Chapter 31 Tents, Temporary Special Event Structures and Other Membrane Structures

CALIFORNIA FIRE CODE — MATRIX ADOPTION TABLE
CHAPTER 31 — TENTS, TEMPORARY SPECIAL EVENT STRUCTURES AND OTHER MEMBRANE STRUCTURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5							
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
3101.1			X																			
[T-19 §303 (a)(b)]				X																		
3101.2			X																			
3101.3			X																			
3103.3.1			X																			
3103.8.2			X																			
3103.9.4				X																		
[T-19 §340]				X																		
[T-19 §341]				X																		
[T-19 §321]				X																		
[T-19 §315																						

	(a)]				X																		
	[T-19 §332 (a)]				X																		
	[T-19 §334]				X																		
	[T-19 §335 (a)(b)]				X																		
	[T-19 §315 (d)]				X																		
	3108			X																			
	[T-19 §315 (b)]				X																		
	[T-19 §326 (b)]				X																		
	[T-19 §316]				X																		
	[T-19 §317]				X																		
	[T-19 §319 (a-c]				X																		
	[T-19 §319 (d)(e)]				X																		
	[T-19 §325]				X																		
	[T-19 §324 (a)(b)]				X																		
	[T-19 §320]				X																		
	[T-19 §326 (a)]				X																		
	[T-19 §326 (c)]				X																		
	3107.20			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

User note:

About this chapter: *Chapter 31 provides requirements that are intended to protect temporary as well as permanent tents and air-supported and other membrane structures and temporary stage special event structures from fire and similar hazards. The provisions regulate structure location and access, anchorage, egress, heat-producing equipment, hazardous materials and operations, combustible vegetation, ignition sources, and waste accumulation. This is accomplished through requiring regular inspections and certifying continued compliance with fire safety regulations. This chapter also addresses outdoor assembly events, which are not limited to those events with tents or other membrane structures, but are regulated due to the number of people, density of those people and hazards associated with large outdoor events related to egress, fire hazards from cooking and other related concerns.*

Section 3101 General

3101.1 Scope

Tents, temporary special event structures and membrane structures shall comply with this chapter. The provisions of Section 3103 are applicable only to temporary tents and membrane structures. The provisions of Sections 3104 and 3106 are applicable to temporary and permanent tents and membrane structures. The provisions of Section 3105 are applicable to temporary special event structures. *The provisions of Section 3106 are applicable to inflatable amusement devices.* The provisions of Section 3107 are applicable to outdoor assembly events. Other temporary structures shall comply with the *California Building Code*.

These building standards govern the use of tents, awnings or other fabric enclosures, including membrane (air-supported and air-inflated) structures and places of assemblage, in or under which 10 or more persons may gather for any lawful purpose.

Exceptions:

1. *Tents, awnings or other fabric enclosures used to cover or enclose private swimming pools and similar facilities on the premises of private one- and two-family dwellings.*

2. *Tents used to conduct committal services on the ground of a cemetery.*

3. *Tents, awnings or other fabric enclosures erected and used within a sound stage, or other similar structural enclosure which is equipped with an overhead automatic sprinkler system.*

4. *Tensioned membrane roof materials supported by rigid frames or installed on a mast and cable system provided such structures conform to the requirements of one of the types of construction as described in these regulations.*

5. *Fabric structures which are part of mobile homes, recreational vehicles or commercial coaches governed by the provisions of Division 13, Part 2, Health and Safety Code (Department of Housing and Community Development).*

[California Code of Regulations, Title 19, Division 1, §303.(a) and (b)] Scope.

(a) The provisions of California Code of Regulations, Title 19, Division 1, Chapter 2 apply to the sale, offering for sale, manufacture for sale, rental and use of tents within this state.

(b) For building standards relating to tents and membrane structures, see California Code of Regulations, Title 24, Part 9.

3101.2 Alternate Means of Protection

When approved by the enforcing agency, exceptions to the provisions of these building standards may be permitted, provided alternate means of protection which are at least equal to these regulations in quality, strength, effectiveness, fire resistance, durability and safety are provided.

3101.3 Labor Camps

Tents used in labor camps for the housing of employees shall have tight wooden floors raised at least 4 inches (102 mm) above

ground level having baseboards on all sides to a height of at least 6 inches (152 mm) or shall have concrete slabs with finished surface at least 4 inches (102 mm) above grade having baseboards on all sides to a height of at least 6 inches (152 mm).

Electrical installations serving and installed within tents shall comply with the applicable requirements of the *California Electrical Code*.

Tents shall not be considered suitable sleeping places when it is found necessary to provide heating facilities in order to maintain a minimum temperature of 60°F (33.3°C) within such tent during the period of occupancy.

Note: See Section 17008 of the Health and Safety Code for definition of labor camp.

Section 3102 Definitions

3102.1 Definitions

The following terms are defined in Chapter 2:

AIR-INFLATED STRUCTURE.

AIR-SUPPORTED STRUCTURE.

MEMBRANE STRUCTURE.

TEMPORARY SPECIAL EVENT STRUCTURE.

TENT.

Section 3103 Temporary Tents and Membrane Structures

3103.1 General

Tents and membrane structures used for temporary periods shall comply with this section and Section 3106. Other temporary structures erected for a period of 180 days or less shall comply with the *California Building Code*.

3103.2 Approval Required

Tents and membrane structures having an area in excess of 400 square feet (37 m^2) shall not be erected, operated or maintained for any purpose without first obtaining a permit and approval from the fire code official.

Exceptions:

1. Tents used exclusively for recreational camping purposes.

2. Tents open on all sides that comply with all of the following:

    2.1. Individual tents having a maximum size of 700 square feet (65 m^2).

    2.2. The aggregate area of multiple tents placed side by side without a fire break clearance of 12 feet (3658 mm), not exceeding 700 square feet (65 m^2) total.

2.3. A minimum clearance of 12 feet (3658 mm) to all structures and other tents.

3103.3 Outdoor Assembly Event

For the purposes of this chapter, an outdoor assembly event shall include a circus, carnival, tent show, theater, skating rink, dance hall or other place of assembly in or under which persons gather for any purpose.

3103.3.1 Special Amusement Area

Tents and other membrane structures erected as a special amusement area shall be equipped with an automatic sprinkler system in accordance with Section 914.7.1.

3103.4 Permits

Permits shall be required as set forth in Sections 105.5 and 105.6.

3103.5 Use Period

Temporary tents, air-supported, air-inflated or tensioned membrane structures shall not be erected for a period of more than 180 days within a 12-month period on a single premises.

3103.6 Construction Documents

A detailed site and floor plan for tents or membrane structures with an occupant load of 50 or more shall be provided with each application for approval. The tent or membrane structure floor plan shall indicate details of the means of egress facilities, seating capacity, arrangement of the seating and location and type of heating and electrical equipment. The construction documents shall include an analysis of structural stability.

3103.7 Inspections

The entire tent, air-supported, air-inflated or tensioned membrane structure system shall be inspected at regular intervals, but not less than two times per permit use period, by the permittee, owner or agent to determine that the installation is maintained in accordance with this chapter.

Exception: Permit use periods of less than 30 days.

3103.7.1 Inspection Report

Where required by the fire code official, an inspection report shall be provided and shall consist of maintenance, anchors and fabric inspections.

3103.8 Access, Location and Parking

Access, location and parking for temporary tents and membrane structures shall be in accordance with this section.

3103.8.1 Access

Fire apparatus access roads shall be provided in accordance with Section 503.

3103.8.2 Location

Tents or membrane structures shall not be located within 20 feet (6096 mm) of lot lines, buildings, other tents or membrane structures, parked vehicles or internal combustion engines. For the purpose of determining required distances, support ropes and guy wires shall be considered as part of the temporary membrane structure or tent.

Exceptions:

1. Separation distance between membrane structures and tents not used for cooking is not required where the aggregate floor area does not exceed 15,000 square feet (1394 m^2).

2. Membrane structures or tents need not be separated from buildings where all of the following conditions are met:

   2.1. The aggregate floor area of the membrane structure or tent shall not exceed 10,000 square feet (929 m^2).

   2.2. The aggregate floor area of the building and membrane structure or tent shall not exceed the allowable floor area including increases as indicated in the *California Building Code*.

   2.3. Required means of egress are provided for both the building and the membrane structure or tent including travel distances.

   2.4. Fire apparatus access roads are provided in accordance with Section 503.

3. *When approved by the enforcing agency, tents may be located in or on permanent buildings provided such use does not constitute an undue hazard.*

3103.8.3 Location of Structures in Excess of 15,000 Square Feet in Area

Membrane structures having an area of 15,000 square feet (1394 m^2) or more shall be located not less than 50 feet (15 240 mm) from any other tent or structure as measured from the sidewall of the tent or membrane structure unless joined together by a corridor.

3103.8.4 Membrane Structures on Buildings

Membrane structures that are erected on buildings, balconies, decks or other structures shall be regulated as permanent membrane structures in accordance with Section 3102 of the *California Building Code*.

3103.8.5 Connecting Corridors

Tents or membrane structures are allowed to be joined together by means of corridors. Exit doors shall be provided at each end of such corridor. On each side of such corridor and approximately opposite each other, there shall be provided openings not less than 12 feet (3658 mm) wide.

3103.8.6 Fire Break

An unobstructed fire break passageway or fire road not less than 12 feet (3658 mm) wide and free from guy ropes or other obstructions shall be maintained on all sides of all tents and membrane structures unless otherwise approved by the fire code official.

3103.9 Structural Stability and Anchorage Required

Tents or membrane structures and their appurtenances shall be designed and installed to withstand the elements of weather and prevent collapsing. Documentation of structural stability shall be furnished to the fire code official.

3103.9.1 Tents and Membrane Structures Greater Than One Story

Tents and membrane structures exceeding one story shall be designed and constructed to comply with Sections 1606 through 1609 of the *California Building Code*.

3103.9.2 Tents and Membrane Structures Greater Than 7,500 Square Feet

Tents and membrane structures greater than 7,500 square feet (697 m^2) shall be designed and constructed to comply with Sections 1606 through 1609 of the *California Building Code*.

3103.9.3 Tents and Membrane Structures With an Occupant Load Greater Than 1,000

Tents and membrane structures with an occupant capacity greater than 1,000 persons shall be designed and constructed to comply with Sections 1606 through 1609 of the *California Building Code*.

3103.9.4 Water-Filled Vessels

Water-filled vessels shall not be used to anchor a tent or membrane structure unless approved and in accordance with the tent or membrane structure manufacturer's instructions.

3103.10 Temporary Air-Supported and Air-Inflated Membrane Structures

Temporary air-supported and air-inflated membrane structures shall be in accordance with Sections 3103.10.1 through 3103.10.4.

3103.10.1 Door Operation

During high winds exceeding 50 miles per hour (22 m/s) or in snow conditions, the use of doors in air-supported structures shall be controlled to avoid excessive air loss. Doors shall not be left open.

3103.10.2 Fabric Envelope Design and Construction

Air-supported and air-inflated structures shall have the design and construction of the fabric envelope and the method of anchoring in accordance with Architectural Fabric Structures Institute FSAAS.

3103.10.3 Blowers

An air-supported structure used as a place of assembly shall be furnished with not less than two blowers, each of which has adequate capacity to maintain full inflation pressure with normal leakage. The design of the blower shall be so as to provide integral limiting pressure at the design pressure specified by the manufacturer.

