   The building has a flat roof, gable roof, or hip roof, and the wind pressures are determined directly from a table.
3. Part 3 is applicable to an enclosed or partially enclosed
   - Building with $h > 60$ ft (18.3 m).

   The building has a flat roof, pitched roof, gable roof, hip roof, mansard roof, arched roof, or domed roof, and the wind pressures are calculated from a wind pressure equation.
4. Part 4 is a simplified approach and is applicable to an enclosed
   - Building with 60 ft $< h \leq 160$ ft (18.3 m $< h \leq 48.8$ m).

   The building has a flat roof, gable roof, hip roof, monoslope roof, or mansard roof, and the wind pressures are determined directly from a table.
5. Part 5 is applicable to an open building of all heights that has a pitched free roof, monoslope free roof, or troughed free roof.
6. Part 6 is applicable to building appurtenances such as roof overhangs, parapets, and rooftop equipment.
7. Part 7 is applicable to non-building structures – circular bins, silos and tanks; and rooftop solar panels.
   - Circular Bins, Silos and Tanks: $h \leq 120$ ft (38.6 m).
   - Rooftop Solar Panels: Buildings of all heights with flat roofs or Gable or Hip Roofs with roof slopes less than or equal to 7 degrees

"...simplified..."

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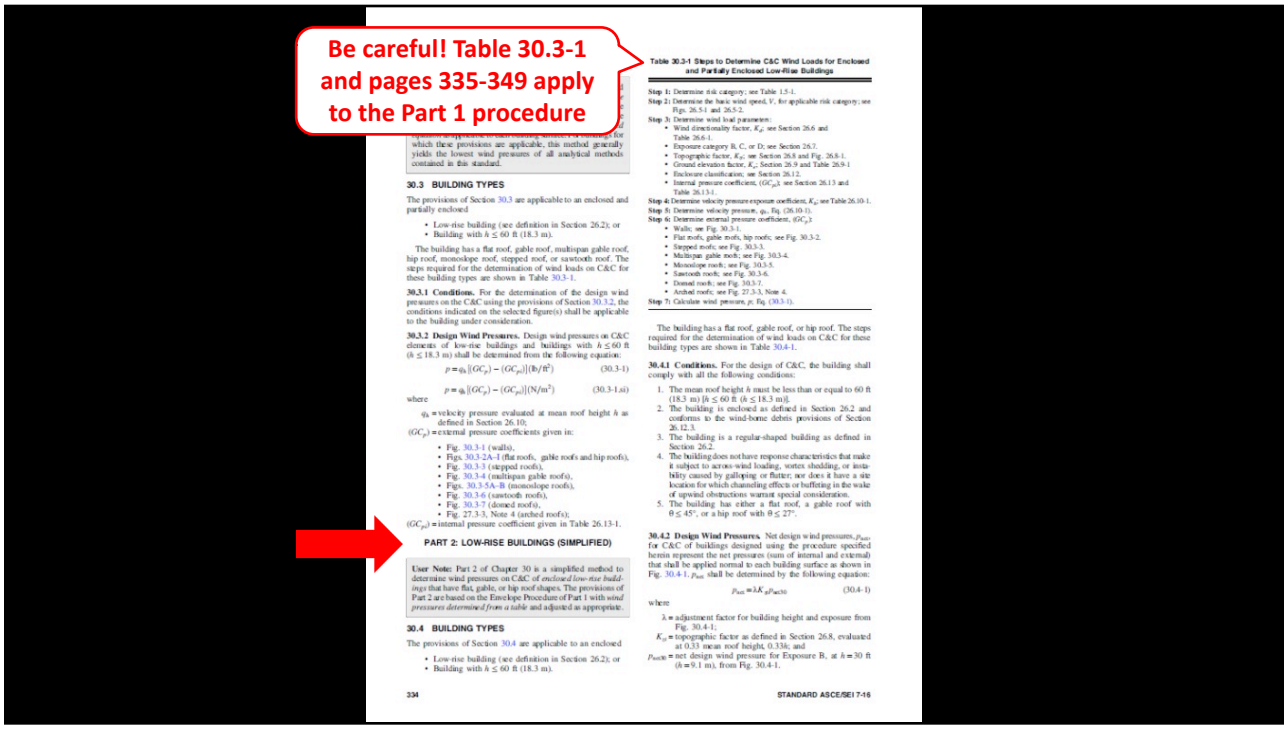
Be careful! Table 30.3-1 and pages 335-349 apply to the Part 1 procedure
Table 30.3-1 Steps to Determine C&C Wind Loads for Enclosed and Partially Enclosed Low-Rise Buildings
30.3 BUILDING TYPES
PART 2: LOW-RISE BUILDINGS (SIMPLIFIED)
30.4 BUILDING TYPES
30.4.1 Conditions.
30.4.2 Design Wind Pressures.
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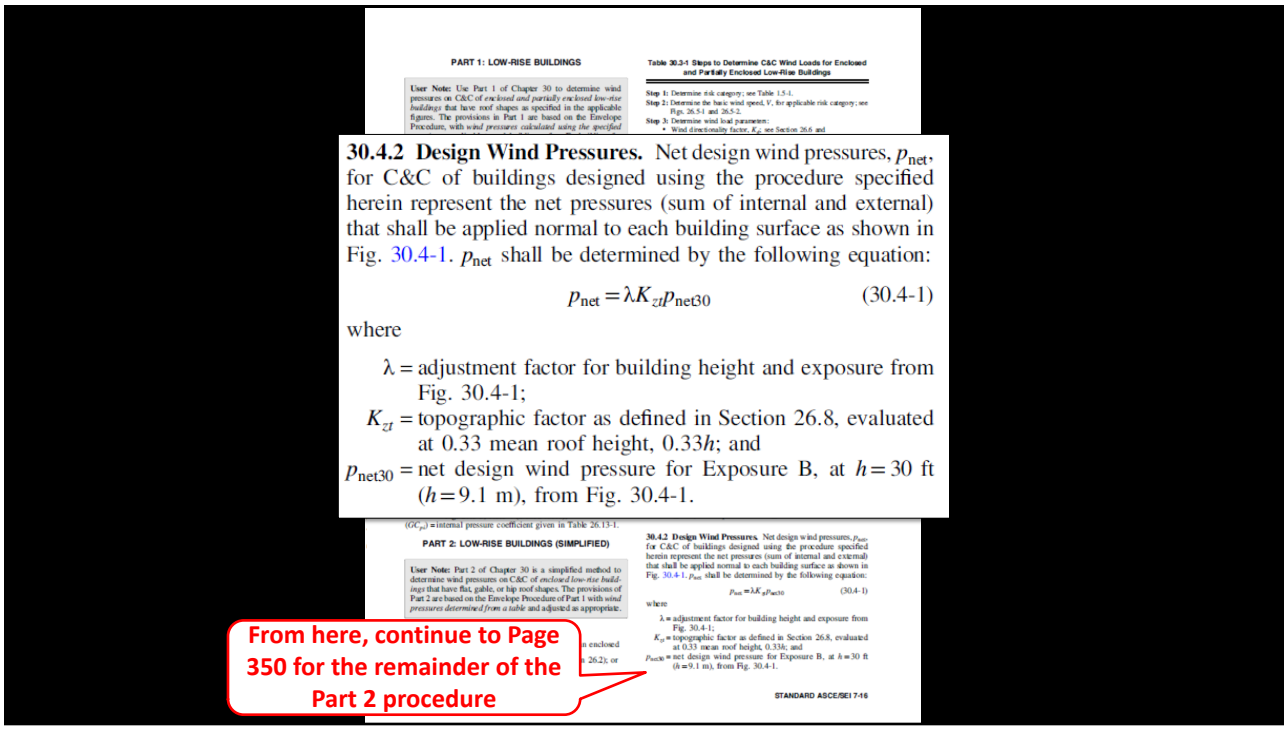
PART 1: LOW-RISE BUILDINGS
30.4.2 Design Wind Pressures. Net design wind pressures, p_{net}, for C&C of buildings designed using the procedure specified herein represent the net pressures (sum of internal and external) that shall be applied normal to each building surface as shown in Fig. 30.4-1. p_{net} shall be determined by the following equation:
$$p_{net} = \lambda K_{zt} p_{net30} \quad (30.4\text{-}1)$$
where
λ = adjustment factor for building height and exposure from Fig. 30.4-1;
K_{zt} = topographic factor as defined in Section 26.8, evaluated at 0.33 mean roof height, 0.33h; and
p_{net30} = net design wind pressure for Exposure B, at h = 30 ft (h = 9.1 m), from Fig. 30.4-1.
From here, continue to Page 350 for the remainder of the Part 2 procedure

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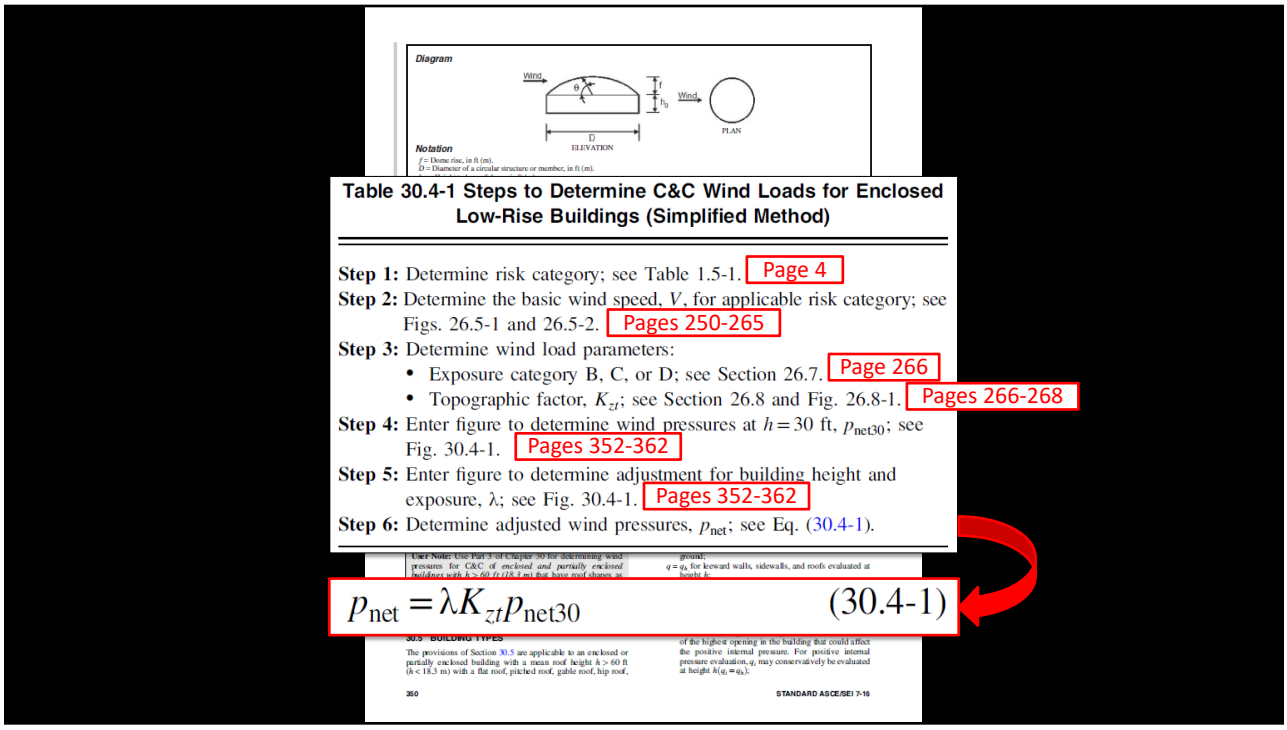
Diagram
Wind
θ
f
h
Wind
D
ELEVATION
PLAN
Notation
f = Dome rise, in ft (m).
D = Diameter of a circular structure or member, in ft (m).
Table 30.4-1 Steps to Determine C&C Wind Loads for Enclosed Low-Rise Buildings (Simplified Method)
Step 1: Determine risk category; see Table 1.5-1.
Page 4
Step 2: Determine the basic wind speed, V, for applicable risk category; see Figs. 26.5-1 and 26.5-2.
Pages 250-265
Step 3: Determine wind load parameters:
• Exposure category B, C, or D; see Section 26.7.
Page 266
• Topographic factor, K_{zt}; see Section 26.8 and Fig. 26.8-1.
Pages 266-268
Step 4: Enter figure to determine wind pressures at $h = 30$ ft, p_{net30}; see Fig. 30.4-1.
Pages 352-362
Step 5: Enter figure to determine adjustment for building height and exposure, λ; see Fig. 30.4-1.
Pages 352-362
Step 6: Determine adjusted wind pressures, p_{net}; see Eq. (30.4-1).
$p_{net} = \lambda K_{zt} p_{net30}$ (30.4-1)
30.5 BUILDING TYPES
The provisions of Section 30.5 are applicable to an enclosed or partially enclosed building with a mean roof height h > 60 ft (h < 18.3 m) with a flat roof, pitched roof, gable roof, hip roof,
of the highest opening in the building that could affect the positive internal pressure. For positive internal pressure evaluation, q_i may conservatively be evaluated at height $h(q_i = q_h)$;
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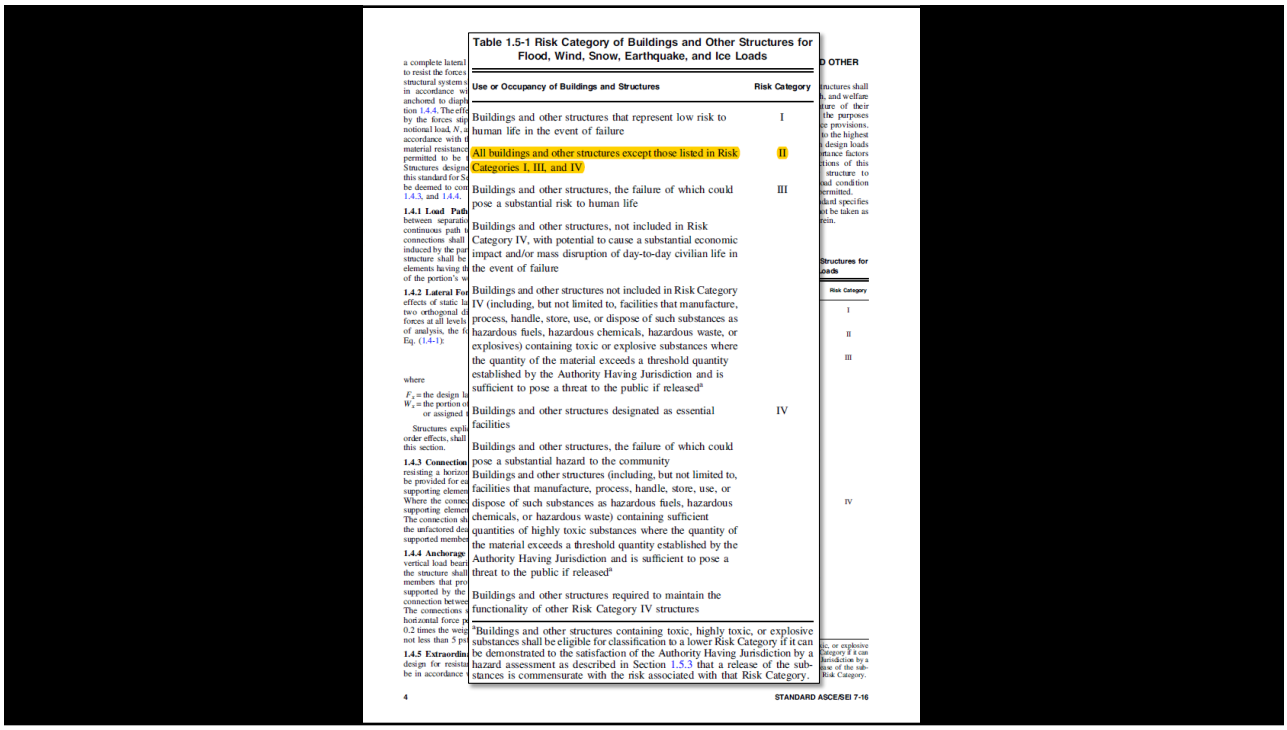
Table 1.5-1 Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake, and Ice Loads
Use or Occupancy of Buildings and Structures
Risk Category
Buildings and other structures that represent low risk to human life in the event of failure
I
All buildings and other structures except those listed in Risk Categories I, III, and IV
II
Buildings and other structures, the failure of which could pose a substantial risk to human life
III
Buildings and other structures, not included in Risk Category IV, with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of failure
Buildings and other structures not included in Risk Category IV (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where the quantity of the material exceeds a threshold quantity established by the Authority Having Jurisdiction and is sufficient to pose a threat to the public if released[a]
Buildings and other structures designated as essential facilities
IV
Buildings and other structures, the failure of which could pose a substantial hazard to the community
Buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity of the material exceeds a threshold quantity established by the Authority Having Jurisdiction and is sufficient to pose a threat to the public if released[a]
Buildings and other structures required to maintain the functionality of other Risk Category IV structures
[a]Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for classification to a lower Risk Category if it can be demonstrated to the satisfaction of the Authority Having Jurisdiction by a hazard assessment as described in Section 1.5.3 that a release of the substances is commensurate with the risk associated with that Risk Category.
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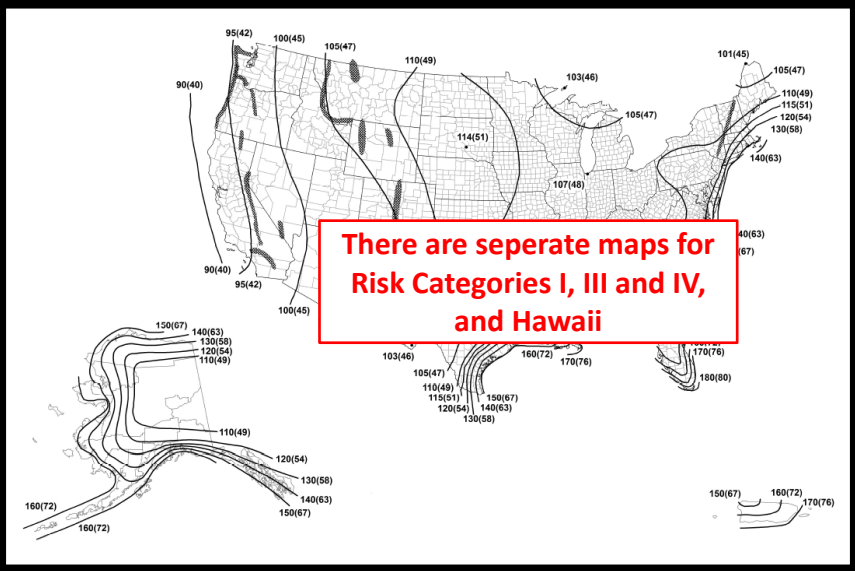

