REVISION RECORD
FOR THE STATE OF CALIFORNIA

ERRATA

January 1, 2020

2019 Title 24, Part 2, Vol. 2, California Building Code

General Information:

1. The date of this erratum is for identification purposes only. See the History Note Appendix on the back side or accompanying page.
2. This erratum is issued by the California Building Standards Commission in order to correct nonsubstantive printing errors or omissions in California Code of Regulations, Title 24, Part 2, of the 2019 *California Building Code*. Instructions are provided below.
3. Health and Safety Code Section 18938.5 establishes that only building standards in effect at the time of the application for a building permit may be applied to the project plans and construction. This rule applies to both adoptions of building standards for Title 24 by the California Building Standards Commission, and local adoptions and ordinances imposing building standards. An erratum to Title 24 is a nonregulatory correction because of a printing error or omission that does not differ substantively from the official adoption by the California Building Standards Commission. Accordingly, the corrected code text provided by this erratum may be applied on and after the stated effective date.
4. You may wish to retain the superseded material with this revision record so that the prior wording of any section can be easily ascertained.

Title 24, Part 2, Vol. 2

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735 and 736

4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof, including but not limited to the loads of machinery or equipment, and that are greater than specified floor and roof loads shall be specified by their descriptions and locations.

1603.1.8.1 Photovoltaic panel systems. The dead load of rooftop-mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1603.1.9 Roof rain load data. Rain intensity, *i* (in/hr) (cm/hr), shall be shown regardless of whether rain loads govern the design.

SECTION 1604
GENERAL DESIGN REQUIREMENTS

1604.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3. Drift limits applicable to earthquake loading shall be in accordance with ASCE 7 Chapter 12, 13, 15 or 16, as applicable.

1604.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

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

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI 100 or SJI 200, as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM. <

1604.3.6 Limits. The deflection limits of Section 1604.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

1604.3.7 Framing supporting glass. The deflection of framing members supporting glass subjected to 0.6 times the "component and cladding" wind loads shall not exceed either of the following:

1. $^{1}/_{175}$ of the length of span of the framing member, for framing members having a length not more than 13 feet 6 inches (4115 mm).
2. $^{1}/_{240}$ of the length of span of the framing member + $^{1}/_{4}$ inch (6.4 mm), for framing members having a length greater than 13 feet 6 inches (4115 mm).

1604.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the effects of added deformations expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design. A diaphragm is rigid for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is less than or equal to two times the average story drift. Where required by ASCE 7, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the effects caused by the forces specified in this chapter, including overturning, uplift and sliding. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

TABLE 1604.3
DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	L or L_r	S or W[f]	$D + L$[d, g]
Roof members:[e]			
Supporting plaster or stucco ceiling	*l*/360	*l*/360	*l*/240
Supporting nonplaster ceiling	*l*/240	*l*/240	*l*/180
Not supporting ceiling	*l*/180	*l*/180	*l*/120
Floor members	*l*/360	—	*l*/240
Exterior walls:			
With plaster or stucco finishes	—	*l*/360	—
With other brittle finishes	—	*l*/240	—
With flexible finishes	—	*l*/120	—
Interior partitions:[b]			
With plaster or stucco finishes	*l*/360	—	—
With other brittle finishes	*l*/240	—	—
With flexible finishes	*l*/120	—	—
Farm buildings	—	—	*l*/180
Greenhouses	—	—	*l*/120

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed *l*/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed *l*/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed *l*/90. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.15.

c. See Section 2403 for glass supports.

d. The deflection limit for the $D+(L+L_r)$ load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from $0.5D$. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from D. The value of $0.5D$ shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.

e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.

f. The wind load shall be permitted to be taken as 0.42 times the "component and cladding" loads or directly calculated using the 10-year mean return interval wind speed for the purpose of determining deflection limits in Table 1604.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604.3.7

g. For steel structural members, the detection due to creep component of long-term dead load shall be permitted to be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed *l*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *l*/175 for each glass lite or *l*/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *l*/120.

i. l = Length of the member between supports. For cantilever members, l shall be taken as twice the length of the cantilever.

1604.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604.5 shall be used in lieu of ASCE 7, Table 1.5-1.