3103.10.4 Auxiliary Inflation Systems

Places of public assembly for more than 200 persons shall be furnished with an auxiliary inflation system capable of powering a blower with the capacity to maintain full inflation pressure with normal leakage in accordance with Section 3103.10.3 for a minimum duration of 4 hours. The auxiliary inflation system shall be either a fully automatic auxiliary engine-generator set or a supplementary blower powered by an internal combustion engine that shall be automatic in operation. The system shall be capable of automatically operating the required blowers at full power within 60 seconds of a commercial power failure.

3103.11 Seating Arrangements

Seating in tents or membrane structures shall be in accordance with Chapter 10.

3103.12 Means of Egress

Means of egress for temporary tents and membrane structures shall be in accordance with Sections 3103.12.1 through 3103.12.8.

3103.12.1 Distribution

Exits shall be spaced at approximately equal intervals around the perimeter of the tent or membrane structure, and shall be located such that all points are 100 feet (30 480 mm) or less from an exit.

3103.12.2 Number

Tents or membrane structures or a usable portion thereof shall have not less than one exit and not less than the number of exits required by Table 3103.12.2. The total width of means of egress in inches (mm) shall be not less than the total occupant load served by a means of egress multiplied by 0.2 inches (5 mm) per person.

TABLE 3103.12.2

MINIMUM NUMBER OF MEANS OF EGRESS AND MEANS OF EGRESS WIDTHS FROM TEMPORARY MEMBRANE STRUCTURES AND TENTS

OCCUPANT LOAD	MINIMUM NUMBER OF MEANS OF EGRESS	MINIMUM WIDTH OF EACH MEANS OF EGRESS (inches)	MINIMUM WIDTH OF EACH MEANS OF EGRESS (inches)
		Tent	Membrane Structure
10 to 199	2	72	36
200 to 499	3	72	72
500 to 999	4	96	72
1,000 to 1,999	5	120	96
2,000 to 2,999	6	120	96
Over 3,000[a]	7	120	96

For SI: 1 inch = 25.4 mm.

a. When the occupant load exceeds 3,000, the total width of means of egress (in inches) shall be not less than the total occupant load multiplied by 0.2 inch per person.

3103.12.3 Exit Openings From Tents

Exit openings from tents shall remain open unless covered by a flame-resistant curtain. The curtain shall comply with the following requirements:

1. Curtains shall be free sliding on a metal support. The support shall be not less than 80 inches (2032 mm) above the floor level at the exit. The curtains shall be so arranged that, when open, no part of the curtains obstructs the exit.

2. Curtains shall be of a color, or colors, that contrasts with the color of the tent.

3103.12.4 Doors

Exit doors shall swing in the direction of exit travel. To avoid hazardous air and pressure loss in air-supported membrane structures, such doors shall be automatic closing against operating pressures. Opening force at the door edge shall not exceed 15 pounds (66 N).

3103.12.5 Aisle

The width of aisles without fixed seating shall be in accordance with the following:

1. In areas serving employees only, the minimum aisle width shall be 24 inches (610 mm) but not less than the width required by the number of employees served.

2. In public areas, smooth-surfaced, unobstructed aisles having a minimum width of not less than 44 inches (1118 mm) shall be provided from seating areas, and aisles shall be progressively increased in width to provide, at all points, not less than 1 foot (305 mm) of aisle width for each 50 persons served by such aisle at that point.

3103.12.5.1 Arrangement and Maintenance

The arrangement of aisles shall be subject to approval by the fire code official and shall be maintained clear at all times during occupancy.

3103.12.6 Exit Signs

Exits shall be clearly marked. Exit signs shall be installed at required exit doorways and where otherwise necessary to indicate clearly the direction of egress where the exit serves an occupant load of 50 or more.

3103.12.6.1 Exit Sign Illumination

Exit signs shall be either listed and labeled in accordance with UL 924 as the internally illuminated type and used in accordance with the listing or shall be externally illuminated by luminaires supplied in either of the following manners:

1. Two separate circuits, one of which shall be separate from all other circuits, for occupant loads of 300 or less.

2. Two separate sources of power, one of which shall be an approved emergency system, shall be provided where the occupant load exceeds 300. Emergency systems shall be supplied from storage batteries or from the on-site generator set, and the system shall be installed in accordance with *the California Electrical Code*. The emergency system provided shall have a minimum duration of 90 minutes when operated at full design demand.

3103.12.7 Means of Egress Illumination

Means of egress shall be illuminated with light having an intensity of not less than 1 foot-candle (11 lux) at floor level while the structure is occupied. Fixtures required for means of egress illumination shall be supplied from a separate circuit or source of power.

3103.12.8 Maintenance of Means of Egress

The required width of exits, aisles and passageways shall be maintained at all times to a public way. Guy wires, guy ropes and other support members shall not cross a means of egress at a height of less than 8 feet (2438 mm). The surface of means of egress shall be maintained in an approved manner.

Section 3104 Temporary and Permanent Tents and Membrane Structures

3104.1 General

Tents and membrane structures, both temporary and permanent, shall be in accordance with this section and Sections 3106 and 3107. Permanent tents and membrane structures shall also comply with the *California Building Code*.

[California Code of Regulations, Title 19, Division 1, §340] Existing Small Tents.

Existing small tents are exempt from California Code of Regulations, Title 19, Division 1, Chapter 2.

[California Code of Regulations, Title 19, Division 1, §341] Existing Membrane Structures and Other (Large) Existing Tents.

Existing membranes of membrane structures and large (10 or more capacity) existing tents may continue to be used provided evidence of satisfactory flame resistance is available to the enforcing authority. Such evidence may be in the form of certification that the fabric passes the standard small scale flame resistance test as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8 regulations or through passage of effective field tests.

[California Code of Regulations, Title 19, Division 1, §321] Abatement of Fire or Panic Hazards.

Any condition that presents a fire hazard, would contribute to the rapid spread of fire, interfere with the rapid exit of persons from the tents, or interfere with or delay the extinguishment of a fire, shall be immediately corrected as ordered by the enforcing authority.

[California Code of Regulations, Title 19, Division 1, §315.(a)] Flame Resistance Standards.

(a) *All tent fabrics and all interior decorative fabrics or materials shall be flame resistant in accordance with appropriate standards set forth in California Code of Regulations, Title 19, Division 1, Chapter 8.*

Tent tops and sidewalls shall be made either from fabric which has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame-resistant fabric approved and listed by the State Fire Marshal.

[California Code of Regulations, Title 19, Division 1, §332.(a)] Flame Resistance.

(a) *All tents manufactured for sale, sold, rented, offered for sale or used in California shall be made from nonflammable material or one of the following flame-resistant fabrics or material approved by the State Fire Marshal:*

(1) *Fabrics complying with the State Fire Marshal's requirements for flame resistance for exterior use, as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8, or*

(2) *Fabrics complying with the flame-resistance requirements set forth in "A Specification for Flame-*

Resistance Materials Used in Camping Tentage" published in 1975 by Canvas Products Association International, hereinafter referred to as CPAI-84.

Exceptions:

(1) Tents used for committal services at cemeteries.

(2) Tents or similar fabric enclosures used within a sound stage or equivalent enclosure equipped with an overhead automatic fire extinguishing system.

3104.2 Flame Propagation Performance Testing and Certification

Before a permit is granted, the owner or agent shall file with the fire code official a certificate provided by the product manufacturer to verify that the materials have been tested and certified by an approved testing laboratory. The certificate shall indicate that the floor coverings, tents, membrane structures and their appurtenances, which include sidewalls, drops and tarpaulins, are composed of materials meeting the flame propagation performance of Test Method 2 of NFPA 701. Additionally, it shall indicate that the bunting and combustible decorative materials and effects are composed of material meeting the flame propagation performance criteria of Test Method 1 or Test Method 2 of NFPA 701, as applicable. Alternatively, the materials shall be treated with a flame retardant in an approved manner and meet the flame propagation performance criteria of the applicable test method of NFPA 701. The certificate shall indicate compliance with the testing requirements of NFPA 701, Chapter 16. The flame propagation performance criteria shall be effective for the period specified by the permit.

3104.3 Label

Membrane structures or tents shall have a permanently affixed label bearing the following information:

1. The identification of size and fabric or material.
2. The names and addresses of the manufacturers of the tent or air-supported structure.
3. A statement that the fabric or material meets the requirements of Section 3104.2.
4. If treated, the date the fabric or material was last treated with flame-retardant solution, the trade name or kind of chemical used in treatment, name of person or firm treating the fabric or material, and name of testing agency and test standard by which the fabric or material was tested.
5. If untreated, a statement that no treatment was applied when the fabric or material met the requirements of Section 3104.2.

[California Code of Regulations, Title 19, Division 1, §334.] Requirements Pertaining to All Tents.

All tents manufactured for sale in California shall be labeled in accordance with the appropriate provisions of California Code of

Regulations, Title 19, Division 1, Section 335.

[California Code of Regulations, Title 19, Division 1, §335.(a) and (b)] Labeling of Tents.

(a) *Each section of top and sidewall in large tents shall have a durable label, permanently affixed, bearing the following information:*

(1) *The Seal of Registration.*

(2) *If treated fabric, the name and registration number of the approved application concern and approved chemical used, and the date of treatment.*

(3) *If registered fabric, the trade name and registration number of the approved fabric, and the date of production.*

In lieu of attached labels, the required information may be applied directly to the fabric by print, stamp or stencil.

(b) *Small tents shall have a permanently affixed label bearing the information in California Code of Regulations, Title 19, Division 1, Section 335, subsection (a), or shall comply with the provisions specified in CPAI-84 (1975) which reads as follows:*

(1) *Certification. A statement that the materials used in the manufacture of the item meet the flame resistance requirements of CPAI-84.*

(2) *Manufacturer Identification. An identification of the manufacturer of the item. If the item bears a private label, it shall identify the private labeler and shall also contain a code mark which will permit the seller of the item to identify the manufacturer to the purchaser upon request.*

(3) *Code Number. A number enabling the manufacturer to identify from his records the suppliers and suppliers' lot numbers of the certified materials used in the item. The manufacturer shall also maintain records identifying the parties to whom he sold camping tentage. Further, he shall maintain records identifying items manufactured from lots of certified material. Records shall be maintained for four (4) years.*

(4) *Warning label.*

24 pt. type
WARNING
16 pt. type
KEEP ALL FLAME
AND HEAT SOURCES
AWAY FROM THIS
TENT FABRIC
12 pt. type

This tent is made with flame-resistant fabric which meets CPAI-84 specifications. It is not fire proof.
The fabric will burn if left in continuous contact with any flame source.

The application of any foreign substance to the tent fabric may render the flame resistant properties ineffective.

This warning label or its equivalent must be permanently affixed to the tent at one conspicuous location, and must block letters on a white background. The first paragraph of the body of the label must be placed in a conspicuous location on each carton containing the tent.

3104.4 Affidavit

The affidavit required by Section 3104.2 shall contain all of the information specified in Section 3104.3.

[California Code of Regulations, Title 19, Division 1, §315.(d)] Flame Resistance Standards.

(d) Certificates of Flame Resistance or other documentation affirming the requirements of California Code of Regulations, Title 19, Division 1, Section 315, subsection (a) shall be made available upon request of the enforcement authority.

Section 3105 Temporary Special Event Structures

3105.1 General

Temporary special event structures shall comply with Section 3104, Sections 3105.2 through 3105.9 and ANSI E1.21.

3105.2 Approval

Temporary special event structures in excess of 400 square feet (37 m^2) shall not be erected, operated or maintained for any purpose without first obtaining approval and a permit from the fire code official and the building official.

3105.3 Permits

Permits shall be required as set forth in Sections 105.5 and 105.6.