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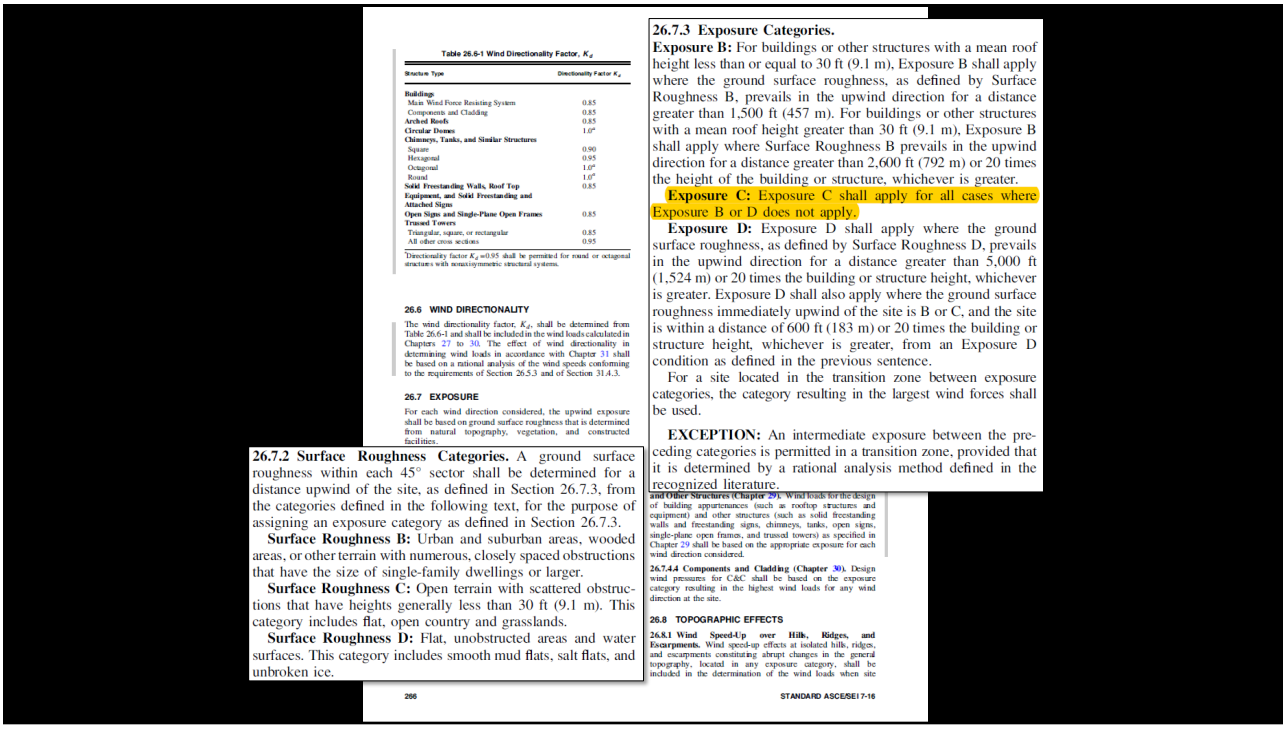

26.7.2 Surface Roughness Categories. A ground surface roughness within each 45° sector shall be determined for a distance upwind of the site, as defined in Section 26.7.3, from the categories defined in the following text, for the purpose of assigning an exposure category as defined in Section 26.7.3.

Surface Roughness B: Urban and suburban areas, wooded areas, or other terrain with numerous, closely spaced obstructions that have the size of single-family dwellings or larger.

Surface Roughness C: Open terrain with scattered obstructions that have heights generally less than 30 ft (9.1 m). 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.

Table 26.6-1 Wind Directionality Factor, K_d

Structure Type	Directionality Factor K_d
Buildings	
Main Wind Force Resisting System	0.85
Components and Cladding	0.85
Arched Roofs	0.85
Circular Domes	1.0[a]
Chimneys, Tanks, and Similar Structures	
Square	0.90
Hexagonal	0.95
Octagonal	1.0[a]
Round	1.0[a]
Solid Freestanding Walls, Roof Top Equipment, and Solid Freestanding and Attached Signs	0.85
Open Signs and Single-Plane Open Frames	0.85
Trussed Towers	
Triangular, square, or rectangular	0.85
All other cross sections	0.95

[a] Directionality factor K_d =0.95 shall be permitted for round or octagonal structures with nonaxisymmetric structural systems.

26.6 WIND DIRECTIONALITY

The wind directionality factor, K_d, shall be determined from Table 26.6-1 and shall be included in the wind loads calculated in Chapters 27 to 30. The effect of wind directionality in determining wind loads in accordance with Chapter 31 shall be based on a rational analysis of the wind speeds conforming to the requirements of Section 26.5.3 and of Section 31.4.3.

26.7 EXPOSURE

For each wind direction considered, the upwind exposure shall be based on ground surface roughness that is determined from natural topography, vegetation, and constructed facilities.

26.7.3 Exposure Categories.

Exposure B: For buildings or other structures with a mean roof height less than or equal to 30 ft (9.1 m), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance greater than 1,500 ft (457 m). For buildings or other structures with a mean roof height greater than 30 ft (9.1 m), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance greater than 2,600 ft (792 m) or 20 times the height of the building or structure, 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 greater than 5,000 ft (1,524 m) or 20 times the building or structure height, 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 ft (183 m) or 20 times the building or structure height, whichever is greater, from an Exposure D condition as defined in the previous sentence.

For a site located in the transition zone between exposure categories, the category resulting in the largest wind forces shall be used.

EXCEPTION: An intermediate exposure between the preceding categories is permitted in a transition zone, provided that it is determined by a rational analysis method defined in the recognized literature.

and Other Structures (Chapter 29). Wind loads for the design of building appurtenances (such as rooftop structures and equipment) and other structures (such as solid freestanding walls and freestanding signs, chimneys, tanks, open signs, single-plane open frames, and trussed towers) as specified in Chapter 29 shall be based on the appropriate exposure for each wind direction considered.

26.7.4 Components and Cladding (Chapter 30). Design wind pressures for C&C shall be based on the exposure category resulting in the highest wind loads for any wind direction at the site.

26.8 TOPOGRAPHIC EFFECTS

26.8.1 Wind Speed-Up over Hills, Ridges, and Escarpments. Wind speed-up effects at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, shall be included in the determination of the wind loads when site

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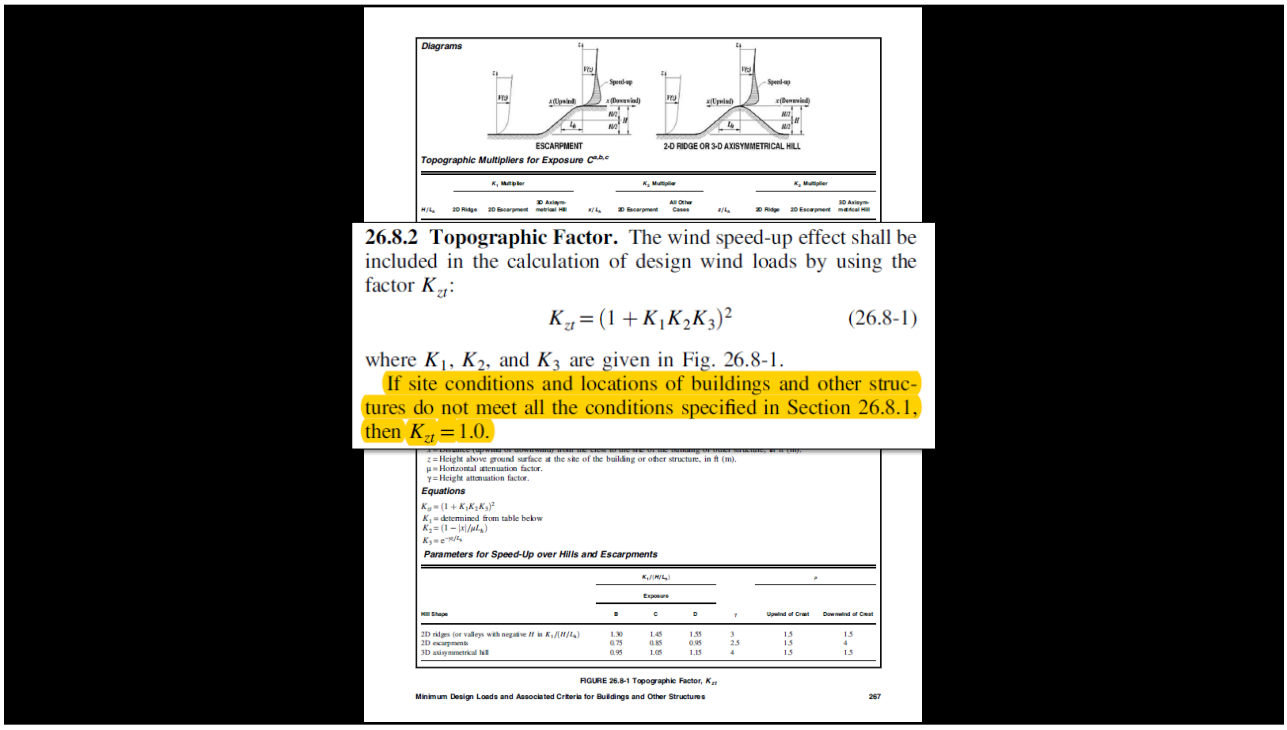

Diagrams

Topographic Multipliers for Exposure $C^{a,b,c}$

K_1 Multiplier				K_2 Multiplier			K_3 Multiplier		
H/L_h	2D Ridge	2D Escarpment	3D Axisymmetrical Hill	x/L_h	3D Escarpment	All Other Cases	z/L_h	3D Ridge	2D Escarpment	3D Axisymmetrical Hill

26.8.2 Topographic Factor. The wind speed-up effect shall be included in the calculation of design wind loads by using the factor K_{zt}:

$$K_{zt} = (1 + K_1 K_2 K_3)^2 \qquad (26.8\text{-}1)$$

where K_1, K_2, and K_3 are given in Fig. 26.8-1.