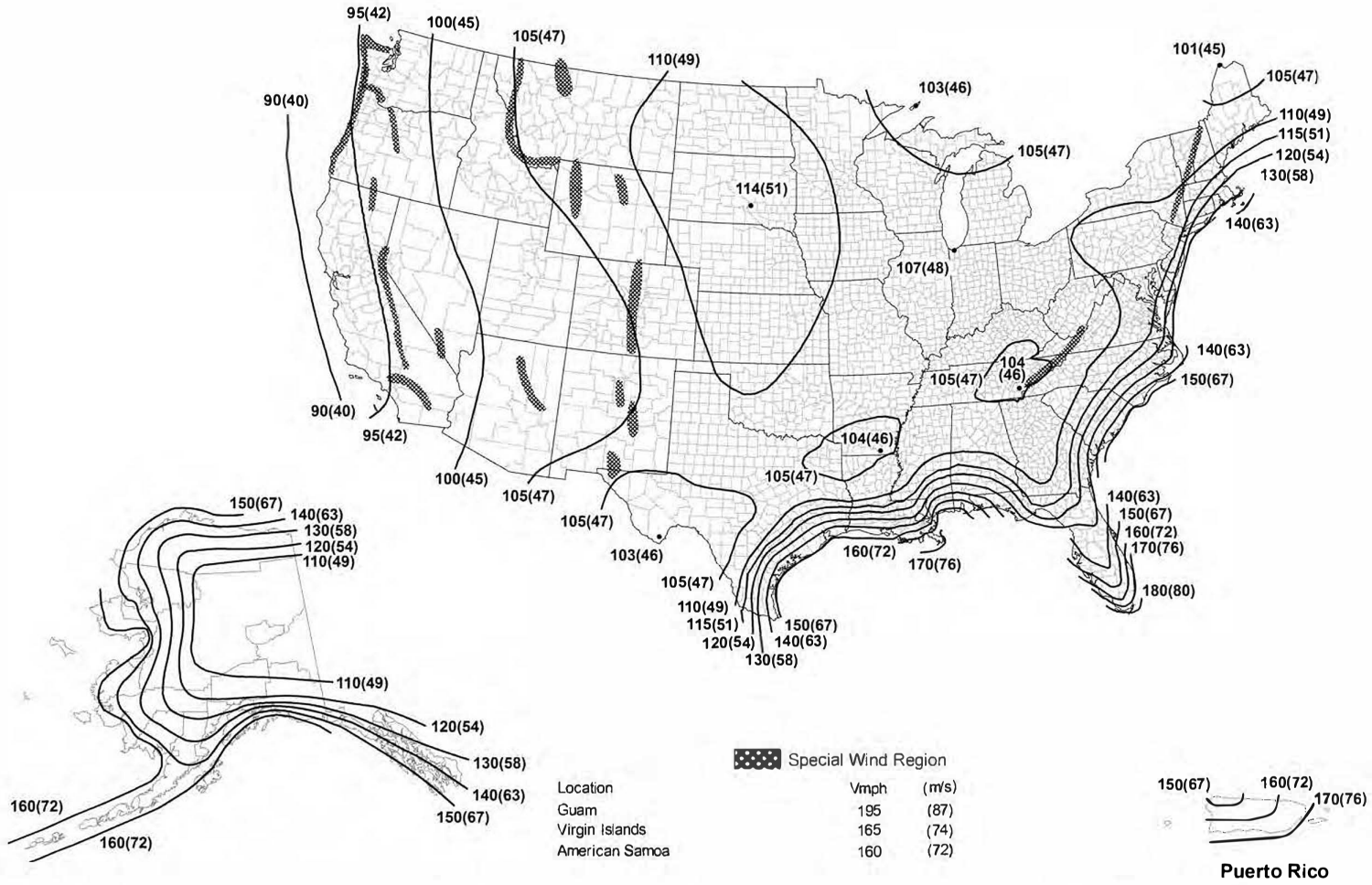
Exception: The assignment of buildings and structures to Tsunami Risk Categories III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher risk category, both portions shall be assigned to the higher risk category.

Exception: Where a storm shelter designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the risk category for the normal occupancy of the building shall apply unless the storm shelter is a designated emergency shelter in accordance with Table 1604.5.

1604.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1708.