3105.4 Use Period

Temporary special event structures erected in accordance with ANSI E1.21 shall not be erected for a period of more than six consecutive weeks.

3105.5 Required Documents

The following documents shall be submitted to the fire code official and the building official for review before a permit is approved:

1. Construction documents: Construction documents shall be prepared by a registered design professional in accordance with the *California Building Code* and ANSI E1.21 where applicable. Construction documents shall include:

    1.1. A summary sheet showing the building code used, design criteria, loads and support reactions.

    1.2. Detailed construction and installation drawings.

    1.3. Design calculations.

    1.4. Operating limits of the structure explicitly outlined by the registered design professional including environmental conditions and physical forces.

    1.5. Effects of additive elements such as video walls, supported scenery, audio equipment, vertical and horizontal coverings.

    1.6. Means for adequate stability including specific requirements for guying and cross-bracing, ground anchors or ballast for different ground conditions.

2. Designation of responsible party: The owner of the temporary special event structure shall designate in writing a person to have responsibility for the temporary special event structure on the site. The designated person shall have sufficient knowledge of the construction documents, manufacturer's recommendations and operations plan to make judgments regarding the structure's safety and to coordinate with the fire code official.

3. Operations plan: The operations plan shall reflect manufacturer's operational guidelines, procedures for environmental monitoring and actions to be taken under specified conditions consistent with the construction documents.

3105.6 Inspections

Inspections shall comply with Section 107 and Sections 3105.6.1 and 3105.6.2.

3105.6.1 Independent Inspector

The owner of a temporary special event structure shall employ a qualified, independent approved agency or individual to inspect the installation of a temporary special event structure.

3105.6.2 Inspection Report

The inspecting agency or individual shall furnish an inspection report to the fire code official. The inspection report shall indicate that the temporary special event structure was inspected and was or was not installed in accordance with the approved construction documents. Discrepancies shall be brought to the immediate attention of the installer for correction. Where any discrepancy is not corrected, it shall be brought to the attention of the fire code official and the designated responsible party.

3105.7 Means of Egress

The means of egress for temporary special event structures shall comply with Chapter 10.

3105.8 Location

Temporary special event structure shall be located a distance from property lines and buildings to accommodate distances indicated in the construction drawings for guy wires, cross-bracing, ground anchors or ballast. Location shall not interfere with egress from a building or encroach on fire apparatus access roads.

3105.9 Portable Fire Extinguishers

Portable fire extinguishers shall be provided as required by Section 906.

Section 3106 Outdoor Assembly Events

3106.1 Scope

Outdoor assembly events shall comply with this section.

3106.2 General

Outdoor assembly events shall be in accordance with this section and Section 403.11. Temporary structures erected for outdoor assembly events shall comply with this chapter.

3106.2.1 Approval Required

Outdoor assembly events shall be approved by the fire code official.

3106.2.2 Permits

An operational permit shall be required as set forth in Section 105.5.

3106.2.3 Access

An approved means of fire apparatus access shall be provided.

3106.2.3.1 Fire Service Features

Unobstructed access to fire hydrants, drafting sources and other fire protection features shall be maintained at all times.

3106.3 Occupancy and Means of Egress

The number and location of emergency egress and escape routes shall be approved by the fire code official.

3106.3.1 Occupant Load

The fire code official shall establish an occupant load for the event site.

3106.3.2 Maintenance of Emergency Egress and Escape Routes

Emergency egress and escape routes shall be maintained at all times.

3106.4 Public Safety for Events

Outdoor assembly events shall comply with Sections 3106.4.1 through 3106.4.7.

3106.4.1 Public Safety Plan for Gatherings

A public safety plan shall be prepared where required by Section 403.11.2. The public safety plan shall be submitted to the fire

code official with the application for an operational permit as required by Section 3106.2.2.

3106.4.2 Weather Monitoring Person

Where required by the fire code official, the event operator or agent shall designate one qualified individual to continuously monitor local weather reports, forecasts and conditions. Said person shall be responsible for initiating weather-related event mitigation activities, ordering the suspension or cancellation of the outdoor assembly event and issuing the evacuation signal in accordance with the approved public safety plan.

3106.4.3 Crowd Managers

Where events involve a gathering of more than 1,000 people, trained crowd managers shall be provided in accordance with Section 403.11.3.

3106.4.4 Portable Fire Extinguishers

Approved portable fire extinguishers complying with Section 906 shall be provided and placed in locations approved by the fire code official.

3106.4.5 Smoking

Smoking shall be permitted only in designated areas. Other areas shall have approved "No Smoking" signs conspicuously posted and maintained in accordance with Section 310.

[California Code of Regulations, Title 19, Division 1, §316] Smoking Prohibited.

Smoking is not permitted in any tent and in any adjacent areas where hay or other highly flammable materials are kept. "No Smoking" signs shall be conspicuously posted in all tents open to the public and wherever otherwise specified by the enforcing authority.

3106.4.6 Combustible Vegetation

Combustible vegetation that could create a fire hazard shall be removed from the outdoor assembly event area.

3106.4.7 Combustible Refuse

Combustible refuse shall be kept in noncombustible containers with tight-fitting or self-closing lids. Combustible refuse shall be removed from the event site at regular intervals to prevent an unsafe accumulation within the event site.

3106.5 Cooking Appliances or Devices

Outdoor assembly events with concession stands or booths using cooking appliances or devices shall comply with Sections 3106.5.1 through 3106.5.3.

3106.5.1 Separation From Tents or Structures

Cooking appliances or devices that produce sparks or grease-laden vapors or flying embers (firebrands) shall not be used within 20 feet (6096 mm) of a tent or temporary structure.

Exceptions:

1. Designated cooking tents not occupied by the public when approved by the fire code official.
2. Tents or structures where cooking appliances are protected with an automatic fire-extinguishing system in accordance with Section 904.13.

3106.5.2 Protection

Cooking equipment using combustible oils or solids shall meet the following:

1. A noncombustible lid shall be immediately available. The lid shall be of sufficient size to cover the cooking well completely.
2. The equipment shall be placed on a noncombustible surface.
3. An approved portable fire extinguisher for protection from cooking grease fires shall be provided at a location approved by the fire code official.

3106.5.3 Liquefied Petroleum Gas (LP-gas)

The use of liquefied petroleum gas (LP-gas) shall be in accordance with Chapter 61.

3106.6 Electrical Equipment and Wiring

Outdoor assembly events with concession stands or booths using electrical equipment and temporary wiring for electrical power or lighting shall comply with the applicable provisions of *the California Electrical Code* and Sections 3106.6.1 through 3106.6.3.

3106.6.1 Outdoor Use

Electrical equipment and wiring shall be listed and labeled for outdoor use.

3106.6.2 Generators

Generators shall be installed not less than 10 feet (3048 mm) from combustible materials, and shall be isolated from the public by physical guard, fence or enclosure installed not less than 3 feet (914 mm) away from the internal combustion power source.

3106.6.3 Portable Fire Extinguishers

Each generator shall be provided with an approved portable fire extinguisher complying with Section 906.

Section 3107 Operational Requirements

3107.1 General

Temporary and permanent tents and membrane structures shall comply with this section.

3107.2 Combustible Materials

Hay, straw, shavings or similar combustible materials shall not be located within any tent or membrane structure containing an assembly occupancy, except the materials necessary for the daily feeding and care of animals. Sawdust and shavings utilized for a public performance or exhibit shall not be prohibited provided that the sawdust and shavings are kept damp. Combustible materials shall not be permitted under stands or seats at any time.

[California Code of Regulations, Title 19, Division 1, §315.(b)] Flame Resistance Standards.

(b) Sawdust, shavings or other combustible material used on the floor or ground shall be made flame resistant or when approved by the enforcing authority shall be kept adequately damp when tent is occupied.

[California Code of Regulations, Title 19, Division 1, §326.(b)] Hazard Abatement.

(b) Hay, straw, trash and other similar flammable material shall be stored more than 50 feet from any tent except upon approval of the enforcing authority.

Exception: *Tents to which the public is not admitted.*

3107.3 Smoking

Smoking shall not be permitted in tents or membrane structures. Approved "No Smoking" signs shall be conspicuously posted in accordance with Section 310.

[California Code of Regulations, Title 19, Division 1, §316] Smoking Prohibited.

Smoking is not permitted in any tent and in any adjacent areas where hay or other highly flammable materials are kept. "No Smoking" signs shall be conspicuously posted in all tents open to the public and wherever otherwise specified by the enforcing authority.

3107.4 Open or Exposed Flame

Open flame or other devices emitting flame, fire or heat or any flammable or combustible liquids, gas, charcoal or other cooking device or any other unapproved devices shall not be permitted inside or located within 20 feet (6096 mm) of the tent or membrane structures while open to the public unless approved by the fire code official.

[California Code of Regulations, Title 19, Division 1, §317] Fireworks and Open Flames.

Fireworks, open flame or any device emitting flame or spark shall not be used in or immediately adjacent to any tent while open to the public, except when approved in writing by the enforcing authority.

3107.5 Fireworks

Fireworks shall not be used within 100 feet (30 480 mm) of tents or membrane structures.

3107.6 Spot Lighting

Spot or effect lighting shall only be by electricity, and all combustible construction located within 6 feet (1829 mm) of such equipment shall be protected with approved noncombustible insulation not less than $9^1/_4$ inches (235 mm) thick.

3107.7 Safety Film

Motion pictures shall not be displayed in tents or membrane structures unless the motion picture film is safety film.

3107.8 Clearance

There shall be a clearance of not less than 3 feet (914 mm) between the fabric envelope and all contents located inside membrane structures.

3107.9 Portable Fire Extinguishers

Approved portable fire extinguishers complying with Section 906 shall be provided and placed in locations as required by the *California Code of Regulations, Title 19, Division 1, Chapter 2, Article 3, Section 319.*

[California Code of Regulations, Title 19, Division 1, §319.(a) through (c)] Fire Extinguishers and Other Fire Protection Equipment.

(a) One Class 2-A fire extinguisher shall be provided in every tent having a floor area between 500 square feet and 1,000 square feet plus one 2-A fire extinguisher in each auxiliary adjacent tent. One additional extinguisher shall be provided for each additional 2000 square feet or fraction thereof.

(b) At least one Class 10 B-C fire extinguisher shall be provided with each generator or transformer.

(c) At least one Class 10 B-C fire extinguisher shall be provided in kitchen, dining areas and at locations where flammable or combustible liquids or flammable gases are used, stored or dispensed.

3107.10 Fire Protection Equipment

Fire hose lines, water supplies and other auxiliary fire equipment shall be maintained at the site in such numbers and sizes as required by the fire code official.

[California Code of Regulations, Title 19, Division 1, §319.(d) and (e)] Fire Extinguishers and Other Fire Protection Equipment.

(d) Tents having a capacity of 1,000 or more persons shall be protected on each of the long sides with fire hose lines of at least $1^{1}/_{2}$-inch internal diameter and of sufficient length to reach either end of the tent. The water supply shall be either from the public water mains or from tanks having a capacity of not less than 500 gallons. There shall be at least 65 pounds of flowing pressure at the nozzle of the hose line when a $^{1}/_{2}$-inch tip is used.

(e) The enforcing authority may modify or waive any of the requirements of this section [Title 19, Division 1, Section 319] and may accept other types of fire extinguishing equipment in lieu of that required by Title 19, Division 1 regulations if, in the authorities' opinion, reasonable and adequate protection will be afforded.

3107.11 Occupant Load Factors

The occupant load allowed in an assembly structure, or portion thereof, shall be determined in accordance with Chapter 10.