If site conditions and locations of buildings and other structures do not meet all the conditions specified in Section 26.8.1, then $K_{zt} = 1.0$.

z = Height above ground surface at the site of the building or other structure, in ft (m).
μ = Horizontal attenuation factor.
γ = Height attenuation factor.

Equations

$K_{zt} = (1 + K_1 K_2 K_3)^2$
K_1 = determined from table below
$K_2 = (1 - |x|/\mu L_h)$
$K_3 = e^{-\gamma z/L_h}$

Parameters for Speed-Up over Hills and Escarpments

	$K_1/(H/L_h)$				μ	
	Exposure					
Hill Shape	B	C	D	γ	Upwind of Crest	Downwind of Crest
2D ridges (or valleys with negative H in $K_1/(H/L_h)$	1.30	1.45	1.55	3	1.5	1.5
2D escarpments	0.75	0.85	0.95	2.5	1.5	4
3D axisymmetrical hill	0.95	1.05	1.15	4	1.5	1.5

FIGURE 26.8-1 Topographic Factor, K_{zt}

Minimum Design Loads and Associated Criteria for Buildings and Other Structures 267

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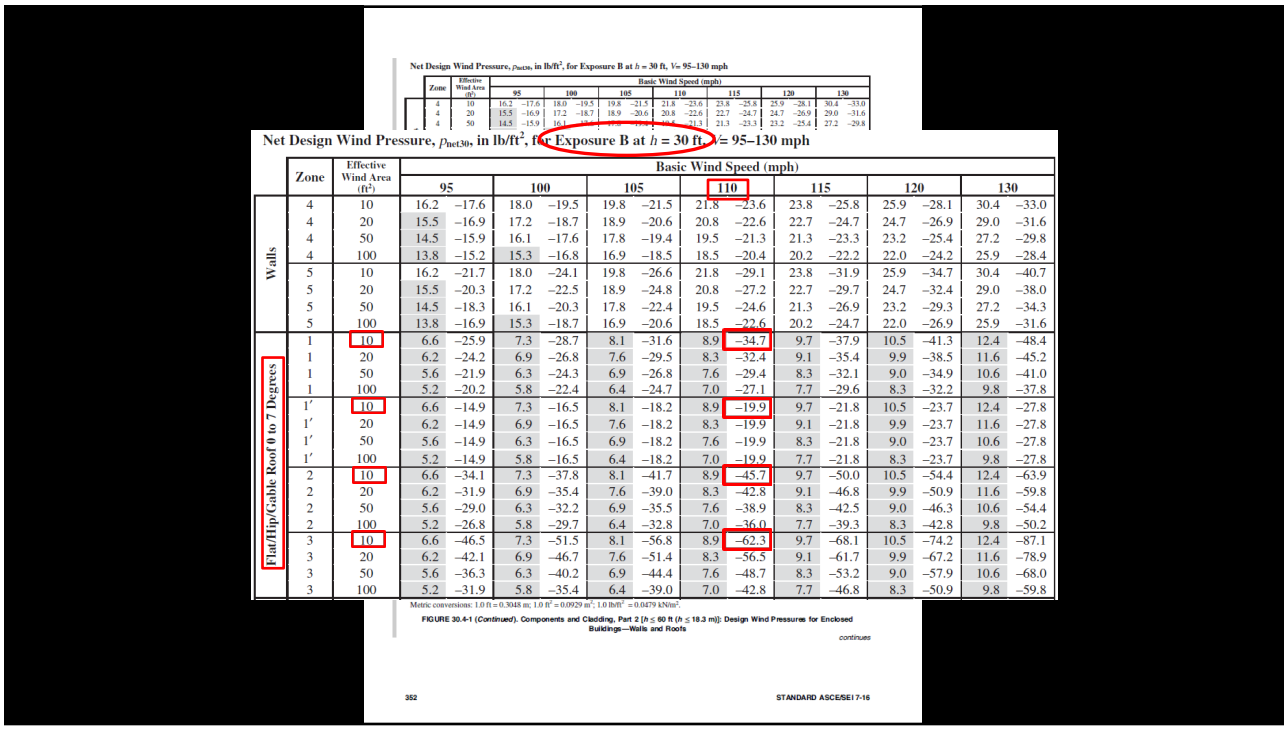

Net Design Wind Pressure, p_{net30}, in lb/ft², for Exposure B at h = 30 ft, V= 95–130 mph

	Zone	Effective Wind Area (ft²)	Basic Wind Speed (mph) 95		100		105		110		115		120		130	
Walls	4	10	16.2	−17.6	18.0	−19.5	19.8	−21.5	21.8	−23.6	23.8	−25.8	25.9	−28.1	30.4	−33.0
	4	20	15.5	−16.9	17.2	−18.7	18.9	−20.6	20.8	−22.6	22.7	−24.7	24.7	−26.9	29.0	−31.6
	4	50	14.5	−15.9	16.1	−17.6	17.8	−19.4	19.5	−21.3	21.3	−23.3	23.2	−25.4	27.2	−29.8
	4	100	13.8	−15.2	15.3	−16.8	16.9	−18.5	18.5	−20.4	20.2	−22.2	22.0	−24.2	25.9	−28.4
	5	10	16.2	−21.7	18.0	−24.1	19.8	−26.6	21.8	−29.1	23.8	−31.9	25.9	−34.7	30.4	−40.7
	5	20	15.5	−20.3	17.2	−22.5	18.9	−24.8	20.8	−27.2	22.7	−29.7	24.7	−32.4	29.0	−38.0
	5	50	14.5	−18.3	16.1	−20.3	17.8	−22.4	19.5	−24.6	21.3	−26.9	23.2	−29.3	27.2	−34.3
	5	100	13.8	−16.9	15.3	−18.7	16.9	−20.6	18.5	−22.6	20.2	−24.7	22.0	−26.9	25.9	−31.6
Flat/Hip/Gable Roof 0 to 7 Degrees	1	10	6.6	−25.9	7.3	−28.7	8.1	−31.6	8.9	−34.7	9.7	−37.9	10.5	−41.3	12.4	−48.4
	1	20	6.2	−24.2	6.9	−26.8	7.6	−29.5	8.3	−32.4	9.1	−35.4	9.9	−38.5	11.6	−45.2
	1	50	5.6	−21.9	6.3	−24.3	6.9	−26.8	7.6	−29.4	8.3	−32.1	9.0	−34.9	10.6	−41.0
	1	100	5.2	−20.2	5.8	−22.4	6.4	−24.7	7.0	−27.1	7.7	−29.6	8.3	−32.2	9.8	−37.8
	1′	10	6.6	−14.9	7.3	−16.5	8.1	−18.2	8.9	−19.9	9.7	−21.8	10.5	−23.7	12.4	−27.8
	1′	20	6.2	−14.9	6.9	−16.5	7.6	−18.2	8.3	−19.9	9.1	−21.8	9.9	−23.7	11.6	−27.8
	1′	50	5.6	−14.9	6.3	−16.5	6.9	−18.2	7.6	−19.9	8.3	−21.8	9.0	−23.7	10.6	−27.8
	1′	100	5.2	−14.9	5.8	−16.5	6.4	−18.2	7.0	−19.9	7.7	−21.8	8.3	−23.7	9.8	−27.8
	2	10	6.6	−34.1	7.3	−37.8	8.1	−41.7	8.9	−45.7	9.7	−50.0	10.5	−54.4	12.4	−63.9
	2	20	6.2	−31.9	6.9	−35.4	7.6	−39.0	8.3	−42.8	9.1	−46.8	9.9	−50.9	11.6	−59.8
	2	50	5.6	−29.0	6.3	−32.2	6.9	−35.5	7.6	−38.9	8.3	−42.5	9.0	−46.3	10.6	−54.4
	2	100	5.2	−26.8	5.8	−29.7	6.4	−32.8	7.0	−36.0	7.7	−39.3	8.3	−42.8	9.8	−50.2
	3	10	6.6	−46.5	7.3	−51.5	8.1	−56.8	8.9	−62.3	9.7	−68.1	10.5	−74.2	12.4	−87.1
	3	20	6.2	−42.1	6.9	−46.7	7.6	−51.4	8.3	−56.5	9.1	−61.7	9.9	−67.2	11.6	−78.9
	3	50	5.6	−36.3	6.3	−40.2	6.9	−44.4	7.6	−48.7	8.3	−53.2	9.0	−57.9	10.6	−68.0
	3	100	5.2	−31.9	5.8	−35.4	6.4	−39.0	7.0	−42.8	7.7	−46.8	8.3	−50.9	9.8	−59.8

Metric conversions: 1.0 ft = 0.3048 m; 1.0 ft² = 0.0929 m²; 1.0 lb/ft² = 0.0479 kN/m².

FIGURE 30.4-1 (*Continued*). Components and Cladding, Part 2 ($h \le 60$ ft ($h \le 18.3$ m)): Design Wind Pressures for Enclosed Buildings—Walls and Roofs

continues

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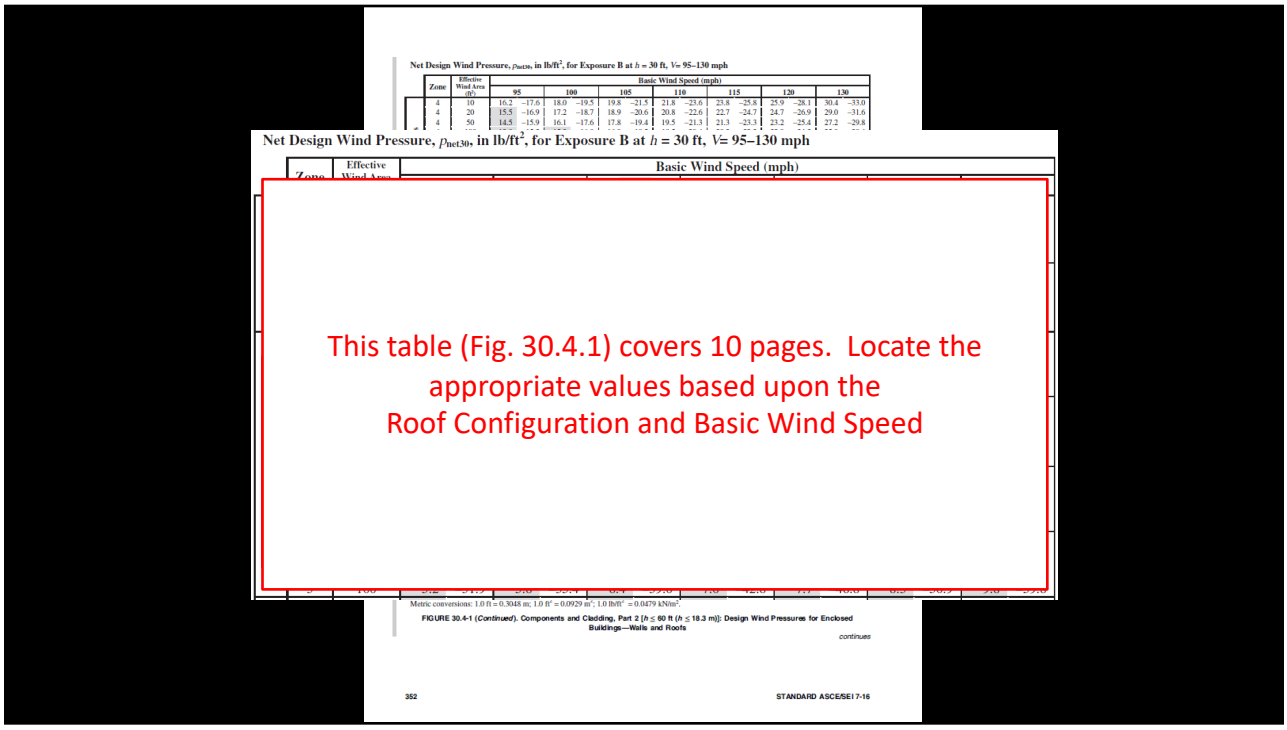
Net Design Wind Pressure, p_{net30}, in lb/ft², for Exposure B at h = 30 ft, V= 95–130 mph
Basic Wind Speed (mph)
This table (Fig. 30.4.1) covers 10 pages. Locate the appropriate values based upon the Roof Configuration and Basic Wind Speed
FIGURE 30.4-1 (Continued). Components and Cladding, Part 2 [h ≤ 60 ft (h ≤ 18.3 m)]: Design Wind Pressures for Enclosed Buildings—Walls and Roofs
continues
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STANDARD ASCE/SEI 7-16