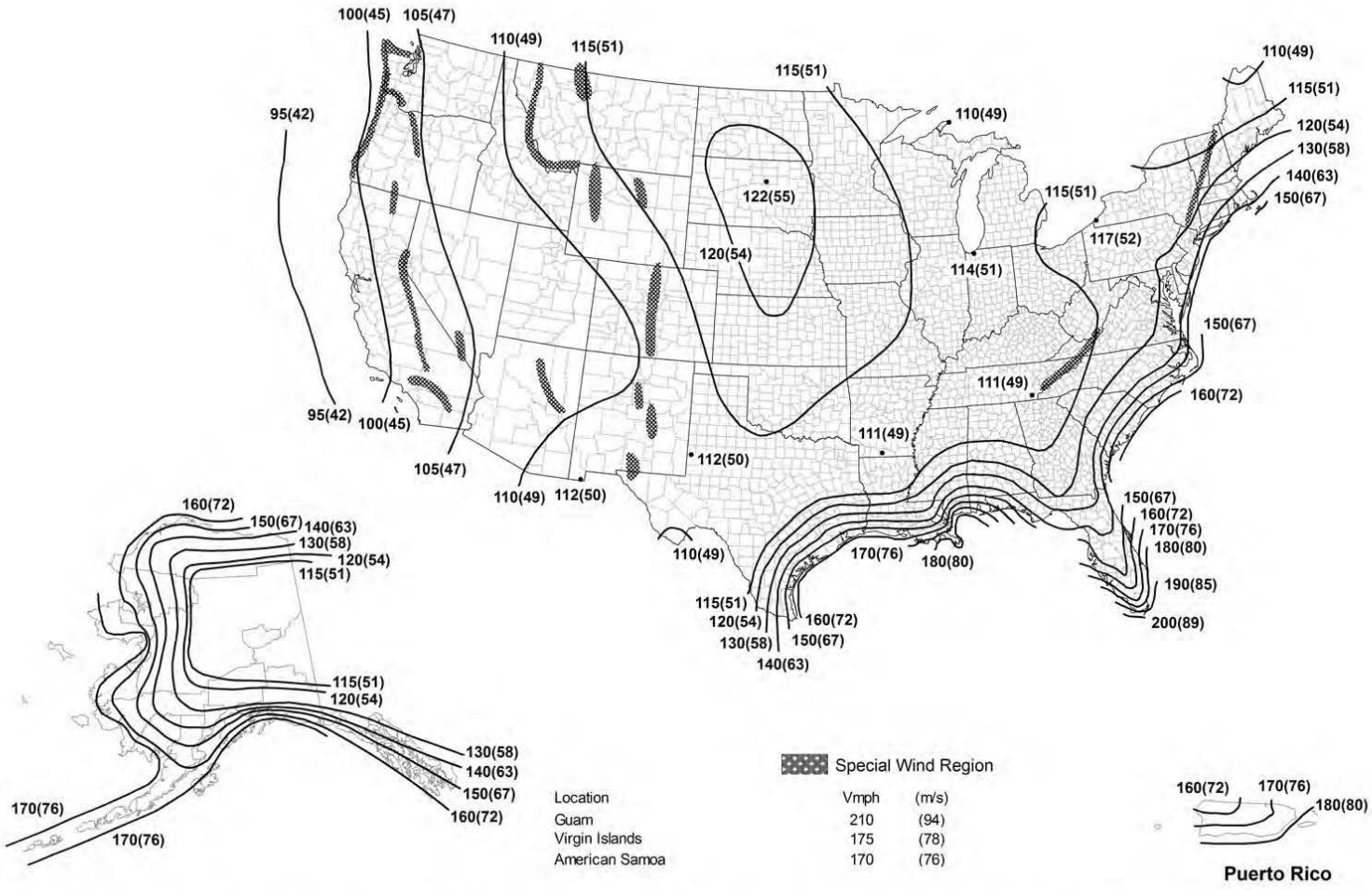
FIGURE 1608.2—continued
GROUND SNOW LOADS, p_g, FOR THE UNITED STATES (psf)



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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.hazards.atcouncil.org.