3107.12 Heating and Cooking Equipment

Heating and cooking equipment shall be in accordance with Sections 3107.12.1 through 3107.12.7.

3107.12.1 Installation

Heating or cooking equipment, tanks, piping, hoses, fittings, valves, tubing and other related components shall be installed as specified in the *International Fuel Gas Code* and the California Mechanical Code, and shall be approved by the fire code official.

3107.12.2 Venting

Gas, liquid and solid fuel-burning equipment designed to be vented shall be vented to the outside air as specified in the *International Fuel Gas Code* and the *California Mechanical Code*. Such vents shall be equipped with *approved* spark arresters where required. Where vents or flues are used, all portions of the tent or membrane structure shall be not less than 12 inches (305 mm) from the flue or vent.

3107.12.3 Location

Cooking and heating equipment shall not be located within 10 feet (3048 mm) of *exits* or combustible materials.

3107.12.4 Operations

Operations such as warming of foods, cooking demonstrations and similar operations that use solid flammables, butane or other similar devices that do not pose an ignition hazard, shall be approved.

3107.12.5 Cooking Tents

Tents with sidewalls or drops where cooking is performed shall be separated from other tents or membrane structures by not less than 20 feet (6096 mm).

3107.12.6 Outdoor Cooking

Outdoor cooking that produces sparks or grease-laden vapors shall not be performed within 20 feet (6096 mm) of a tent or membrane structure.

3107.12.7 Electrical Heating and Cooking Equipment

Electrical cooking and heating equipment shall comply with *the California Electrical Code*.

3107.13 LP-gas

The storage, handling and use of LP-gas and LP-gas equipment shall be in accordance with Sections 3107.13.1 through 3107.13.3.

3107.13.1 General

LP-gas equipment such as containers, tanks, piping, hoses, fittings, valves, tubing and other related components shall be approved and in accordance with Chapter 61 and with the *International Fuel Gas Code*.

[California Code of Regulations, Title 19, Division 1, §325] Liquefied Petroleum Gas.

Liquefied petroleum gas shall not be stored or used in connection with any tent unless the storage containers, equipment, fittings, appliances, placement, use and operation complies with the provisions of California Code of Regulations, Title 8, Article 5, Subchapter 1, Chapter 4.

3107.13.2 Location of Containers

LP-gas containers and tanks shall be located outside in accordance with Table 6104.3. Pressure relief devices shall be pointed away from the tent or membrane structure.

3107.13.3 Protection and Security

Portable LP-gas containers, tanks, piping, valves and fittings that are located outside and are being used to fuel equipment inside a tent or membrane structure shall be adequately protected to prevent tampering, damage by vehicles or other hazards and shall be located in an approved location. Portable LP-gas containers shall be secured to prevent unauthorized movement.

3107.14 Flammable and Combustible Liquids

The storage of flammable and combustible liquids and the use of flammable-liquid-fueled equipment shall be in accordance with Sections 3107.14.1 through 3107.14.3.

3107.14.1 Use

Flammable-liquid-fueled equipment shall not be used in tents or membrane structures.

3107.14.2 Flammable and Combustible Liquid Storage

Flammable and combustible liquids shall be stored outside in an approved manner not less than 50 feet (15 240 mm) from tents or membrane structures. Storage shall be in accordance with Chapter 57.

[California Code of Regulations, Title 19, Division 1, §324.(a) and (b)] Flammable and Combustible Liquids.

(a) Liquids having a flash point below 200°F shall not be stored in any tent nor less than 50 feet from any tent.

(b) Flammable or combustible liquids shall be stored and dispensed in accordance with the provisions of the California Fire Code. The enforcing authority may permit limited quantities of flammable or combustible liquids required for display and normal merchandising.

3107.14.3 Refueling

Refueling shall be performed in an approved location not less than 20 feet (6096 mm) from tents or membrane structures.

3107.15 Display of Motor Vehicles

Liquid- and gas-fueled vehicles and equipment used for display within tents or membrane structures shall be in accordance with Sections 3107.15.1 through 3107.15.5.3.

3107.15.1 Batteries

Batteries shall be disconnected except where the fire code official requires that the batteries remain connected to maintain safety features.

3107.15.2 Fuel

Vehicles or equipment shall not be fueled or defueled within the tent or membrane structure.

3107.15.2.1 Quantity Limit

Fuel in the fuel tank shall not exceed one-quarter of the tank capacity or 5 gallons (19 L), whichever is less.

3107.15.2.2 Inspection

Fuel systems shall be inspected for leaks.

3107.15.2.3 Closure

Fuel tank openings shall be locked and sealed to prevent the escape of vapors.

3107.15.3 Location

The location of vehicles or equipment shall not obstruct means of egress.

3107.15.4 Places of Assembly

When a compressed natural gas (CNG) or liquefied petroleum gas (LP-gas) powered vehicle is parked inside a place of assembly, all of the following conditions shall be met:

1. The quarter-turn shutoff valve or other shutoff valve on the outlet of the CNG or LP-gas container shall be closed and the engine shall be operated until it stops. Valves shall remain closed while the vehicle is indoors.
2. The hot lead of the battery shall be disconnected.
3. Dual-fuel vehicles equipped to operate on gasoline and CNG or LP-gas shall comply with this section and Sections 3107.15.1 through 3107.15.3 for gasoline-powered vehicles.

3107.15.5 Competitions and Demonstrations

Liquid- and gas-fueled vehicles and equipment used for competition or demonstration within a tent or membrane structure shall comply with Sections 3107.15.5.1 through 3107.15.5.3.

3107.15.5.1 Fuel Storage

Fuel for vehicles or equipment shall be stored in approved containers in an approved location outside of the structure in accordance with Section 3107.14.2.

3107.15.5.2 Fueling

Refueling shall be performed outside of the structure in accordance with Section 3107.14.3.

3107.15.5.3 Spills

Fuel spills shall be cleaned up immediately.

3107.16 Separation of Generators

Generators and other internal combustion power sources shall be separated from tents or membrane structures by not less than 20 feet (6096 mm) and shall be isolated from contact with the public by fencing, enclosure or other approved means.

3107.17 Standby Personnel

Where, in the opinion of the fire code official, it is essential for public safety in a tent or membrane structure used as a place of assembly or any other use where people congregate, because of the number of persons, or the nature of the performance, exhibition, display, contest or activity, the owner, agent or lessee shall employ one or more qualified persons, as required and approved, to remain on duty during the times such places are open to the public, or when such activity is being conducted.

[California Code of Regulations, Title 19, Division 1, §320] Fire Safety Personnel.

The owners or operators of any tent used as a place of assemblage shall provide at least one qualified fire safety person in every tent having a capacity of 500 persons and one additional qualified person for each 1,000 additional persons or fraction thereof. Such persons shall be on duty in the tent at all times when the tent is open to the public. They shall be proficient in the

handling of fire extinguishers and equipment and shall be familiar with the fire and panic safety regulations. The individual designated under this section shall meet the approval of the fire authority having jurisdiction.

Exception: *The enforcing authority may waive or modify the provisions of this section if, in his opinion, public safety will not be jeopardized.*

3107.17.1 Duties

Before each performance or the start of such activity, standby personnel shall keep diligent watch for fires during the time such place is open to the public or such activity is being conducted and take prompt measures for extinguishment of fires that occur and assist in the evacuation of the public from the structure.

3107.17.2 Crowd Managers

There shall be trained crowd managers or trained crowd supervisors at a ratio of one crowd manager or supervisor for every 250 occupants, as approved.

3107.18 Combustible Vegetation

Combustible vegetation that could create a fire hazard shall be removed from the area occupied by a tent or membrane structure, and from areas within 30 feet (9144 mm) of such structures.

[California Code of Regulations, Title 19, Division 1, §326.(a)] Hazard Abatement.

(a) All flammable vegetation within 50 feet of any tent shall be removed.

3107.19 Combustible Waste Material

The floor surface inside tents or membrane structures and the grounds outside and within a 30-foot (9144 mm) perimeter shall be kept free from combustible waste and other combustible materials that could create a fire hazard. Such waste shall be stored in approved containers and removed from the premises not less than once a day during the period the structure is occupied by the public.

[California Code of Regulations, Title 19, Division 1, §326.(c)] Hazard Abatement.

(c) Combustible waste shall not be permitted to accumulate on the grounds either inside or outside of tents. Such waste shall be stored in approved containers until removed from the premises.

3107.20 Obstructions

Exits, aisles and passageways shall not be blocked or have their minimum clear width obstructed in any manner by ticket offices, turnstiles, concessions, chairs, equipment, animal chutes, poles or guy ropes, or anything whatsoever, nor shall they be blocked by persons for whom no seats are available.

In occupancies having fixed seating, and on request of the owner or manager, the enforcing agency may permit modifications from the provisions of this code to accommodate seating for handicapped persons using mechanical aids such as, but not limited to, walkers and wheelchairs.

Section 3108 Inflatable Amusement Devices

3108.1 Scope

All inflatable amusement devices shall comply with this section.

3108.2 General

Inflatable amusement devices shall be designed, anchored, operated and maintained in accordance with the manufacturer's instructions and the requirements of ASTM F2374.

3108.3 Combustible Materials

The fabrics, textiles, containment netting and combustible small mesh materials used in the construction of the inflatable amusement device shall meet the flame propagation criteria of Test Method 2 of NFPA 701. Additionally, a label and affidavit containing the information required in Sections 3104.3 and 3104.4 of this code shall be permanently affixed to the device.

3108.4 Electrical Equipment and Wiring

All electrical equipment, blower motors and temporary wiring for electrical power or lighting shall comply with Section 603 of this code.

3108.5 Portable Generators

Portable generators shall comply with the applicable provisions of NFPA 70 and with the portable generator requirements of this code.

3108.6 Portable Fire Extinguishers

Each generator shall be provided with an approved portable fire extinguisher complying with Section 906 and placed in an approved location.

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Section 1606 Dead Loads

1606.1 General

Dead loads are those loads defined in Chapter 2 of this code. Dead loads shall be considered to be permanent loads.

1606.2 Weights of Materials of Construction

For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606.3 Weight of Fixed Service Equipment

In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.

2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606.4 Photovoltaic Panel Systems

The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606.5 Vegetative and Landscaped Roofs

The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.

Section 1607 Live Loads

1607.1 General

Live loads are those loads defined in Chapter 2 of this code.