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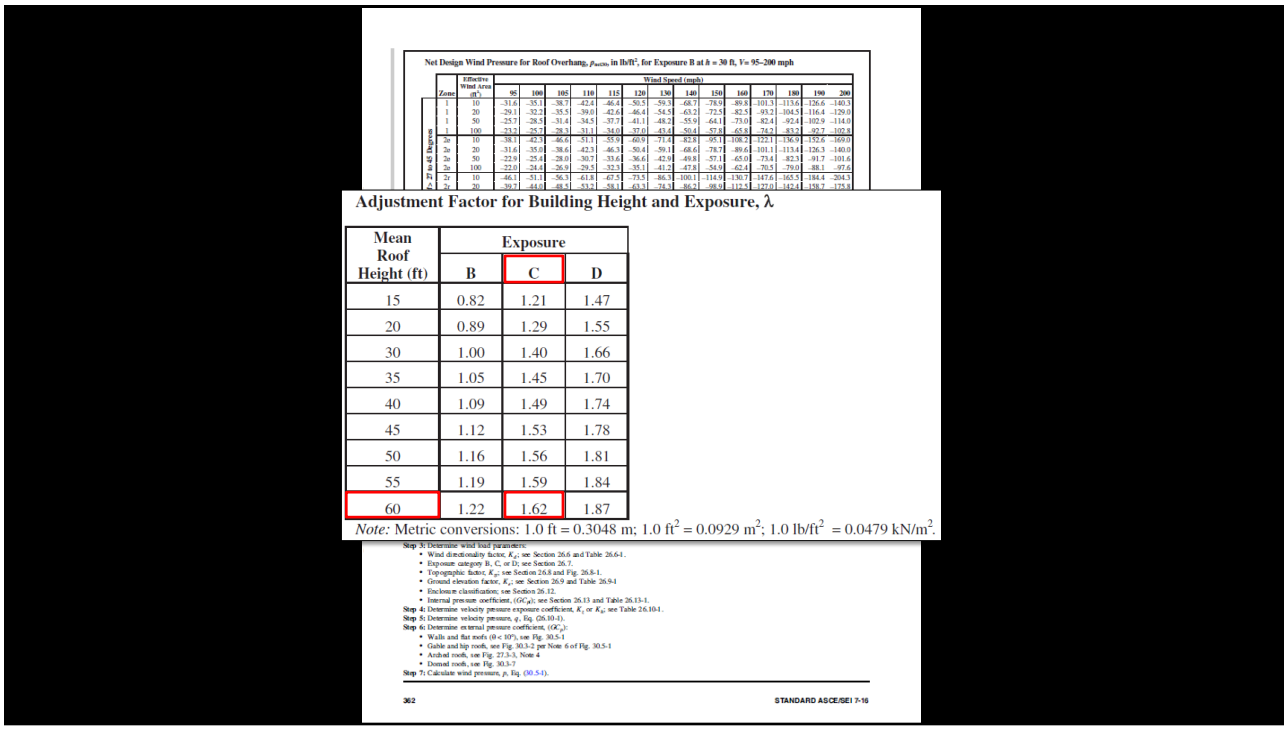
Net Design Wind Pressure for Roof Overhang, p_{net30}, in lb/ft², for Exposure B at h = 30 ft, V= 95–200 mph
Wind Speed (mph)
Adjustment Factor for Building Height and Exposure, λ
Mean Roof Height (ft)
Exposure
B
C
D
15 0.82 1.21 1.47
20 0.89 1.29 1.55
30 1.00 1.40 1.66
35 1.05 1.45 1.70
40 1.09 1.49 1.74
45 1.12 1.53 1.78
50 1.16 1.56 1.81
55 1.19 1.59 1.84
60 1.22 1.62 1.87
Note: Metric conversions: 1.0 ft = 0.3048 m; 1.0 ft² = 0.0929 m²; 1.0 lb/ft² = 0.0479 kN/m².
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STANDARD ASCE/SEI 7-16

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30.4.2 Design Wind Pressures. Net design wind pressures, p_{net}, for C&C of buildings designed using the procedure specified herein represent the net pressures (sum of internal and external) that shall be applied normal to each building surface as shown in Fig. 30.4-1. p_{net} shall be determined by the following equation:

$$p_{net} = \lambda K_{zt} p_{net30} \quad (30.4\text{-}1)$$

So for our hypothetical example, where:

- Enclosed structure
- Risk Category II
- v = 110 mph
- Exposure C
- K_{ZT} = 1.0
- Mean roof height = 60 ft

Zone 1': p_{net} = 1.62 x 1.0 x (-19.9) = -32.2 psf
Zone 1: p_{net} = 1.62 x 1.0 x (-34.7) = -56.2 psf
Zone 2: p_{net} = 1.62 x 1.0 x (-45.7) = -74.0 psf
Zone 3: p_{net} = 1.62 x 1.0 x (-62.3) = -100.1 psf

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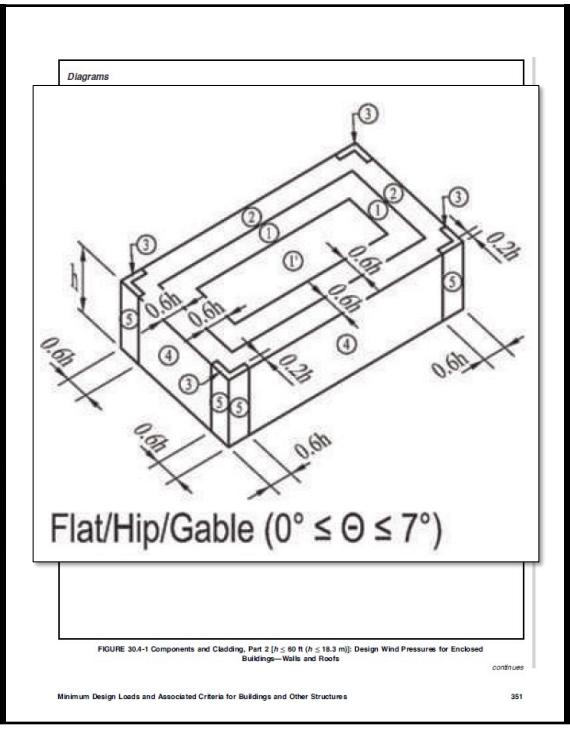

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User Note: Part 4 of Chapter 30 is a simplified method for determining wind pressures for C&C *of enclosed buildings with* 60 ft < $h \leq$ 160 ft (18.3 m < $h \leq$ 48.8 m) that have roof shapes as specified in the applicable figures. These provisions are based on the Directional Procedure from Part 3 with *wind pressures selected directly from a table* and adjusted as applicable. Fig. 30.4-1 in Part 2 is referenced for buildings with $h \leq 60$ ft ($h \leq 18.3$ m) for all roof shapes and for the specified roof shapes when $h > 60$ ft ($h > 18.3$ m).

Final design wind pressure shall be determined from the following equation:

$$p = p_{\text{table}}(\text{EAF})(\text{RF})K_{zt} \qquad (30.6\text{-}1)$$

where

RF = effective area reduction factor from Table 30.6-2;
EAF = exposure adjustment factor from Table 30.6-2; and
K_{zt} = topographic factor as defined in Section 26.8.

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Table 30.6-1 Steps to Determine C&C Wind Loads for Enclosed Building with 60 ft < $h \leq$ 160 ft (18.3 m < $h \leq$ 48.8 m)

Step 1: Determine risk category of building; see Table 1.5-1. Page 4
Step 2: Determine the basic wind speed, V, for applicable risk category; see Figs. 26.5-1 and 26.5-2. Pages 250-265
Step 3: Determine wind load parameters:
- Exposure category B, C, or D; see Section 26.7. Page 266

Step 4: For flat, gable, hip, monoslope, and mansard roofs with $h \leq 60$ ft ($h \leq 18.3$ m), refer to the figures in Table 30.6-2 and determine roof and wall pressures directly from Fig. 30.4-1. Page 365 and Pages 352-362
Step 5: For flat and monoslope roofs with $h > 60$ ft ($h > 18.3$ m), see Table 30.6-2 to determine pressure on walls and roof, p_h. Pages 368-373
For flat, hip, gable, monoslope, and mansard roofs with $h > 60$ ft ($h > 18.3$ m) and roof slope $\theta \leq 7$ degrees, apply roof pressu Pages 368-373
For hip and gable roofs with $h > 60$ ft ($h > 18.3$ m) and all roof slopes $\theta > 7$ degrees, apply Fig. 30.4-1 with appropriate velocity pressure q_h.
Step 6: Determine topographic factor, K_{zt}, and apply factor to pressures determined from tables (if applicable); see Section 26.8. Pages 266-268

$$p = p_{\text{table}}(\text{EAF})(\text{RF})K_{zt} \qquad (30.6\text{-}1)$$

Determination of q_h is from Part 1: Low-rise Buildings ***(Not "simplified")***

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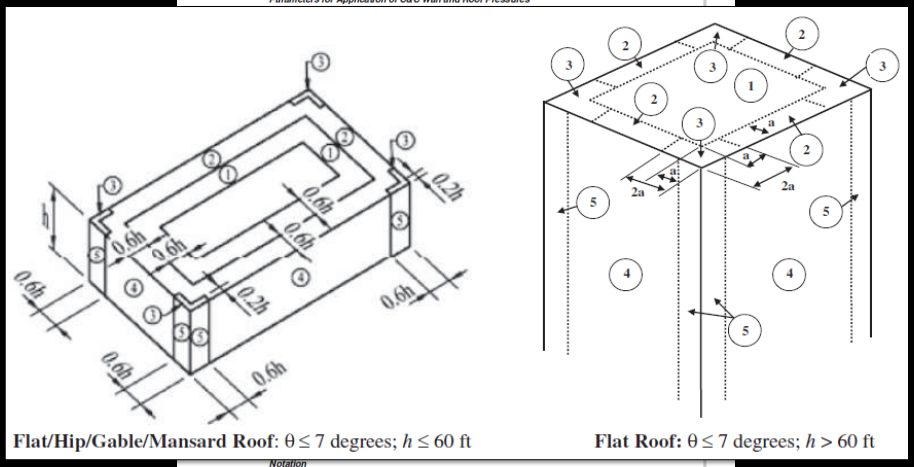
Table 30.6-2 Components and Cladding, Part 4 [$h \leq 160$ ft ($h \leq 48.8$ m)]: C&C Zones for Enclosed Buildings—C&C Wall and Roof Pressures

Parameters for Application of C&C Wall and Roof Pressures



Flat/Hip/Gable/Mansard Roof: $\theta \leq 7$ degrees; $h \leq 60$ ft

Flat Roof: $\theta \leq 7$ degrees; $h > 60$ ft

Notation

a = 10% of the least horizontal dimension but not less than 3 ft (0.9 m).
h = Mean roof height, in ft (m).
V = Basic wind speed, in mph (m/s).

Notes

1. See Section 30.6.1.1 for tabulated wall and roof pressure from Table 30.6-2 and Fig. 30.4-1, as applicable.
2. For mansard roofs, apply roof pressures on sloped surfaces as tabulated for sloped surfaces of gable roofs; apply roof pressure on flat surfaces ($\theta < 7°$) as tabulated for flat roofs.

continues

Minimum Design Loads and Associated Criteria for Buildings and Other Structures 365

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…so, it really is "simplified".

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Noteworthy changes in ASCE 7-16

Compared to ASCE 7-10

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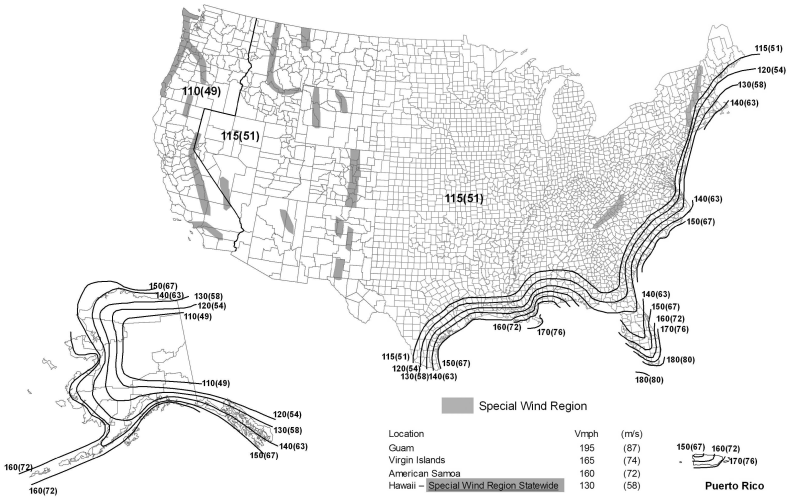
ASCE 7-10 basic wind speed map

Fig. 1607A--V_{ult} for Risk Category II Buildings



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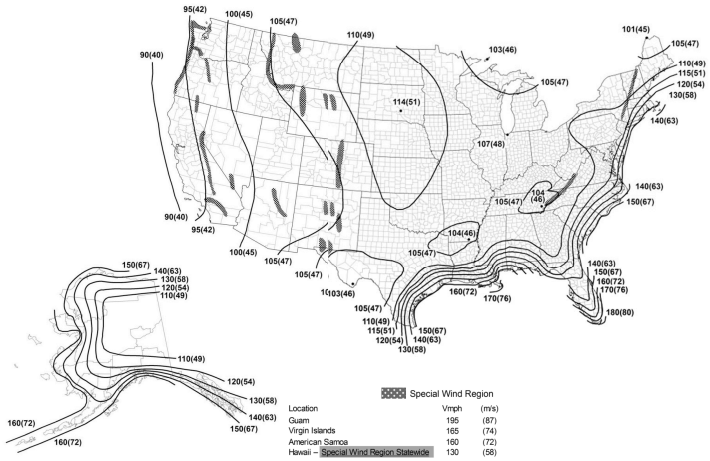
ASCE 7-16 basic wind speed map