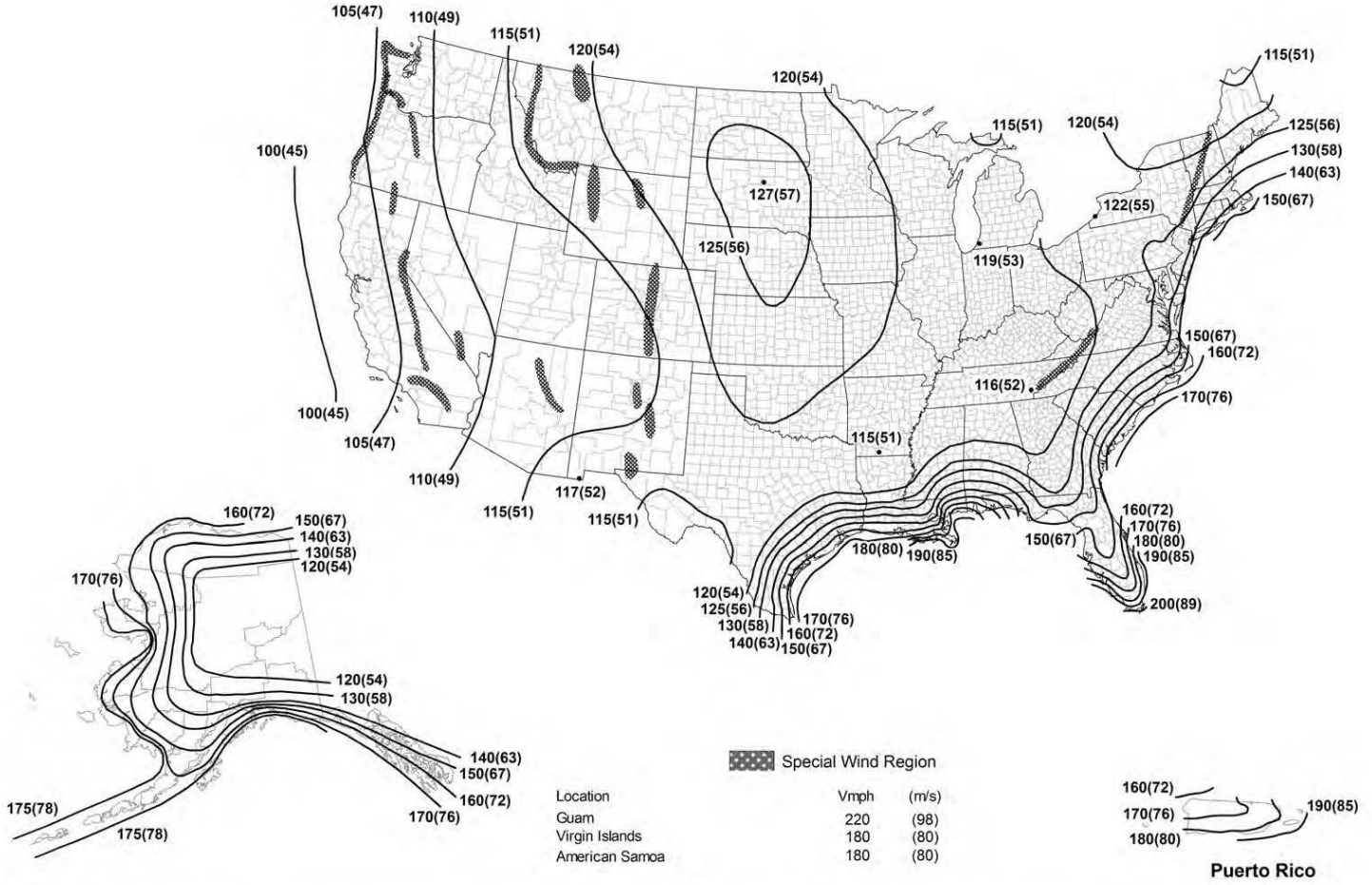
FIGURE 1609.3(1)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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 = 0.000588, MRI = 1700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.hazards.atcouncil.org.