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_0, AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	
1.	Apartments (see residential)		—	—	
2.	Access floor systems	Office use	50	2,000	
		Computer use	100	2,000	
3.	Armories and drill rooms		150[b]	—	
4.	Assembly areas	Fixed seats (fastened to floor)	60[a]	—	
		Follow spot, projections and control rooms	50		
		Lobbies	100[a]		
		Movable seats	100[a]		
		Stage floors	150[b]		
		Platforms (assembly)	100[a]		
		Bleachers, folding and telescopic seating and grandstands	100[a] (See Section 1607.19)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60[a] (See Section 1607.19)		
		Other assembly areas	100[a]		
5.	Balconies and decks		1.5 times the live load for the area served, not required to exceed 100	—	
6.	Catwalks for maintenance and service access		40	300	
7.	Cornices		60	—	
8.	Corridors	First floor	100	—	
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants		100[a]	—	
10.	Dwellings (see residential)		—	—	

11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)		—	300
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)		—	200
13.	Fire escapes		100	—
		On single-family dwellings only	40	
14.	Fixed ladders		See Section 1607.17	
15.	Garages	Passenger vehicles only	40[c]	See Section 1607.7
		Trucks and buses	See Section 1607.8	
16.	Handrails, guards and grab bars		See Section 1607.9	
17.	Helipads		See Section 1607.6	
18.	Hospitals	Corridors above first floor	80	1,000
		Operating rooms, laboratories	60	1,000
		Patient rooms	40	1,000
19.	Hotels (see residential)		—	—
20.	Libraries	Corridors above first floor	80	1,000
		Reading rooms	60	1,000
		Stack rooms	150[b]	1,000
21.	Manufacturing	Heavy	250[b]	3,000
		Light	125[b]	2,000
22.	Marquees, except one- and two-family dwellings		75	—
23.	Office buildings	Corridors above first floor	80	2,000
		File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
		Lobbies and first-floor corridors	100	2,000
		Offices	50	2,000
24.	Penal institutions	Cell blocks	40	—
		Corridors	100	
25.	Recreational uses	Bowling alleys, poolrooms and similar uses	75[a]	—
		Dance halls and ballrooms	100[a]	

		Gymnasiums	100[a]	
		Ice skating rinks	250[b]	
		Roller skating rinks	100[a]	
26.	Residential	One- and two-family dwellings:		—
		Uninhabitable attics without storage	10	
		Uninhabitable attics with storage	20	
		Habitable attics and sleeping areas	30	
		Canopies, including marquees	20	
		All other areas	40	
		Hotels and multifamily dwellings:		
		Private rooms and corridors serving them	40	
		Public rooms[a] and corridors serving them	100	
27.	Roofs	Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	—
		Roof areas used for assembly purposes	100[a]	—
		Roof areas used for occupancies other than assembly	Same as occupancy served	—
		Vegetative and landscaped roofs:		—
		Roof areas not intended for occupancy	20	—
		Roof areas used for assembly purposes	100[a]	—
		Roof areas used for other occupancies	Same as occupancy served	—
		Awnings and canopies:		—
		Fabric construction supported by a skeleton structure	5[a]	—
		All other construction, except one- and two-family dwellings	20	—
		Primary roof members exposed to a work floor:		
		Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage	—	2,000

		warehouses, and repair garages		
		All other primary roof members	—	300
		All roof surfaces subject to maintenance workers	—	300
28.	Schools	Classrooms	40	1,000
		Corridors above first floor	80	1,000
		First-floor corridors	100	1,000
29.	Scuttles, skylight ribs and accessible ceilings		—	200
30.	Sidewalks, vehicular driveways and yards, subject to trucking		250[b]	8,000
31.	Stairs and exits	One- and two-family dwellings	40	300
		All other	100	300
32.	Storage areas above ceilings		20	—
33.	Storage warehouses (shall be designed for heavier loads if required for anticipated storage)	Heavy	250[b]	—
		Light	125[b]	
34.	Stores	Retail:		
		First floor	100	1,000
		Upper floors	75	1,000
		Wholesale, all floors	125[b]	1,000
35.	Vehicle barriers		See Section 1607.10	
36.	Walkways and elevated platforms (other than exitways)		60	—
37.	Yards and terraces, pedestrian		100[a]	—
38.	***[OSHPD 1R, 2 & 5]*** *Storage racks and wall-hung cabinets.*		*Total loads*[d]	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m^3.

a. Live load reduction is not permitted.

b. Live load reduction is only permitted in accordance with Section 1607.12.1.2 or Item 1 of Section 1607.12.2.

c. Live load reduction is only permitted in accordance with Section 1607.12.1.3 or Item 2 of Section 1607.12.2.

d. ***[OSHPD 1R, 2 & 5]*** *The minimum vertical design live load shall be as follows:*

Paper media:

12-inch-deep (305 mm) shelf 33 pounds per lineal foot (482 N/m)

15-inch-deep (381 mm) shelf 41 pounds per lineal foot (598 N/m), or

33 pounds per cubic foot (5183 N/m^3) per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep (457 mm) shelf 100 pounds per lineal foot (1459 N/m), or

50 pounds per cubic foot (7853 N/m^3) per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot (311 N/m^3) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

1607.2 Loads Not Specified

For occupancies or uses not designated in Section 1607, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform Live Loads

The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607.1.

1607.4 Concentrated Live Loads

Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated live loads, given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of $2^1/_2$ feet by $2^1/_2$ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition Loads

In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load is 80 psf (3.83 kN/m^2) or greater. The partition load shall be not less than a uniformly distributed live load of 15 psf (0.72 kN/m^2).

1607.6 Helipads

Helipads shall be designed for the following live loads:

1. A uniform live load, *L*, as specified in Items 1.1 and 1.2. This load shall not be reduced.

    1.1. 40 psf (1.92 kN/m^2) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.

    1.2. 60 psf (2.87 kN/m^2) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).

2. A single concentrated live load, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.

3. Two single concentrated live loads, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

1607.7 Passenger Vehicle Garages

Floors in garages or portions of a building used for the storage of motor vehicles shall be designed for the uniformly distributed live loads indicated in Table 1607.1 or the following concentrated load:

1. For garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds (13.35 kN) acting on an area of 4.5 inches by 4.5 inches (114 mm by 114 mm).

2. For mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds (10 kN) per wheel.

1607.8 Heavy Vehicle Loads

Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.8.1 through 1607.8.5.

1607.8.1 Loads

Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607.8.2 Fire Truck and Emergency Vehicles

Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official.

2. The live loading specified in Section 1607.8.1.

1607.8.3 Heavy Vehicle Garages

Garages designed to accommodate vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607.8.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided that such loads and placement are based on rational engineering principles and are approved by the building official, but shall be not less than 50 psf (2.9 kN/m^2). This live load shall not be reduced.

1607.8.4 Forklifts and Movable Equipment

Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted in accordance with Section 1607.8.5.

1607.8.4.1 Impact and Fatigue

Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

1607.8.5 Posting

The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in accordance with Section 106.1.

1607.9 Loads on Handrails, Guards, Grab Bars, Shower Seats, Dressing Room Bench and Seats

Handrails and guards shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.2.

1607.9.1 Handrails and Guards

Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1.1 of ASCE 7. Glass handrail assemblies and guards shall comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.9.1.1 shall be applied.

2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

1607.9.1.1 Concentrated Load

Handrails and guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

1607.9.1.2 Guard Component Loads

Balusters, panel fillers and guard infill components, including all rails except the handrail and the top rail, shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1.2 of ASCE 7.

1607.9.2 Grab Bars, Shower Seats and Accessible Benches

Grab bars, shower seats and accessible benches shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar, shower seat, or seat of the accessible bench so as to produce the maximum load effects. ***[DSA-AC & HCD 1-AC]*** *See Chapter 11A, Section 1127A.4 and Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.*

1607.10 Vehicle Barriers

Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

1607.11 Impact Loads

The live loads specified in Sections 1607.3 through 1607.10 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.11.1 Elevators

Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1/CSA B44.

1607.11.2 Machinery

For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact:

1. Light machinery, shaft- or motor-driven, 20 percent.

2. Reciprocating machinery or power-driven units, 50 percent.

Percentages shall be increased where specified by the manufacturer.

1607.11.3 Elements Supporting Hoists for Façade Access and Building Maintenance Equipment

In addition to any other applicable live loads, structural elements that support hoists for façade access and building maintenance equipment shall be designed for a live load of 2.5 times the rated load of the hoist or the stall load of the hoist, whichever is larger.

1607.11.4 Fall Arrest, Lifeline, and Rope Descent System Anchorages

In addition to any other applicable live loads, fall arrest, lifeline, and rope descent system anchorages and structural elements that support these anchorages shall be designed for a live load of not less than 3,100 pounds (13.8 kN) for each attached line, in any direction that the load can be applied.

Anchorages of horizontal lifelines and the structural elements that support these anchorages shall be designed for the maximum tension that develops in the horizontal lifeline from these live loads.

1607.12 Reduction in Uniform Live Loads

Except for uniform live loads at roofs, all other minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.12.1 or 1607.12.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607.14.2.

1607.12.1 Basic Uniform Live Load Reduction

Subject to the limitations of Sections 1607.12.1.1 through 1607.12.1.3 and Table 1607.1, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced uniformly distributed *live load*, *L*, in accordance with the following equation:

$$L = L_o\left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}}\right) \quad \textbf{(Equation 16-7)}$$

$$\text{For SI: } L = L_o\left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}}\right)$$

where:

L = Reduced design live load per square foot (m^2) of area supported by the member.

L_o = Unreduced design live load per square foot (m^2) of area supported by the member (see Table 1607.1).

K_{LL} = Live load element factor (see Table 1607.12.1).

A_T = Tributary area, in square feet (m^2).

L shall be not less than $0.50L_o$ for members supporting one floor and L shall be not less than $0.40L_o$ for members supporting two or more floors.

TABLE 1607.12.1
LIVE LOAD ELEMENT FACTOR, K_{LL}

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
Members not previously identified including:	1
Edge beams with cantilever slabs	
Cantilever beams	
One-way slabs	
Two-way slabs	
Members without provisions for continuous shear transfer normal to their span	

1607.12.1.1 One-Way Slabs

The tributary area, A_T, for use in Equation 16-7 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

1607.12.1.2 Heavy Live Loads

Live loads that exceed 100 psf (4.79 kN/m^2) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the live load shall be not less than L as calculated in Section 1607.12.1.

2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

1607.12.1.3 Passenger Vehicle Garages

The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the live load be shall be not less than *L* as calculated in Section 1607.12.1.

1607.12.2 Alternative Uniform Live Load Reduction

As an alternative to Section 1607.12.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m^2) except that the design live load for members supporting two or more floors is permitted to be reduced by not greater than 20 percent.

   Exception: For uses other than storage, where *approved*, additional *live load* reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent.

3. For live loads not exceeding 100 psf (4.79 kN/m^2), the design live load for any structural member supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with Equation 16-8

4. For one-way slabs, the area, *A*, for use in Equation 16-8 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

$$R = 0.08(A - 150) \quad \textbf{(Equation 16-8)}$$

For SI: $R = 0.861(A - 13.94)$

Such reduction shall not exceed the smallest of:

1. 40 percent for members supporting one floor.

2. 60 percent for members supporting two or more floors.

3. *R* as determined by the following equation:

$$R = 23.1(1 + D/L_o) \quad \textbf{(Equation 16-9)}$$

where:

A = Area of floor supported by the member, square feet (m^2).

D = Dead load per square foot (m^2) of area supported.

L_o = Unreduced live load per square foot (m^2) of area supported.

R = Reduction in percent.

1607.13 Distribution of Floor Loads

Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Floor live loads are permitted to be reduced in accordance with Section 1607.12 .

1607.14 Roof Loads

The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.14.1 Distribution of Roof Loads

Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m^2) in accordance with Section 1607.14.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect. See Section 1607.14.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

1607.14.2 Reduction in Uniform Roof Live Loads

The minimum uniformly distributed live loads of roofs and marquees, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.14.2.1.

1607.14.2.1 Ordinary Roofs, Awnings and Canopies

Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, L_r, as specified in the following equations or other controlling combinations of *loads* as specified in Section 1605, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof *l*oad than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m^2).

$$L_r = L_o R_1 R_2 \qquad \textbf{(Equation 16-10)}$$

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_o = Unreduced roof live load per square foot (m^2) of horizontal projection supported by the member (see Table 1607.1).