Risk Category II Buildings



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Comparing GC_p pressure coefficients

h ≤ 60 ft., gable roofs ≤ 7 degrees

Zone	ASCE 7-10	ASCE 7-16	Change
1’	n/a	0.9	-10%
1 (field)	-1.0	-1.7	+70%
2 (perimeter)	-1.8	-2.3	+28%
3 (corners)	-2.8	-3.2	+14%

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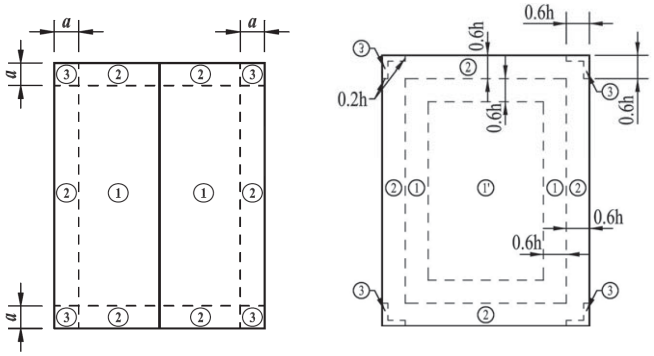
Zones

h ≤ 60 ft., gable roofs ≤ 7 degrees



ASCE 7-10 **ASCE 7-16**

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Noteworthy changes in ASCE 7-16

compared to ASCE 7-10

- Revised basic wind speed map
- Changes (and new) pressure coefficients
- Revised perimeter and corner zones

While center field pressures may be slightly lower, field, perimeter and corner uplift pressures will generally be greater

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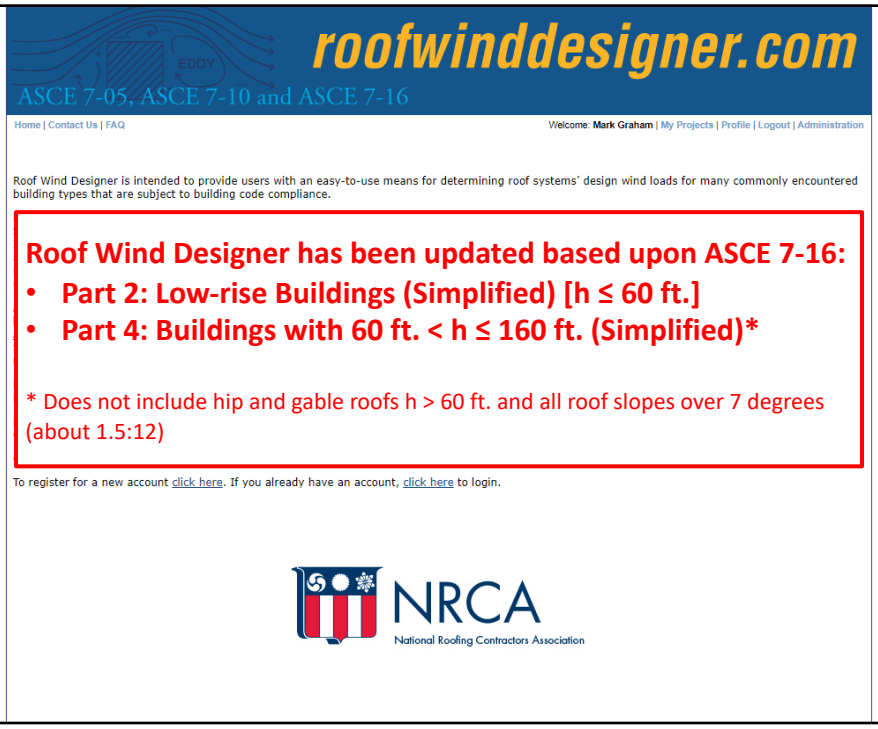

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How the roofing industry will adapt to ASCE 7-16 remains to be seen….

FM Global has indicated they will update their FM 1-28 to be based on ASCE 7-16 (with modifications) by the end of the 2018.

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This comparison illustrates why it is important for Designers to include wind design loads in their Construction Documents (per IBC Sec. 1603.1)…

…It also illustrate why specifying a wind warrantee can create an uneven playing field. Unless the Designer indicates the wind design loads, which design method will the manufacturer use (e.g., in a competitive environment)?

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Steel roof decks/seam-fastened systems

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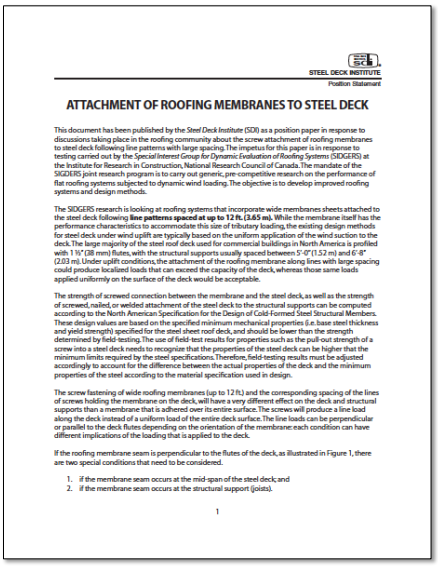
SDI bulletin

2009



STEEL DECK INSTITUTE
Position Statement

ATTACHMENT OF ROOFING MEMBRANES TO STEEL DECK

This document has been published by the *Steel Deck Institute* (SDI) as a position paper in response to discussions taking place in the roofing community about the screw attachment of roofing membranes to steel deck following line patterns with large spacing. The impetus for this paper is in response to testing carried out by the *Special Interest Group for Dynamic Evaluation of Roofing Systems* (SIDGERS) at the Institute for Research in Construction, National Research Council of Canada. The mandate of the SIGDERS joint research program is to carry out generic, pre-competitive research on the performance of flat roofing systems subjected to dynamic wind loading. The objective is to develop improved roofing systems and design methods.

The SIDGERS research is looking at roofing systems that incorporate wide membranes sheets attached to the steel deck following **line patterns spaced at up to 12 ft. (3.65 m).** While the membrane itself has the performance characteristics to accommodate this size of tributary loading, the existing design methods for steel deck under wind uplift are typically based on the uniform application of the wind suction to the deck. The large majority of the steel roof deck used for commercial buildings in North America is profiled with 1 ½" (38 mm) flutes, with the structural supports usually spaced between 5'-0" (1.52 m) and 6'-8" (2.03 m). Under uplift conditions, the attachment of the roofing membrane along lines with large spacing could produce localized loads that can exceed the capacity of the deck, whereas those same loads applied uniformly on the surface of the deck would be acceptable.

The strength of screwed connection between the membrane and the steel deck, as well as the strength of screwed, nailed, or welded attachment of the steel deck to the structural supports can be computed according to the North American Specification for the Design of Cold-Formed Steel Structural Members. These design values are based on the specified minimum mechanical properties (i.e. base steel thickness and yield strength) specified for the steel sheet roof deck, and should be lower than the strength determined by field-testing. The use of field-test results for properties such as the pull-out strength of a screw into a steel deck needs to recognize that the properties of the steel deck can be higher that the minimum limits required by the steel specifications. Therefore, field-testing results must be adjusted accordingly to account for the difference between the actual properties of the deck and the minimum properties of the steel according to the material specification used in design.

The screw fastening of wide roofing membranes (up to 12 ft.) and the corresponding spacing of the lines of screws holding the membrane on the deck, will have a very different effect on the deck and structural supports than a membrane that is adhered over its entire surface. The screws will produce a line load along the deck instead of a uniform load of the entire deck surface. The line loads can be perpendicular or parallel to the deck flutes depending on the orientation of the membrane: each condition can have different implications of the loading that is applied to the deck.

If the roofing membrane seam is perpendicular to the flutes of the deck, as illustrated in Figure 1, there are two special conditions that need to be considered.

1. if the membrane seam occurs at the mid-span of the steel deck; and
2. if the membrane seam occurs at the structural support (joists).

1

- Decks designed for joist spacing between 5’ and 6’ 8” o.c.
- Deck designed for uniform loading
- Seam-fastened single-ply membranes are a concern

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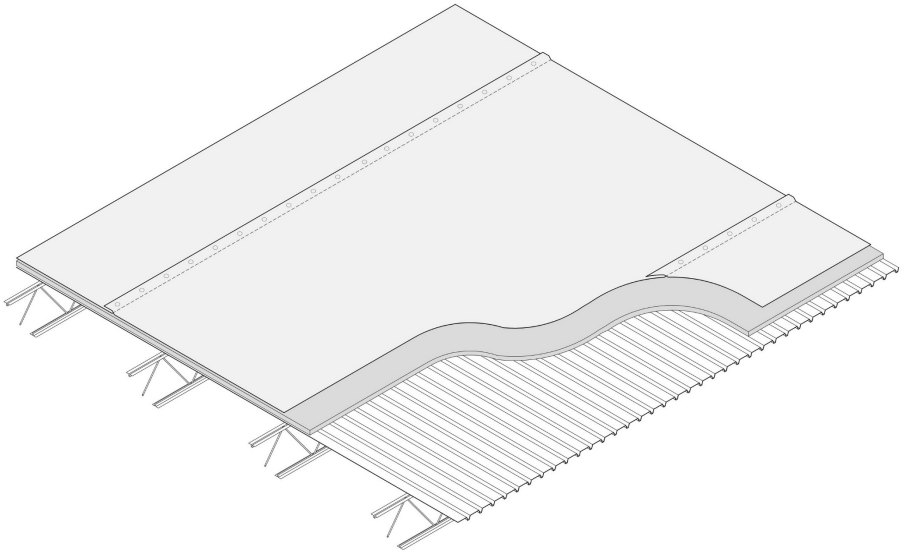
Membrane seams across deck flutes



SDI: 3.8 X moment (deck); 2 X load (joists)

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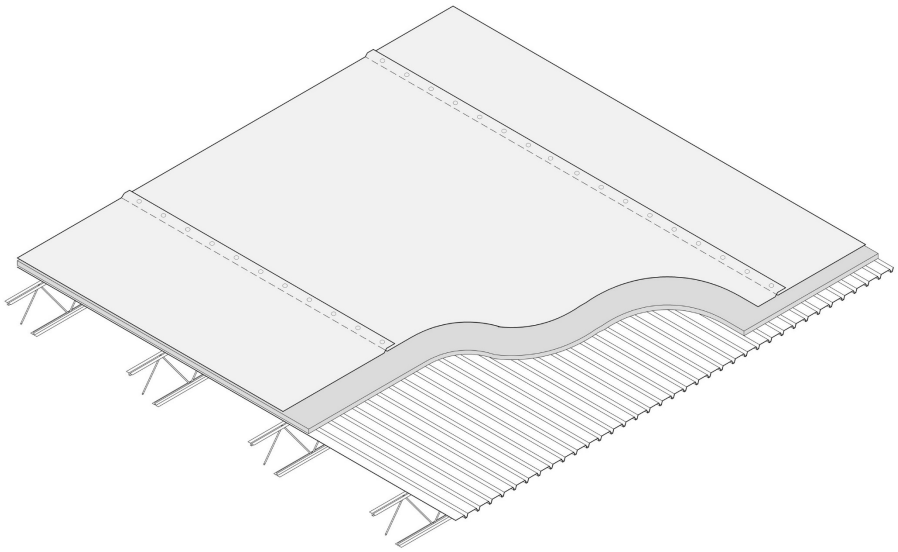
Membrane seams in deck flute direction



SDI: 12 X bending moment and shear (deck)

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SDI bulletin – Conclusion

2009 bulletin

"…SDI does not recommend the use of roofing membranes attached to the steel deck using line patterns with large spacing unless a structural engineer has reviewed the adequacy of the steel deck and the structural supports to resist to wind uplift loads transmitted along the lines of attachment. Those lines of attachment shall only be perpendicular to the flutes of the deck."

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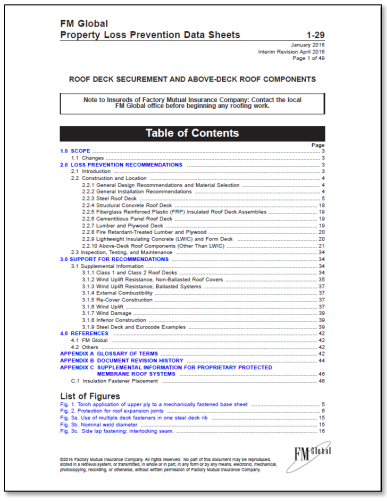
FM Global's Loss Prevention Data Sheet 1-29

April 2016



FM Global
Property Loss Prevention Data Sheets 1-29

January 2016
Interim Revision April 2016
Page 1 of 49

ROOF DECK SECUREMENT AND ABOVE-DECK ROOF COMPONENTS

Note to Insureds of Factory Mutual Insurance Company: Contact the local FM Global office before beginning any roofing work.