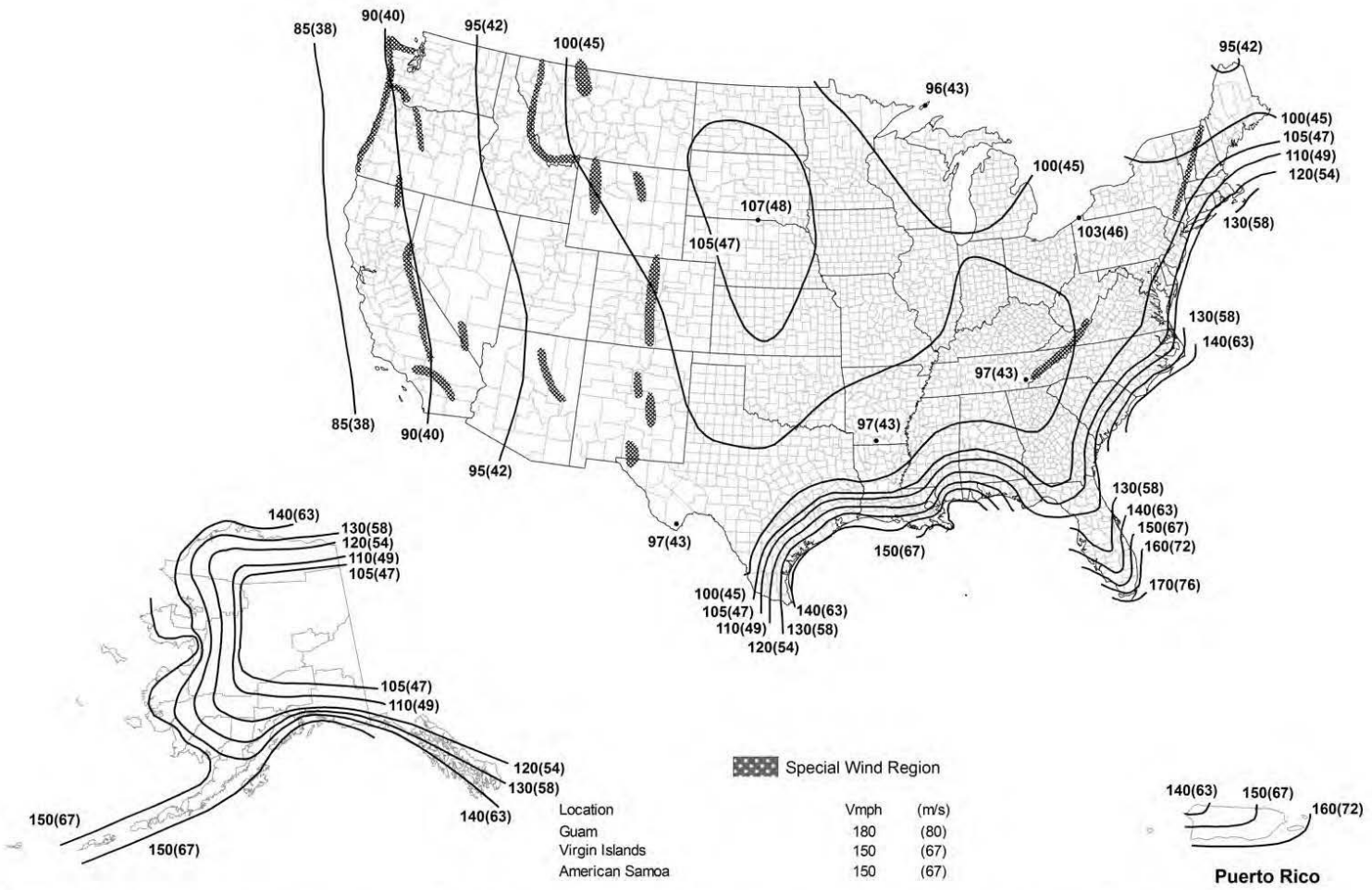
FIGURE 1609.3(2)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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.hazards.atcouncil.org.

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 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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.hazards.atcouncil.org.

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

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 and ASTM E1886 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.

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 (58 m/s) ≤ basic design wind speed, *V* ≤ 160 mph (63 m/s), or 140 mph (54 m/s) ≤ basic design wind speed, *V* ≤ 160 mph (63 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 Wind Zone 4— basic design wind speed, *V* > 160 mph (63 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 (8). 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) and 1609.3(5). 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) and 1609.3(6). 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) and 1609.3(7). The basic design wind speed, *V*, for use in the design of Risk Category I buildings and structures shall be obtained from Figures

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.