L_r = Reduced roof live load per square foot (m^2) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

$$R_1 = 1 \text{ for } A_t \le 200 \text{ square feet } (18.58 \text{ m}^2) \qquad \textbf{(Equation 16-11)}$$

$$R_1 = 1.2 - 0.001A_t \text{ for } 200 \text{ square feet} < A_t < 600 \text{ square feet} \qquad \textbf{(Equation 16-12)}$$

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t <$ 55.74 square meters

$R_1 = 0.6$ for
$A_t \geq 600$ square feet (55.74 m^2) **(Equation 16-13)**

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by the member, and

$R_2 = 1$ for $F \leq 4$ **(Equation 16-14)**

$R_2 = 1.2 - 0.05\,F$ for $4 < F < 12$ **(Equation 16-15)**

$R_2 = 0.6$ for $F \geq 12$ **(Equation 16-16)**

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.14.2.2 Occupiable Roofs

Areas of roofs that are occupiable, such as vegetative roofs, landscaped roofs or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.12.

1607.14.3 Awnings and Canopies

Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for snow loads and wind loads as specified in Sections 1608 and 1609.

1607.14.4 Photovoltaic Panel Systems

Roof structures that provide support for photovoltaic panel systems shall be designed in accordance with Sections 1607.14.4.1 through 1607.14.4.5, as applicable.

1607.14.4.1 Roof Live Load

Roof structures that support photovoltaic panel systems shall be designed to resist each of the following conditions:

1. Applicable uniform and concentrated roof loads with the photovoltaic panel system dead loads.

   Exception: Roof live loads need not be applied to the area covered by photovoltaic panels where the clear space between the panels and the roof surface is 24 inches (610 mm) or less.

2. Applicable uniform and concentrated roof loads without the photovoltaic panel system present.

1607.14.4.2 Photovoltaic Panels or Modules

The structure of a roof that supports solar photovoltaic panels or modules shall be designed to accommodate the full solar photovoltaic panels or modules and ballast dead load, including concentrated loads from support frames in combination with the loads from Section 1607.14.4.1 and other applicable loads. Where applicable, snow drift loads created by the photovoltaic

panels or modules shall be included.

1607.14.4.3 Photovoltaic Panels Installed on Open Grid Roof Structures

Structures with open grid framing and without a roof deck or sheathing supporting photovoltaic panel systems shall be designed to support the uniform and concentrated roof live loads specified in Section 1607.14.4.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m^2).

1607.14.4.4 Ground-Mounted Photovoltaic (PV) Panel Systems

Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic live load. Other loads and combinations in accordance with Section 1605 shall be accommodated.

1607.14.4.5 Ballasted Photovoltaic Panel Systems

Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604.4; checked in accordance with Section 1604.3.6 for deflections; and checked in accordance with Section 1611 for ponding.

1607.15 Crane Loads

The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607.15.1 Maximum Wheel Load

The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

1607.15.2 Vertical Impact Force

The maximum wheel loads of the crane shall be increased by the following percentages to account for the effects of vertical impact or vibration:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-geared bridge, trolley and hoist	0 percent

1607.15.3 Lateral Force

The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with due regard to the lateral stiffness of the runway beam and supporting structure.

1607.15.4 Longitudinal Force

The longitudinal force on crane runway beams, except for bridge cranes with hand-geared bridges, shall be calculated as 10

percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.16 Interior Walls and Partitions

Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m^2).

1607.16.1 Fabric Partitions

Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the following load conditions:

1. The horizontal distributed load need only be applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.

2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch-diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

1607.16.2 Fire Walls

In order to meet the structural stability requirements of Section 706.2 where the structure on either side of the wall has collapsed, fire walls and their supports shall be designed to withstand a minimum horizontal allowable stress load of 5 psf (0.240 kN/m^2).

1607.17 Fixed Ladders

Fixed ladders with rungs shall be designed to resist a single concentrated load of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated load of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7. Ship's ladders shall be designed to resist the stair loads given in Table 1607.1.

1607.18 Library Stack Rooms

The live loading indicated in Table 1607.1 for library stack rooms applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches (2290 mm).

2. The nominal shelf depth shall not exceed 12 inches (305 mm) for each face.

3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (914 mm) in width.

1607.19 Seating for Assembly Uses

Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300. Stadiums and arenas with

fixed seats shall be designed for the horizontal sway loads in Section 1607.19.1.

1607.19.1 Horizontal Sway Loads

The design of stadiums and arenas with fixed seats shall include horizontal swaying forces applied to each row of seats as follows:

1. 24 pounds per linear foot (0.35 kN/m) of seat applied in a direction parallel to each row of seats.
2. 10 pounds per linear foot (0.15 kN/m) of seat applied in a direction perpendicular to each row of seats.

The parallel and perpendicular horizontal swaying forces are not required to be applied simultaneously.

1607.20 Sidewalks, Vehicular Driveways, and Yards Subject to Trucking

The live loading indicated in Table 1607.1 for sidewalks, vehicular driveways, and yards subject to trucking shall comply with the requirements of this section.

1607.20.1 Uniform Loads

In addition to the loads indicated in Table 1607.1, other uniform loads in accordance with an approved method that contains provisions for truck loading shall be considered where appropriate.

1607.20.2 Concentrated Loads

The concentrated wheel load indicated in Table 1607.1 shall be applied on an area of $4^1/_2$ inches by $4^1/_2$ inches (114 mm by 114 mm).

1607.21 Stair Treads

The concentrated load indicated in Table 1607.1 for stair treads shall be applied on an area of 2 inches by 2 inches (51 mm by 51 mm). This load need not be assumed to act concurrently with the uniform load.

1607.22 Residential Attics

The live loads indicated in Table 1607.1 for attics in residential occupancies shall comply with the requirements of this section.

1607.22.1 Uninhabitable Attics Without Storage

In residential occupancies, uninhabitable attic areas without storage are those where the maximum clear height between the joists and rafters is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need not be assumed to act concurrently with any other live load requirement.

1607.22.2 Uninhabitable Attics With Storage

In residential occupancies, uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 inches (1067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches (508 mm) in width by 30 inches (762 mm) in length that is located where the clear height in the attic is not less than 30 inches (762 mm).

2. The slope of the joists or truss bottom chords is not greater than 2 units vertical in 12 units horizontal.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot (0.48 kN/m^2).

1607.22.3 Attics Served by Stairs

Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

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

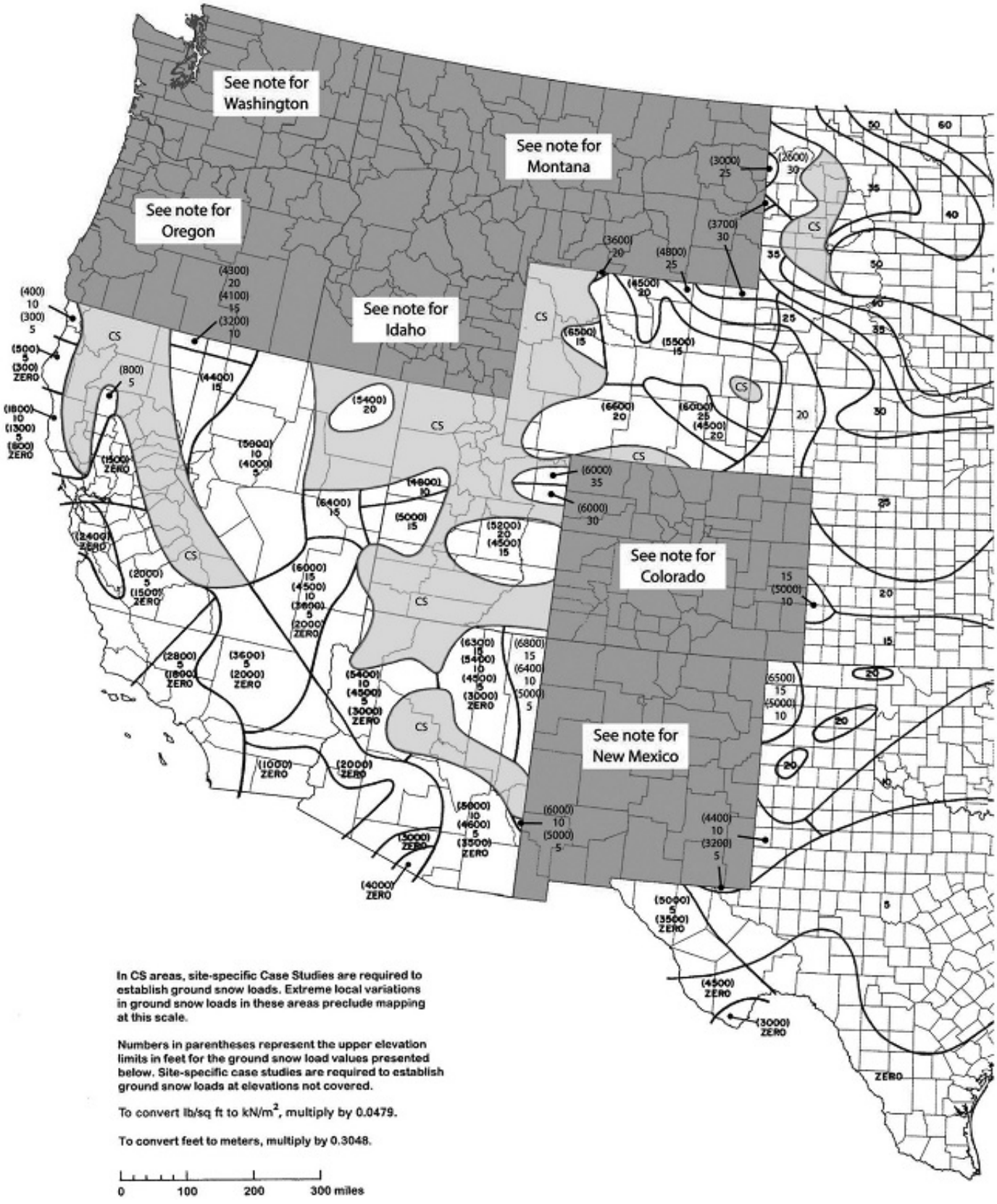
The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figures 1608.2(1) and 1608.2(2) for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be made in areas designated "CS" in Figures 1608.2(1) and 1608.2(2). Ground snow loads for sites at elevations above the limits indicated in Figures 1608.2(1) and 1608.2(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.