Table of Contents

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List of Figures

Revised/new criteria:

- Steel roof decks:
  - Uniformly-distributed loading
  - Concentrated loading
- Lightweight structural concrete

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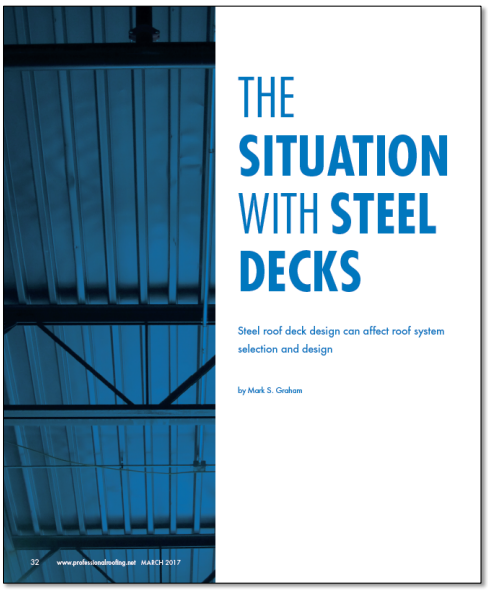

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March 2017
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Fastener pull-out tests…

There is little correlation between fastener pull-out resistance and a steel roof deck's yield strength and uplift (bending) strength

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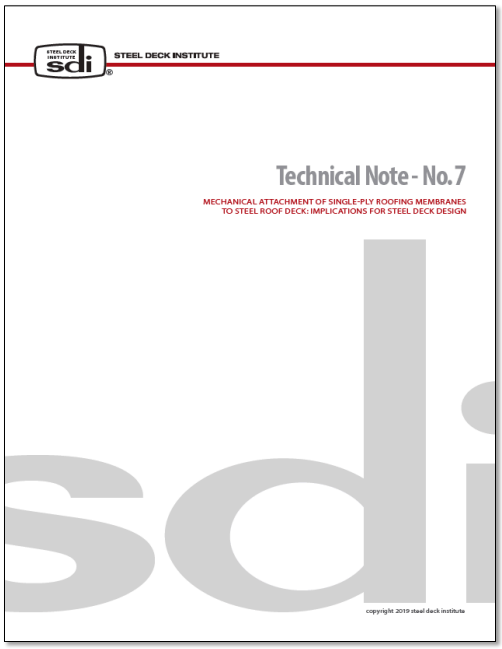

SDI Technical Note-No. 7 (Nov. 2019)

Mechanical attachment of single-ply roofing membranes to steel roof deck: Implications for steel deck design

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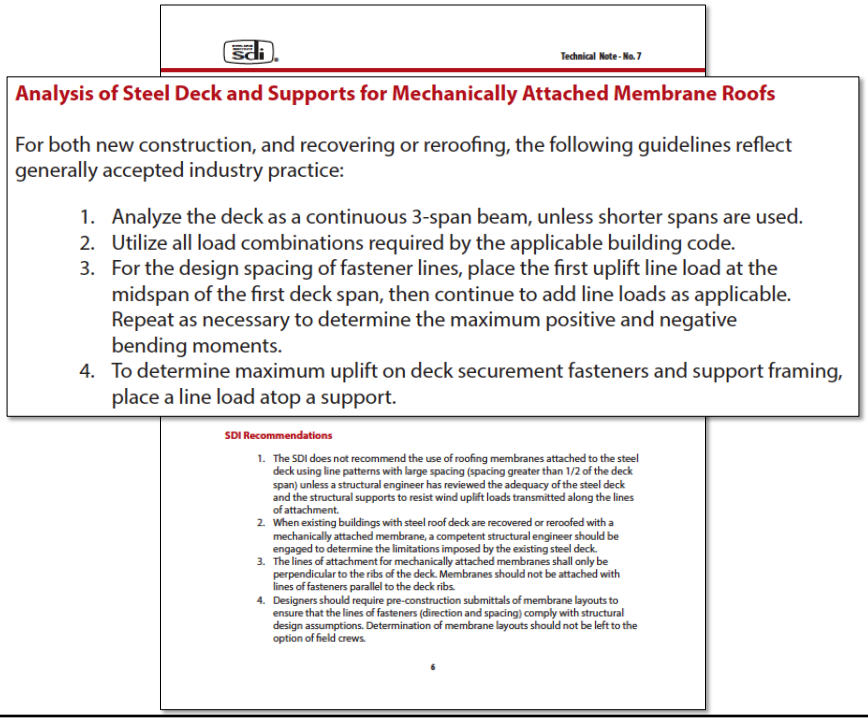

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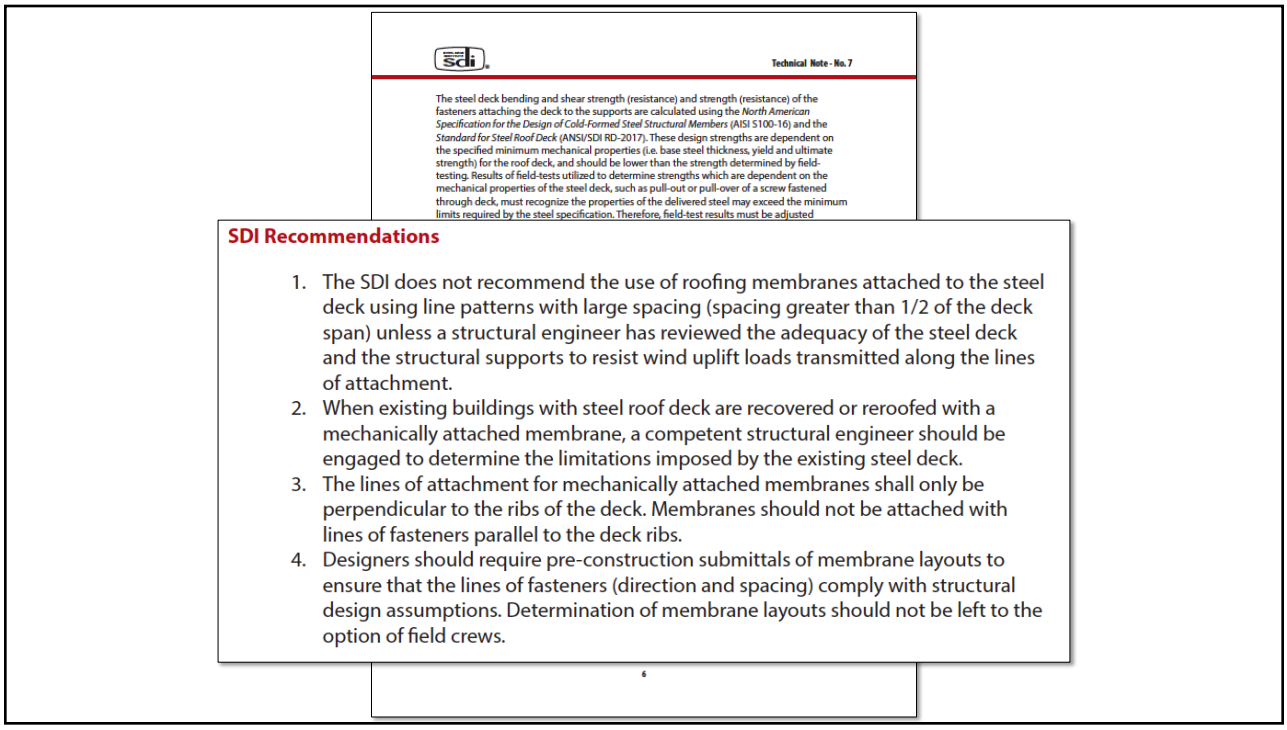

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Expect additional scrutiny of seam-fastened, mechanically-attached, single-ply membrane roof systems

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RESEARCH+TECH

Consider the deck

SDI provides additional guidance for steel roof deck designers

by Mark S. Graham

In November 2019, the Steel Deck Institute issued new guidance for steel roof decks that features seam-fastened, mechanically attached, single-ply membranes. Although this guidance is directed toward roof deck designers, single-ply membrane manufacturers and suppliers, roof system designers and roofing contractors also should be aware of SDI's latest guidelines.

Previous guidance

In May 2009, SDI issued a position statement, "Attachment of Roofing Membranes to Steel Deck," indicating seam-fastened, mechanically attached, single-ply membrane roof systems apply wind-uplift loads to roof decks differently than adhered membrane roof systems. Although adhered membrane roof systems apply uplift loads uniformly across a roof deck, seam-fastened membrane systems result in concentrated line loads along the deck. Such line loads can result in excess bending moment and shear applied to the deck or a doubling of uplift loads on specific structural supports (joists) depending on the orientation of the membrane sheets relative to the deck flutes and joists.

SDI's document goes on to recommend structural engineers should review the adequacy of steel roof decks and their underlying

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January 2020

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Moisture in concrete roof decks

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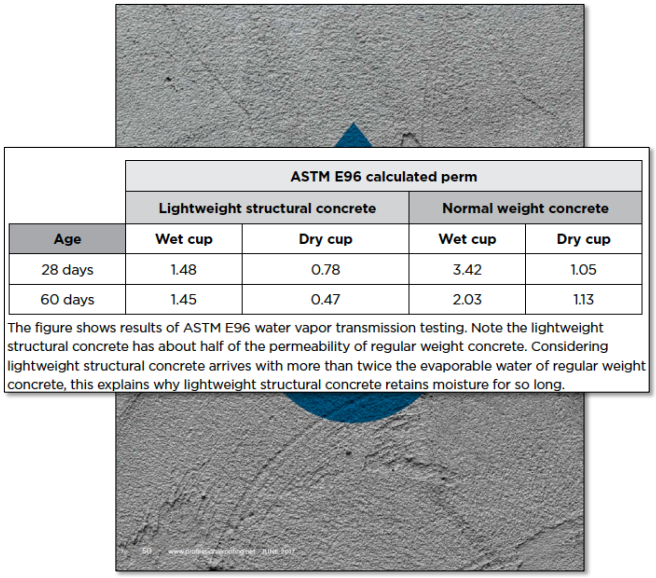

	ASTM E96 calculated perm			
	Lightweight structural concrete		Normal weight concrete	
Age	Wet cup	Dry cup	Wet cup	Dry cup
28 days	1.48	0.78	3.42	1.05
60 days	1.45	0.47	2.03	1.13

The figure shows results of ASTM E96 water vapor transmission testing. Note the lightweight structural concrete has about half of the permeability of regular weight concrete. Considering lightweight structural concrete arrives with more than twice the evaporable water of regular weight concrete, this explains why lightweight structural concrete retains moisture for so long.

Professional Roofing, June 2017

RESEARCH+TECH

Are admixtures the answer?

Moisture in concrete roof decks continues to be problematic

by Mark S. Graham

NRCA's Technical Services Section has been receiving inquiries regarding the use and effectiveness of specific concrete mix additives and topical surface treatments to address moisture release-related concerns with concrete roof decks. Such admixtures broadly are referred to as moisture vapor reduction admixtures (MVRAs) or porosity-inhibiting admixtures. NRCA provides recommendations regarding their use.

MVRAs

Concrete admixtures intended as MVRAs are specific chemicals added during concrete's batching and mixing to provide an additional chemical reaction during the concrete's hydration and curing process. MVRAs use the concrete mix's excess water and chlorides to create a calcium silicate hydrate gel within the concrete. The gel is said to fill the small pores and capillary openings in curing concrete, minimizing the concrete's ability to pass and release moisture vapor. The gel is intended to be permanent and integral throughout the concrete's entire thickness.

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Professional Roofing, December 2018

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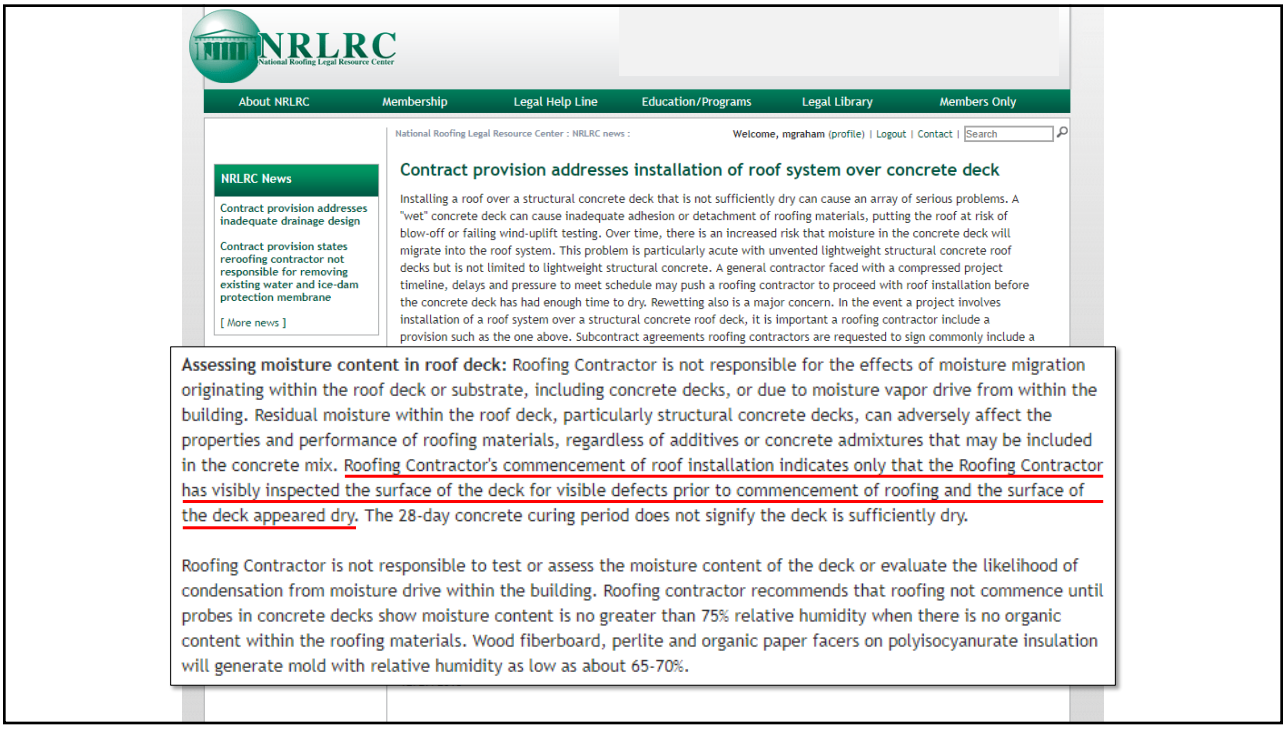

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NRLRC News

Contract provision addresses inadequate drainage design

Contract provision states reroofing contractor not responsible for removing existing water and ice-dam protection membrane

[More news]

Contract provision addresses installation of roof system over concrete deck

Installing a roof over a structural concrete deck that is not sufficiently dry can cause an array of serious problems. A "wet" concrete deck can cause inadequate adhesion or detachment of roofing materials, putting the roof at risk of blow-off or failing wind-uplift testing. Over time, there is an increased risk that moisture in the concrete deck will migrate into the roof system. This problem is particularly acute with unvented lightweight structural concrete roof decks but is not limited to lightweight structural concrete. A general contractor faced with a compressed project timeline, delays and pressure to meet schedule may push a roofing contractor to proceed with roof installation before the concrete deck has had enough time to dry. Rewetting also is a major concern. In the event a project involves installation of a roof system over a structural concrete roof deck, it is important a roofing contractor include a provision such as the one above. Subcontract agreements roofing contractors are requested to sign commonly include a

Assessing moisture content in roof deck: Roofing Contractor is not responsible for the effects of moisture migration originating within the roof deck or substrate, including concrete decks, or due to moisture vapor drive from within the building. Residual moisture within the roof deck, particularly structural concrete decks, can adversely affect the properties and performance of roofing materials, regardless of additives or concrete admixtures that may be included in the concrete mix. Roofing Contractor's commencement of roof installation indicates only that the Roofing Contractor has visibly inspected the surface of the deck for visible defects prior to commencement of roofing and the surface of the deck appeared dry. The 28-day concrete curing period does not signify the deck is sufficiently dry.