1603*A*.1.9 Roof rain load data. Rain intensity, *i* (in/hr) (cm/hr), shall be shown regardless of whether rain loads govern the design.

1603A.1.10 Construction procedures. *Where unusual erection or construction procedures are considered essential by the Registered Design Professional (RDP) in order to accomplish the intent of the design or influence the construction, such procedure shall be indicated on the construction documents.*

1603A.2 Site data reports. *Geotechnical and geohazard reports for review by the enforcement agency shall be accompanied by a description of the project prepared by the registered design professional (RDP) in responsible charge, which shall include the following:*

1. *Type of service such as general acute care facility, central utility plants, K-12 school, community college, essential services, etc.*
2. *Construction materials used for the project such as steel, concrete. masonry, wood, etc.*
3. *Type of construction project such as new, addition, alteration, repair, etc.*
4. *For existing buildings, extent of construction such as incidental, minor, major, and/or voluntary seismic improvements as defined in Section 318, Part 10, Title 24, C.C.R.* ***[DSA-SS]*** *Section 202 and California Existing Building Code Section 202A* ***[OSHPD 1]****.*
5. *Seismic force resisting system used for each structure in the project.*
6. *Foundation system that will be used for each structure in the project such as spread footing, drilled piers, etc.*
7. *Analysis procedure used and basis of design such as ASCE 7 Equivalent Lateral Force Procedure, ASCE 41 Nonlinear Dynamic Procedure, etc.*
8. *Building characteristics such as number of stories above and below grade, foot print area at grade, grade slope on site, etc.*
9. *Special features such as requirement for shoring, underpinning, retaining walls, etc.*

1603A.3 Structural design basis and calculations. *The application for the approval of construction documents that involves structural elements or components shall be accompanied by complete and accurate structural design computations, which shall comply with requirements prescribed by the enforcement agency:*

1. *The computations shall be preceded by a detailed index.*
2. *The computations including each major subsection shall be prefaced by a statement clearly and concisely outlining the basis for the structural design and indicating the manner in which the structure will resist the vertical loads and lateral forces.*
3. *The computations shall be sufficiently complete to the extent that calculations for the individual structural members and connections can be readily interpreted.*

SECTION 1604*A*
GENERAL DESIGN REQUIREMENTS

1604*A*.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604*A*.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604*A*.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604*A*.3. Drift limits applicable to earthquake loading shall be in accordance with ASCE 7 Chapter 12, 13, 15 or 16, as applicable.

1604*A*.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604*A*.3.2 through 1604*A*.3.9 or that permitted by Table 1604*A*.3.

1604*A*.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604*A*.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI 100 or SJI 200, as applicable.

1604*A*.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402.

1604*A*.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM.

1604*A*.3.6 Limits. The deflection limits of Section 1604*A*.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

TABLE 1604*A*.3
DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	*L* or L_r	*E*, *S* or *W*[f]	*D* + (*L* or L_r)[d, g]
Roof members:[e]			
Supporting plaster or stucco ceiling	*l*/360	*l*/360	*l*/240
Supporting nonplaster ceiling	*l*/240	*l*/240	*l*/180
Not supporting ceiling	*l*/180	*l*/180	*l*/120
Floor members	*l*/360	—	*l*/240
Exterior walls:			
With plaster or stucco finishes	—	*l*/360	—
With other brittle finishes	—	*l*/240	—
With flexible finishes	—	*l*/120	—
Veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing	—	*l*/600	—
Interior partitions:[b]			
With plaster or stucco finishes	*l*/360	—	—
With other brittle finishes	*l*/240	—	—
With flexible finishes	*l*/120	—	—
Farm buildings	—	—	*l*/180
Greenhouses	—	—	*l*/120

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed *l*/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed *l*/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed *l*/90. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607*A*.15.

c. See Section 2403 for glass supports.

d. The deflection limit for the $D+(L+L_r)$ load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from 0.5D. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from D. The value of 0.5D shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.

e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.

f. The wind load shall be permitted to be taken as 0.42 times the "component and cladding" loads or directly calculated using the 10-year mean return interval wind speed for the purpose of determining deflection limits in Table 160*A*4.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604*A*.3.7

g. For steel structural members, the *deflection* due to creep component of long-term dead load shall be permitted to be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed *l*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *l*/175 for each glass lite or *l*/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *l*/120.

i. *l* = Length of the member between supports. For cantilever members, *l* shall be taken as twice the length of the cantilever.