TABLE 1608.2
GROUND SNOW LOADS, p_g, FOR ALASKAN LOCATIONS

LOCATION	POUNDS PER SQUARE FOOT
Adak	30
Anchorage	50
Angoon	70
Barrow	25
Barter Island	35
Bethel	40
Big Delta	50
Cold Bay	25
Cordova	100
Fairbanks	60
Fort Yukon	60
Galena	60
Gulkana	70
Homer	40
Juneau	60
Kenai	70
Kodiak	30

Kotzebue	60
McGrath	70
Nenana	80
Nome	70
Palmer	50
Petersburg	150
St. Paul Islands	40
Seward	50
Shemya	25
Sitka	50
Talkeetna	120
Unalakleet	50
Valdez	160
Whittier	300
Wrangell	60
Yakutat	150

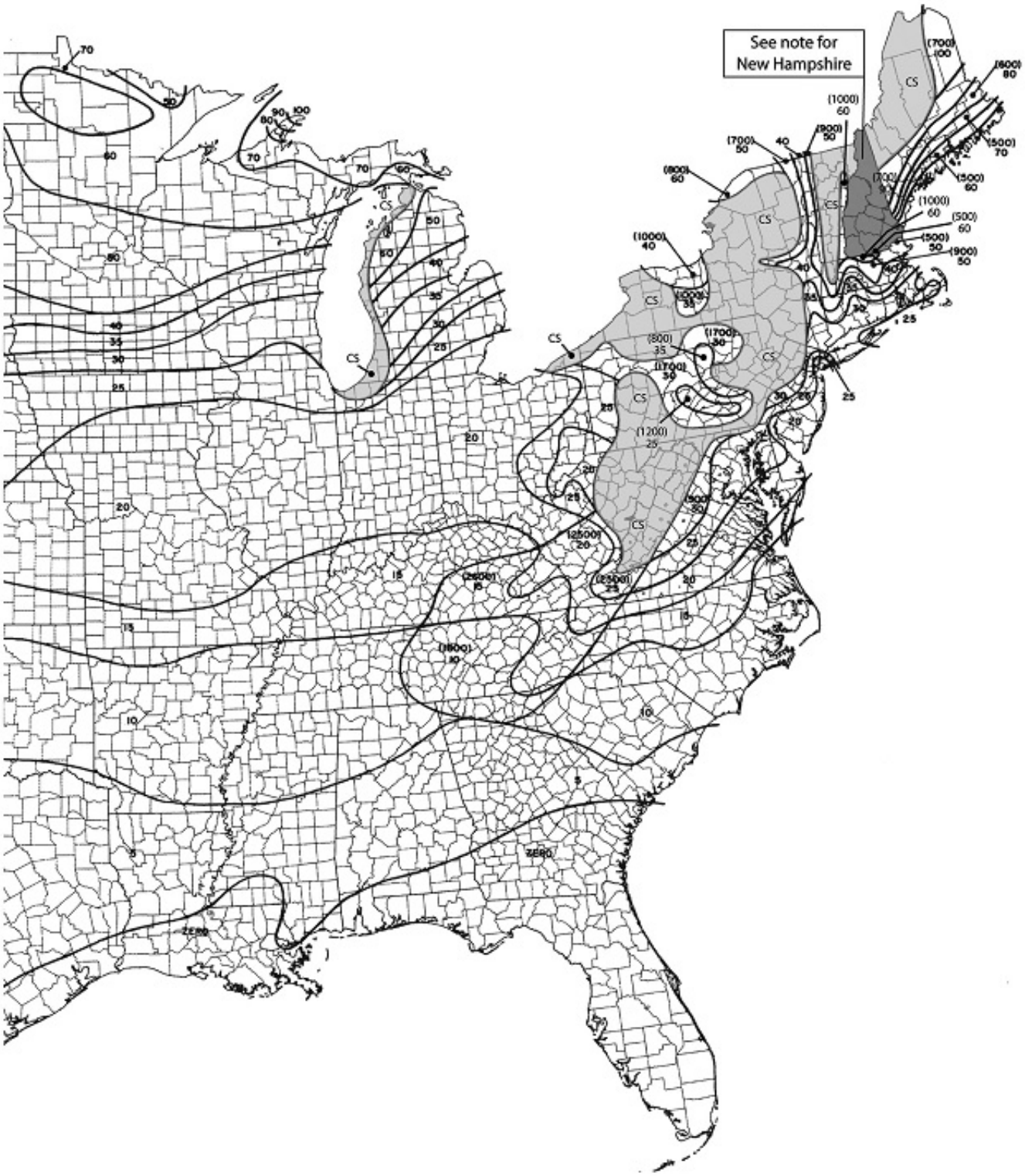
For SI: 1 pound per square foot = 0.0479 kN/m^2.



NOTE: See ASCE 7 Table 7.2-2 for Colorado, Table 7.2-3 for Idaho, Table 7.2-4 for Montana, Table 7.2-5 for Washington, Table 7.2-6 for New Mexico and Table 7.2-7 for Oregon.

FIGURE 1608.2(1)

GROUND SNOW LOADS, p_g, FOR THE UNITED STATES (psf)



NOTE: See ASCE 7 Table 7.2-8 for New Hampshire.

FIGURE 1608.2(2)
GROUND SNOW LOADS, p_g, FOR THE UNITED STATES (psf)

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 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. 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(12) 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 Protection of Openings

In windborne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E1996 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E1996.

2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E1996.

Exceptions:

1. Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in buildings with a mean roof height of 33 feet (10 058 mm) or less that are classified as a Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where V_{asd} determined in accordance with Section 1609.3.1 does not exceed 140 mph (63 m/s).

2. Glazing in *Risk Category* I buildings, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.

3. Glazing in *Risk Category* II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

TABLE 1609.2

WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c, d]

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
$^1/_4$-inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

a. This table is based on 140 mph wind speeds and a 45-foot mean roof height.

b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.

c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located not less than $2^1/_2$ inches from the edge of concrete block or concrete.

d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

1609.2.1 Louvers

Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 540.

1609.2.2 Application of ASTM E1996

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

6.2.2 Unless otherwise specified, select the wind zone based on the basic design wind speed, *V*, as follows:

6.2.2.1 *Wind Zone 1*—130 mph ≤ basic design *wind speed*, *V* < 140 mph.

6.2.2.2 *Wind Zone 2*—140 mph ≤ basic design *wind speed*, *V* < 150 mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 *Wind Zone 3*—150 mph (67 m/s) ≤ basic design *wind speed*, *V* ≤ 160 mph (72 m/s), or 140 mph (63 m/s) ≤ basic design *wind speed*, *V* ≤ 160 mph (72 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 *Wind Zone 4*— basic design *wind speed*, *V* > 160 mph (72 m/s).

1609.2.3 Garage Doors

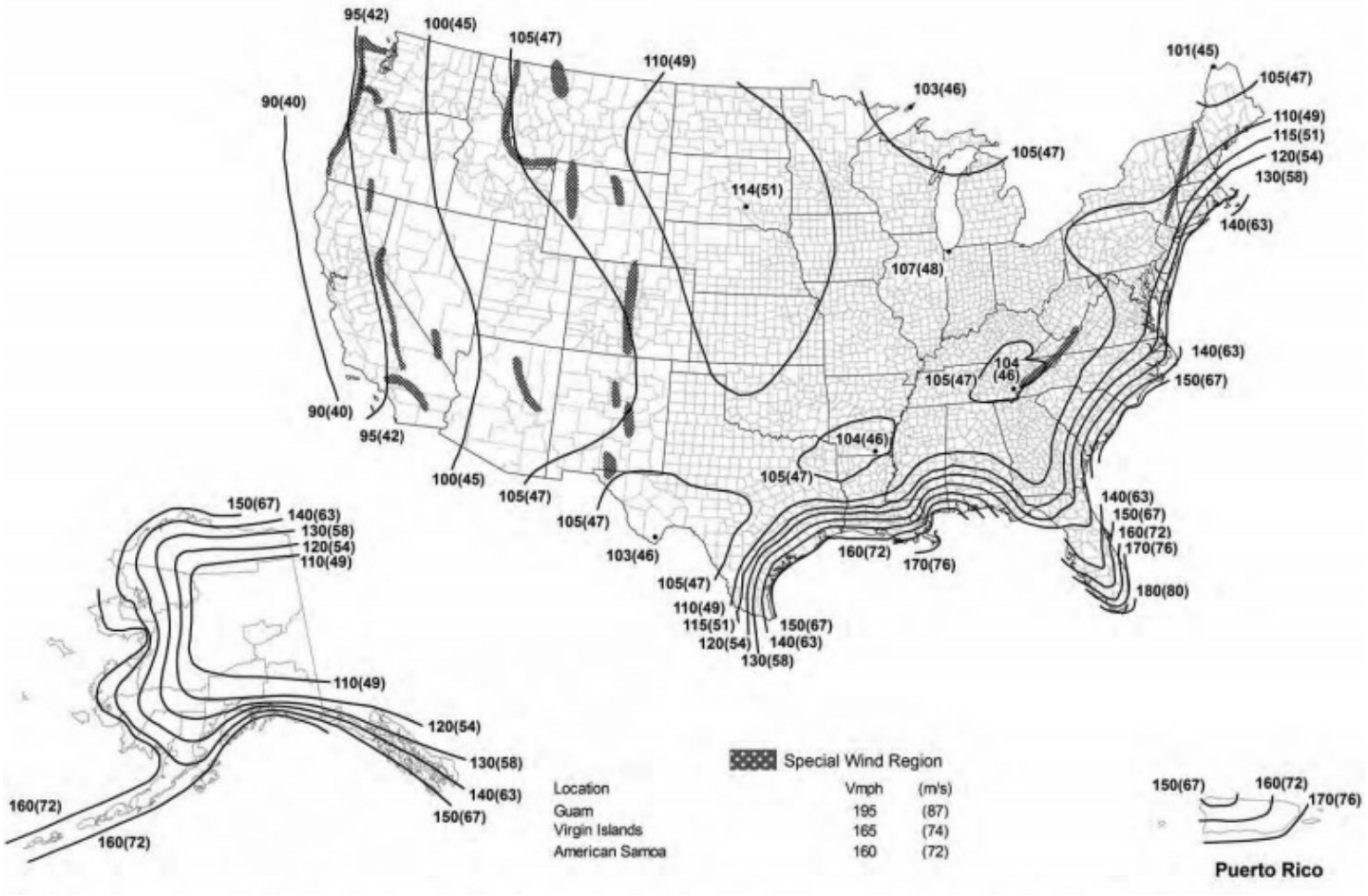
Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard

or ANSI/DASMA 115.

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 Figures 1609.3(1) through 1609.3(12). The basic design wind speed, *V*, for use in the design of *Risk Category* II buildings and structures shall be obtained from Figures 1609.3(1), 1609.3(5) and 1609.3(6). The basic design wind speed, *V*, for use in the design of *Risk Category* III buildings and structures shall be obtained from Figures 1609.3(2), 1609.3(7) and 1609.3(8). The basic design wind speed, *V*, for use in the design of *Risk Category* IV buildings and structures shall be obtained from Figures 1609.3(3), 1609.3(9) and 1609.3(10). The basic design wind speed, *V*, for use in the design of *Risk Category* I buildings and structures shall be obtained from Figures 1609.3(4), 1609.3(11) and 1609.3(12). The basic design wind speed, *V*, for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The basic design wind speeds, *V*, determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7.

In nonhurricane-prone regions, when the basic design wind speed, *V*, is estimated from regional climatic data, the basic design wind speed, *V*, shall be determined in accordance with Chapter 26 of ASCE 7.