Roofing Contractor is not responsible to test or assess the moisture content of the deck or evaluate the likelihood of condensation from moisture drive within the building. Roofing contractor recommends that roofing not commence until probes in concrete decks show moisture content is no greater than 75% relative humidity when there is no organic content within the roofing materials. Wood fiberboard, perlite and organic paper facers on polyisocyanurate insulation will generate mold with relative humidity as low as about 65-70%.

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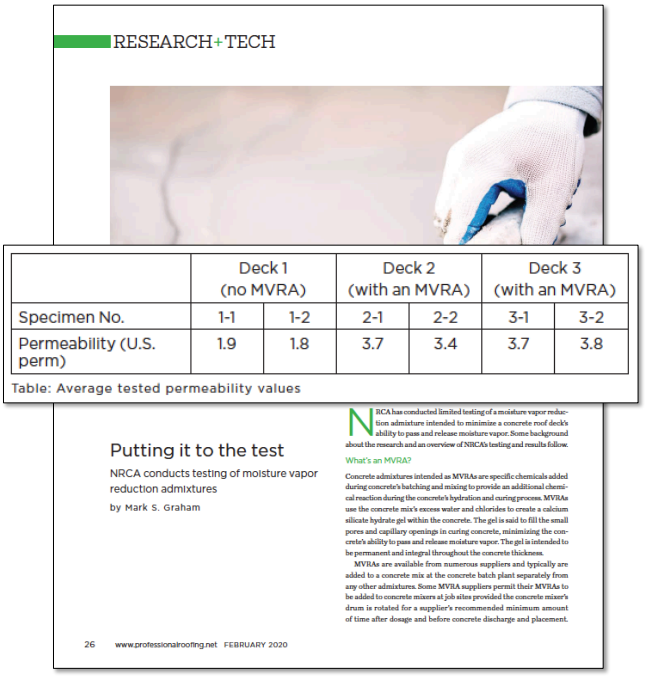

RESEARCH+TECH

	Deck 1 (no MVRA)		Deck 2 (with an MVRA)		Deck 3 (with an MVRA)	
Specimen No.	1-1	1-2	2-1	2-2	3-1	3-2
Permeability (U.S. perm)	1.9	1.8	3.7	3.4	3.7	3.8

Table: Average tested permeability values

Putting it to the test

NRCA conducts testing of moisture vapor reduction admixtures

by Mark S. Graham

NRCA has conducted limited testing of a moisture vapor reduction admixture intended to minimize a concrete roof deck's ability to pass and release moisture vapor. Some background about the research and an overview of NRCA's testing and results follow.

What's an MVRA?

Concrete admixtures intended as MVRAs are specific chemicals added during concrete's batching and mixing to provide an additional chemical reaction during the concrete's hydration and curing process. MVRAs use the concrete mix's excess water and chlorides to create a calcium silicate hydrate gel within the concrete. The gel is said to fill the small pores and capillary openings in curing concrete, minimizing the concrete's ability to pass and release moisture vapor. The gel is intended to be permanent and integral throughout the concrete thickness.

MVRAs are available from numerous suppliers and typically are added to a concrete mix at the concrete batch plant separately from any other admixtures. Some MVRA suppliers permit their MVRAs to be added to concrete mixers at job sites provided the concrete mixer's drum is rotated for a supplier's recommended minimum amount of time after dosage and before concrete discharge and placement.

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Professional Roofing
February 2020

"…These test results contradict claims an MVRA minimizes concrete's ability to pass and release moisture vapor…"

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Roof coatings

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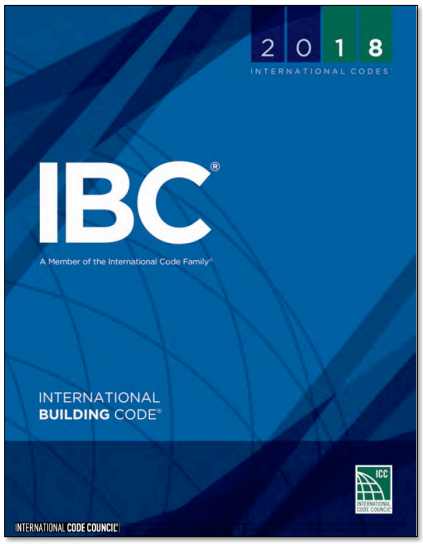
***International Building Code, 2018 Edition* (IBC 2018)**



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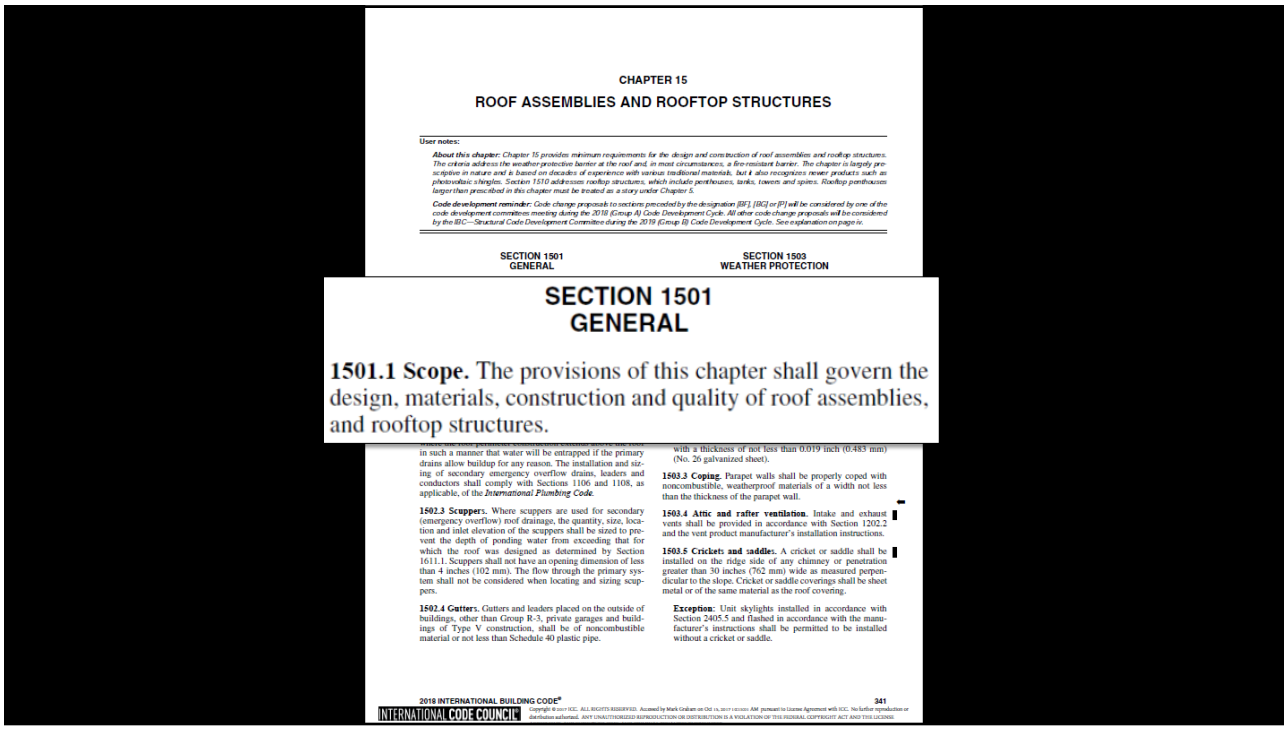

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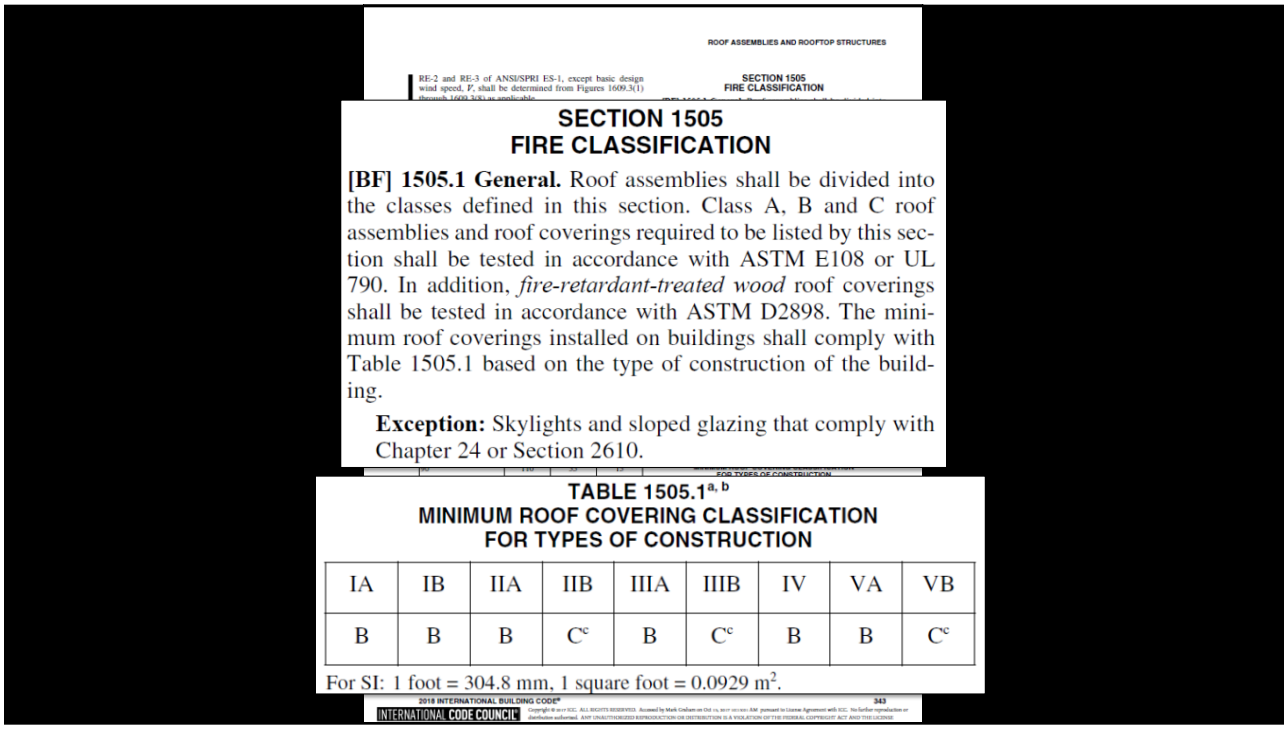

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design wind speed, V, shall be determined from Figures 1609.3(1) through 1609.3(8) as applicable.

SECTION 1505
FIRE CLASSIFICATION

SECTION 1505
FIRE CLASSIFICATION

[BF] 1505.1 General. Roof assemblies shall be divided into the classes defined in this section. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E108 or UL 790. In addition, *fire-retardant-treated wood* roof coverings shall be tested in accordance with ASTM D2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.