1604*A*.3.7 Framing supporting glass. The deflection of framing members supporting glass subjected to 0.6 times the "component and cladding" wind loads shall not exceed either of the following:

1. $^1/_{175}$ of the length of span of the framing member, for framing members having a length not more than 13 feet 6 inches (4115 mm).
2. $^1/_{240}$ of the length of span of the framing member + $^1/_4$ inch (6.4 mm), for framing members having a length greater than 13 feet 6 inches (4115 mm).

1604A.3.8 Horizontal diaphragms. *The maximum span-depth ratio for any roof or floor diaphragm consisting of steel and composite steel slab decking shall not exceed those given in Table 1604A.4, unless test data and design calculations acceptable to the enforcement agency are submitted and approved for the use of other span-depth ratios. Concrete diaphragms shall not exceed the span depth ratios for the equivalent composite steel-slab diaphragm in Table 1604A.4.*

1604A.3.9 Deflections. *Deflection criteria for materials not specified shall be developed by the project architect or structural engineer in a manner consistent with the provisions of this section and approved by the enforcement agency.*

1604*A*.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the effects of added deformations expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design. *Structural analysis shall explicitly include consideration of stiffness of diaphragms in accordance with ASCE 7 Section 12.3.1.* A diaphragm is rigid for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is less than or equal to two times the average story drift. Where required by ASCE 7, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the effects caused by the forces specified in this chapter, including overturning, uplift and sliding. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604*A*.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604*A*.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604*A*.5 shall be used in lieu of ASCE 7, Table 1.5-1.

Exception: The assignment of buildings and structures to Tsunami Risk Categories III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.

1604*A*.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher risk category, both portions shall be assigned to the higher risk category.

Exception: Where a storm shelter designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the risk category for the normal occupancy of the building shall apply unless the storm shelter is a designated emergency shelter in accordance with Table 1604*A*.5.

TABLE 1604A.4
MAXIMUM HORIZONTAL DIAPHRAGM SPAN AND SPAN-DEPTH RATIOS[1, 3, 4]

FLEXIBILITY FACTOR(F)[2]	MAXIMUM DIAPHRAGM SPAN FOR MASONRY OR CONCRETE WALLS (feet)	DIAPHRAGM SPAN-DEPTH LIMITATION			
		Rotation (torsion) Not Considered in Diaphragm		Rotation (torsion) Considered in Diaphragm	
		Masonry or Concrete Walls	Flexible Walls	Masonry or Concrete Walls	Flexible Walls
More than 150	Not to be used	Not to be used	2:1	Not to be used	$1^1/_2$:1
70–150	200	2:1 or as required for deflection	3:1	Not to be used	2:1
10–70	400	$2^1/_2$:1 or as required for deflection	4:1	As required for deflection	$2^1/_2$:1
1–10	No limitation	3:1 or as required for deflection	5:1	As required for deflection	3:1
Less than 1	No limitation	As required for deflection	No limitation	As required for deflection	$3^1/_2$:1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.594 N/m, 1 psi = 6894 Pa

1. *Diaphragms shall satisfy span-depth limitations based on flexibility.*
2. *Flexibility factor (F) is the average deflection in micro inches (10^{-6}) or μm of the diaphragm web per foot (m) of span stressed with a shear of 1 pound per foot (N/m).*
3. *The total deflection Δ of the diaphragm may be computed from the equation: $\Delta = \Delta_f + \Delta_w$.*

   Where:

   Δ_f = Flexural deflection of the diaphragm determined in the same manner as the deflection of beams. The flexural stiffness of the web of diaphragms consisting of bare steel decking shall be neglected.

   Δ_w = Web deflection of the diaphragm may be determined solving the following equation:

$$F = \frac{\Delta_w x 10^6}{q_{ave} L}$$

   Where:

   L = Distance in feet (m) between the vertical resisting element (such as a shear wall) and the point to which the deflection is to be determined.

   q_{ave} = Average shear in the diaphragm in pounds per foot (N/m) over length L.
4. *When applying these limitations to cantilevered diaphragms, the allowable span-depth ratio will be half of that shown.*

1604*A*.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1708*A*.