Notes:

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

2. Linear interpolation between contours. Point values are provided to aid with interpolation.

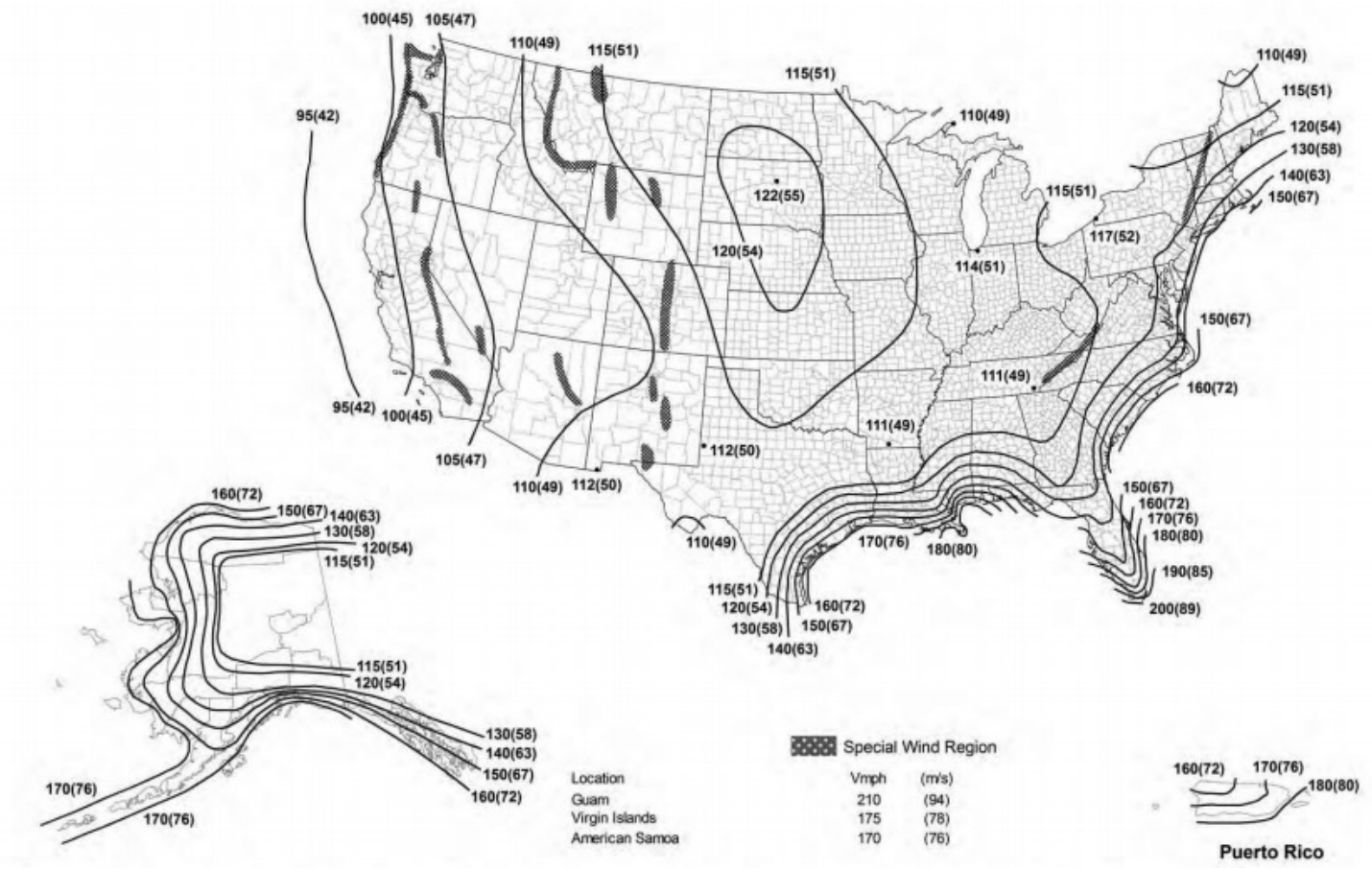
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.

4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

FIGURE 1609.3(1)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES



Notes:

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

2. Linear interpolation between contours. Point values are provided to aid with interpolation.

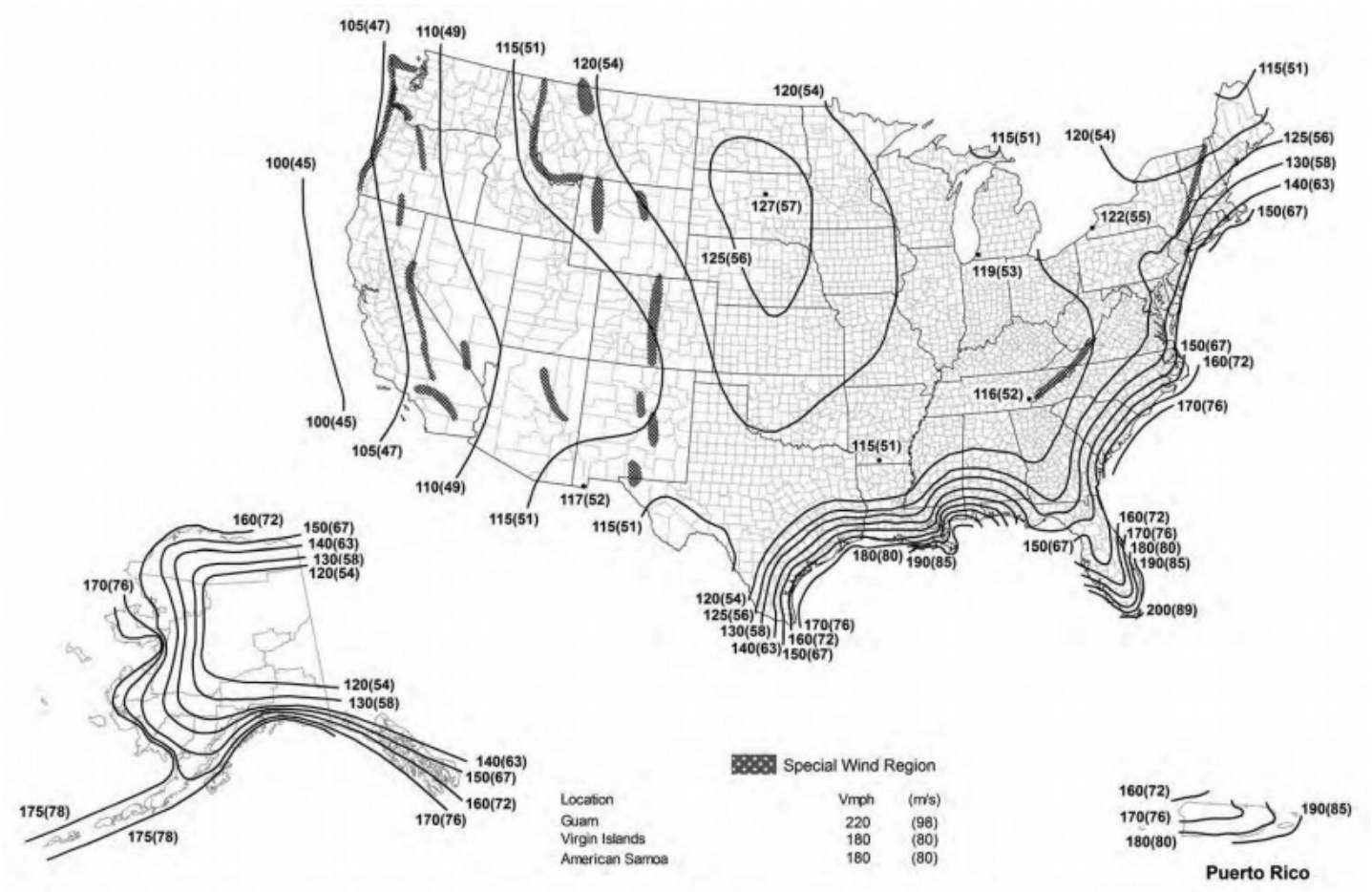
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.

4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

5. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

FIGURE 1609.3(2)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES



Notes:

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

2. Linear interpolation between contours. Point values are provided to aid with interpolation.

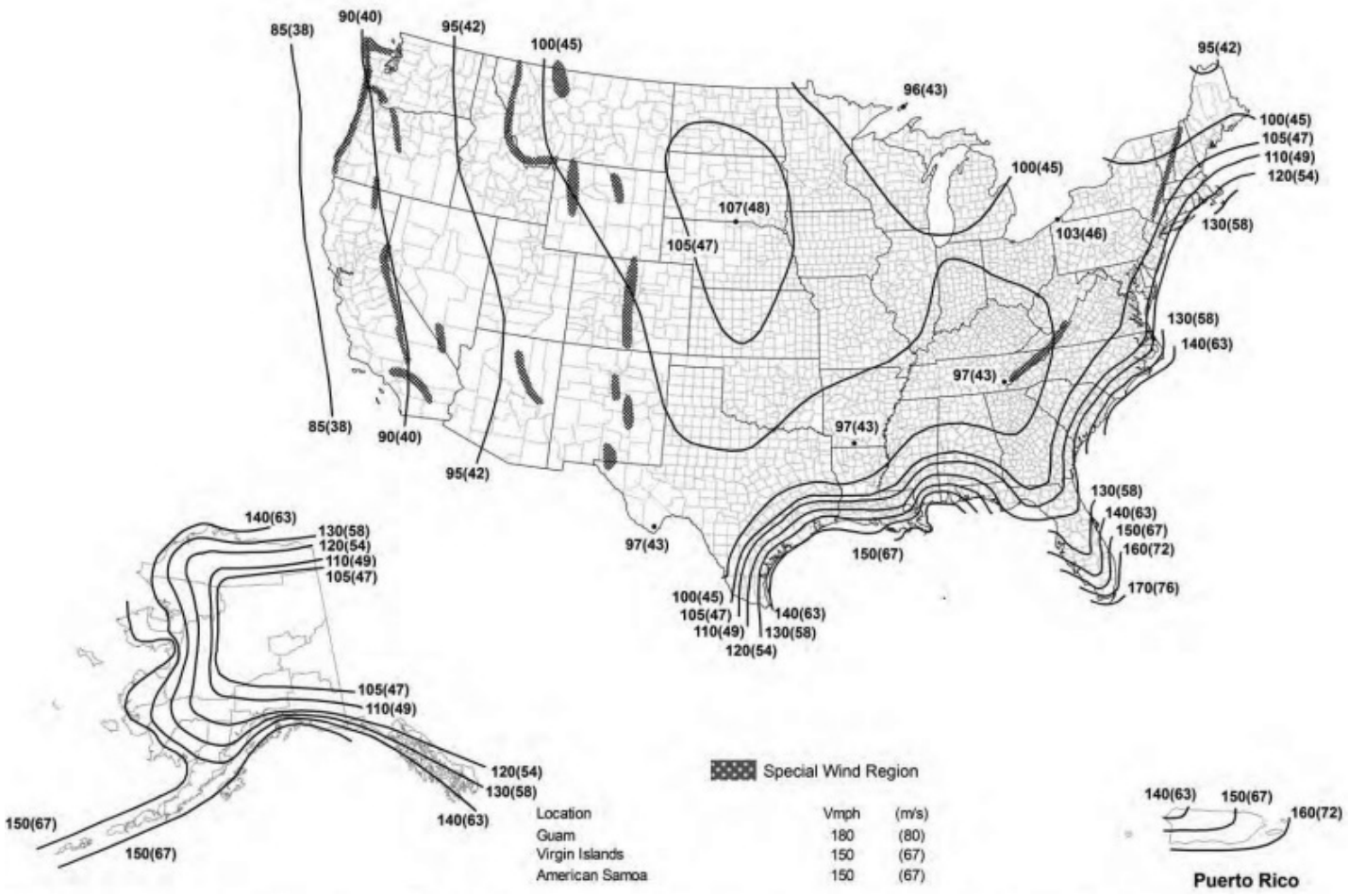
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.

4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

5. Wind speeds correspond to approximately a 1.6% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00033, MRI = 3000 Years).

6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

FIGURE 1609.3(3)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES



Notes:

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

2. Linear interpolation between contours. Point values are provided to aid with interpolation.

3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.

4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

5. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00333, MRI = 300 Years).

6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed.

FIGURE 1609.3(4)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES

1609.3.1 Wind Speed Conversion

Where required, the basic design wind speeds of Figures 1609.3(1) through 1609.3(12) shall be converted to allowable stress design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-17.

$$V_{asd} = V\sqrt{0.6} \qquad \textbf{(Equation 16-17)}$$

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(12).

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(12).

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.

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 1504.2.

1609.5.3 Rigid Tile

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

$$M_a = q_h C_L b L L_a [1.0 - G C_p] \quad \textbf{(Equation 16-18)}$$

For SI:

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

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 1504.3.1.

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.
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.