FOR TYPES OF CONSTRUCTION

TABLE 1505.1[a, b]
MINIMUM ROOF COVERING CLASSIFICATION FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C[c]	B	C[c]	B	B	C[c]

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

2018 INTERNATIONAL BUILDING CODE® 343

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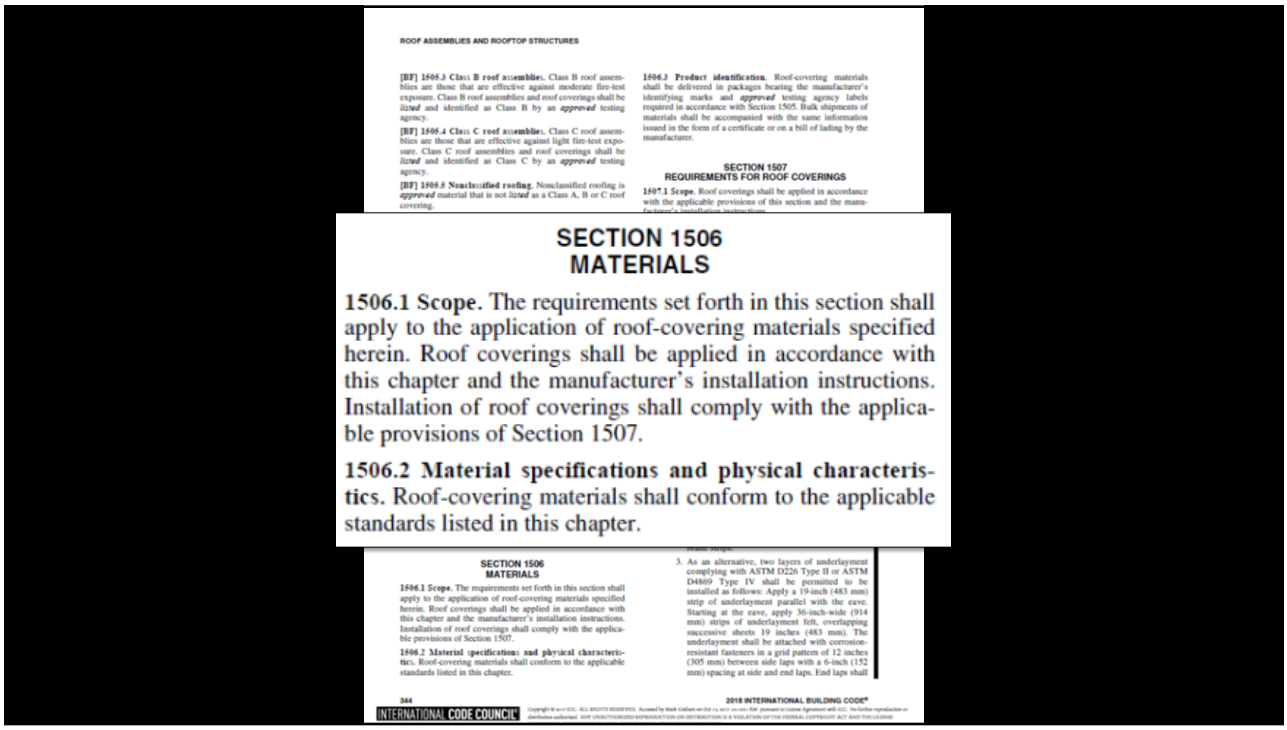

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[BF] 1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be *listed* and identified as Class B by an *approved* testing agency.

[BF] 1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be *listed* and identified as Class C by an *approved* testing agency.

[BF] 1505.5 Nonclassified roofing. Nonclassified roofing is *approved* material that is not *listed* as a Class A, B or C roof covering.

1506.3 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and *approved* testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

SECTION 1507
REQUIREMENTS FOR ROOF COVERINGS

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manu-

SECTION 1506
MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter.

SECTION 1506
MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter.

3. As an alternative, two layers of underlayment complying with ASTM D226 Type II or ASTM D4869 Type IV shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment felt, overlapping successive sheets 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall

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TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D6083
Aggregate surfacing	ASTM D1863
Asphalt adhesive used in roofing	ASTM D3747
Asphalt cements used in roofing	ASTM D2822; D3019; D4586
Asphalt-coated glass fiber base sheet	ASTM D4601
Asphalt coatings used in roofing	ASTM D1227; D2823; D2824; D4479
Asphalt glass felt	ASTM D2178
Asphalt primer used in roofing	ASTM D41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D2626
Asphalt-saturated organic felt (perforated)	ASTM D226
Asphalt used in roofing	ASTM D312
Coal-tar cements used in roofing	ASTM D4022; D5643
Coal-tar saturated organic felt	ASTM D227
Coal-tar pitch used in roofing	ASTM D450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D43
Glass mat, coal tar	ASTM D4990
Glass mat, venting type	ASTM D4897
Mineral-surfaced inorganic cap sheet	ASTM D3909
Thermoplastic fabrics used in roofing	ASTM D5665, D5726

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1507.14 Sprayed polyurethane foam roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

1507.14.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of not less than one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.14.2 Material standards. Spray-applied polyurethane foam insulation shall comply with ASTM C1029 Type III or IV or ASTM D7425.

1507.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Table 1507.14.3 shall be applied not less than 2 hours nor more than 72 hours following the application of the foam.

TABLE 1507.14.3
PROTECTIVE COATING MATERIAL STANDARDS

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

1507.14.4 Foam plastics. Foam plastic materials and installation shall comply with Chapter 26.

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ASTM product standards

Roof coatings

- ASTM D6083: acrylic
- ASTM D1227: emulsified asphalt
- ASTM D2823: asphalt
- ASTM D2824: aluminum
- ASTM D4479: asphalt
- ASTM D6694: silicone
- ASTM D6947: polyurethane

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Roof coatings
vs.
Liquid-applied membranes

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The differences

- Roof coatings are classified as surfacing products
- Liquid-applied membranes are classified as roof membranes

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1507.15 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.15.1 Slope. Liquid-applied roofing shall have a design slope of not less than one-fourth unit vertical in 12 units horizontal (2-percent slope).

1507.15.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, ASTM C957, ASTM D1227 or ASTM D3468, ASTM D6083, ASTM D6694 or ASTM D6947.

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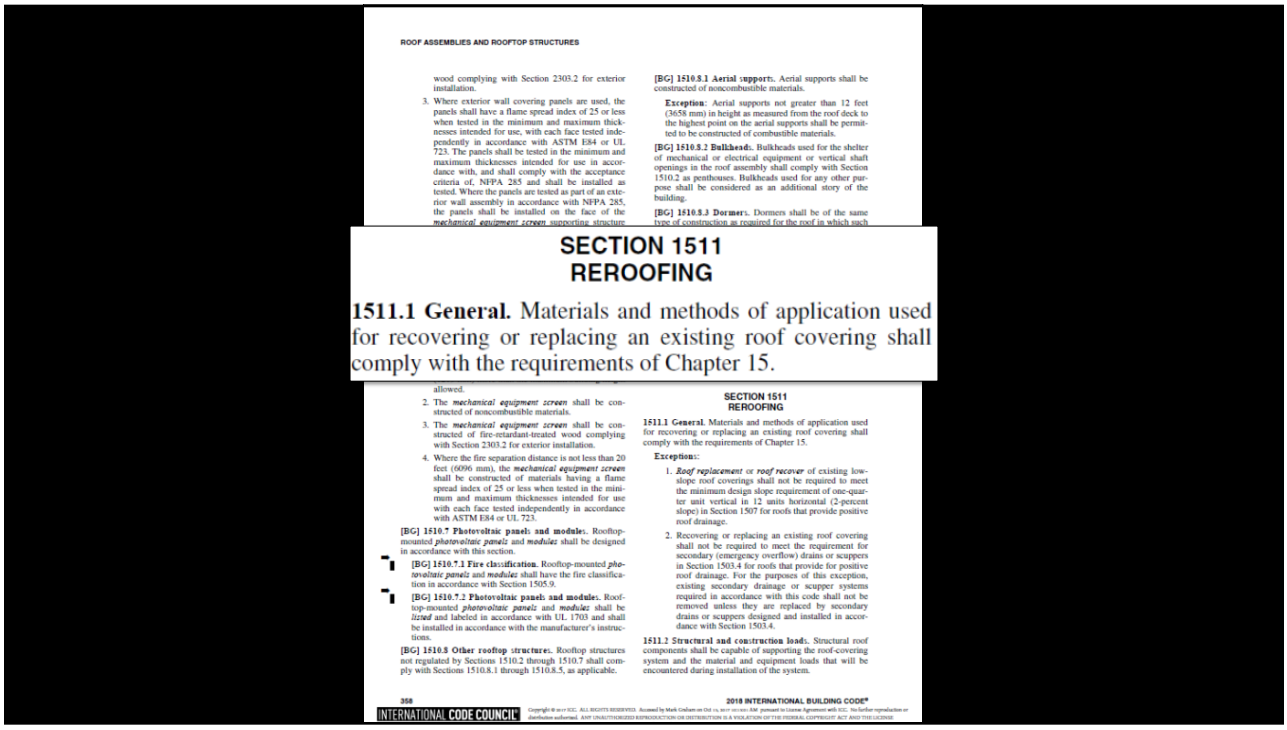

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

wood complying with Section 2303.2 for exterior installation.

3. Where exterior wall covering panels are used, the panels shall have a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use, with each face tested independently in accordance with ASTM E84 or UL 723. The panels shall be tested in the minimum and maximum thicknesses intended for use in accordance with, and shall comply with the acceptance criteria of, NFPA 285 and shall be installed as tested. Where the panels are tested as part of an exterior wall assembly in accordance with NFPA 285, the panels shall be installed on the face of the *mechanical equipment screen* supporting structure

[BG] 1510.8.1 Aerial supports. Aerial supports shall be constructed of noncombustible materials.

Exception: Aerial supports not greater than 12 feet (3658 mm) in height as measured from the roof deck to the highest point on the aerial supports shall be permitted to be constructed of combustible materials.

[BG] 1510.8.2 Bulkheads. Bulkheads used for the shelter of mechanical or electrical equipment or vertical shaft openings in the roof assembly shall comply with Section 1510.2 as penthouses. Bulkheads used for any other purpose shall be considered as an additional story of the building.

[BG] 1510.8.3 Dormers. Dormers shall be of the same type of construction as required for the roof in which such

SECTION 1511
REROOFING

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

allowed.

2. The *mechanical equipment screen* shall be constructed of noncombustible materials.
3. The *mechanical equipment screen* shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation.
4. Where the fire separation distance is not less than 20 feet (6096 mm), the *mechanical equipment screen* shall be constructed of materials having a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E84 or UL 723.

[BG] 1510.7 Photovoltaic panels and modules. Rooftop-mounted *photovoltaic panels* and *modules* shall be designed in accordance with this section.

[BG] 1510.7.1 Fire classification. Rooftop-mounted *photovoltaic panels* and *modules* shall have the fire classification in accordance with Section 1505.9.

[BG] 1510.7.2 Photovoltaic panels and modules. Rooftop-mounted *photovoltaic panels* and *modules* shall be *listed* and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's instructions.

[BG] 1510.8 Other rooftop structures. Rooftop structures not regulated by Sections 1510.2 through 1510.7 shall comply with Sections 1510.8.1 through 1510.8.5, as applicable.

SECTION 1511
REROOFING

1511.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1503.4 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

1511.2 Structural and construction loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

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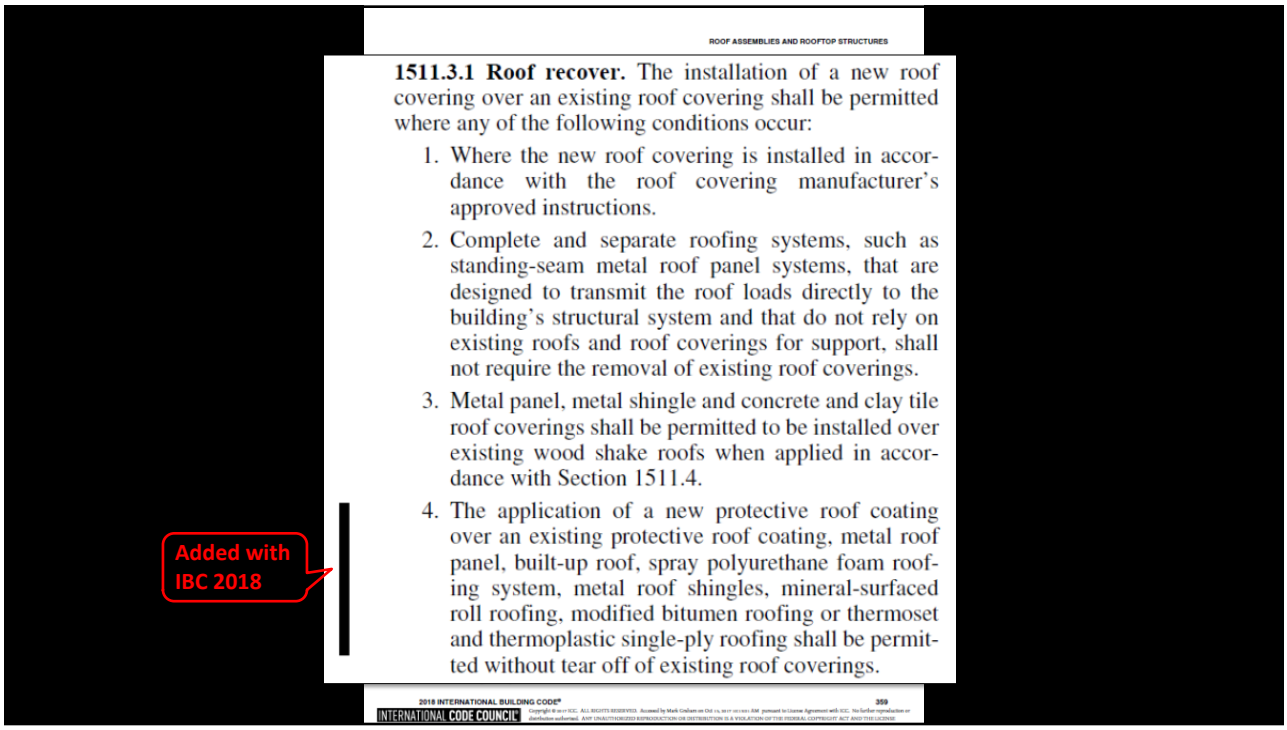

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1511.3.1 Roof recover. The installation of a new 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 panel systems, that are designed to transmit the roof loads directly to the building's structural system and that 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 when applied in accordance with Section 1511.4.
4. The application of a new protective roof coating over an existing protective roof coating, metal roof panel, built-up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.

Added with IBC 2018

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Roof coatings -- summary

- Fire classification (Class A, B or C) – tested as an assembly
- Installed per the coating manufacturer's instructions
- ASTM product standards
- Reroofing? (Clarified in IBC 2018)

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Questions… and other topics

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