1604*A*.7 Preconstruction load tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707*A*, shall be load tested in accordance with Section 1709*A*.

1604*A*.8 Anchorage. Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604*A*.8.1 through 1604*A*.8.3, as applicable.

1604*A*.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

TABLE 1604*A*.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing Group E occupancies with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2, Condition 1 occupancies with 50 or more care recipients. • Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *California Fire Code*; and Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities, including but not limited to: • ***[OSHPD 1 & 4]*** *General Acute-care Hospital Buildings, General Acute-care Hospital Buildings providing only acute medical rehabilitation center services, and Correctional Treatment Center Buildings and all structures required for their continuous operation or access/egress.* • Ambulatory care facilities having emergency surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. ***[DSA-SS]*** *as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.* • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *California Fire Code*; and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004*A*.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

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*A*-29)**

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*A*-30)**

$R_2 = 1.2 - 0.05\ F$ for $4 < F < 12$ **(Equation 16*A*-31)**

$R_2 = 0.6$ for $F \geq 12$ **(Equation 16*A*-32)**

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*A*.13.3 Occupiable roofs. Areas of roofs that are occupiable, such as vegetative roofs, roof gardens or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607*A*.11.

1607*A*.13.3.1 Vegetative and landscaped roofs. The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil as determined in accordance with Section 3.1.4 of ASCE 7. The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf (0.958 kN/m^2). The uniform design live load for occupied landscaped areas on roofs shall be determined in accordance with Table 1607*A*.1.

1607*A*.13.4 Awnings and canopies. Awnings and canopies shall be designed for uniform live loads as required in Table 1607*A*.1 as well as for snow loads and wind loads as specified in Sections 1608*A* and 1609*A*.

1607*A*.13.5 Photovoltaic panel systems. Roof structures that provide support for photovoltaic panel systems shall be designed in accordance with Sections 1607*A*.13.5.1 through 1607*A*.13.5.4, as applicable.

1607*A*.13.5.1 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*A*.13.5.2 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*A*.13.5.1 and other applicable loads. Where applicable, snow drift loads created by the photovoltaic panels or modules shall be included.

1607A.13.5.2.1 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*A*.13.5.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m^2).

1607*A*.13.5.3 Photovoltaic panels or modules installed as an independent structure. Solar photovoltaic panels or modules that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic live load, provided that the area under the structure is restricted to keep the public away. Other loads and combinations in accordance with Section 1605*A* shall be accommodated.

Solar photovoltaic panels or modules that are designed to be the roof, span to structural supports and have accessible/occupied space underneath shall have the panels or modules and all supporting structures designed to support a roof photovoltaic live load, as defined in Section 1607*A*.13.5.1 in combination with other applicable loads. Solar photovoltaic panels or modules in this application are not permitted to be classified as "not accessible" in accordance with Section 1607*A*.13.5.1.

1607*A*.13.5.4 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604*A*.4; checked in accordance with Section 1604*A*.3.6 for deflections; and checked in accordance with Section 1611*A* for ponding.

1607A.13.6 Uncovered open-frame roof structures. *Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m^2) of the total area encompassed by the framework.*

1607*A*.14 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*A*.14.1 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*A*.14.2 Vertical impact force. The maximum wheel loads of the crane shall be increased by the following percentages to determine the induced vertical impact or vibration force:

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*A*.14.3 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*A*.14.4 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*A*.15 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). *The 5 psf (0.24 kN/m^2) service load need not be applied simultaneously with wind or seismic loads. The deflection of such walls under a load of 5 psf (0.24 kN/m^2) shall not exceed the limits in Table 1604A.3.*

1607*A*.15.1 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*A*.15.2 Fire walls. In order to meet the structural stability requirements of Section 706*A*.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).

SECTION 1608*A*
SNOW LOADS

1608*A*.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*A*.

1608*A*.2 Ground snow loads. The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figure 1608*A*.2 for the contiguous United States. Site-specific case studies shall be made in areas designated "CS" in Figure 1608*A*.2. Ground snow loads for sites at elevations above the limits indicated in Figure 1608.2 and for all sites within the CS areas shall be approved. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval).

1608*A*.3 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7.

1608A.4 Determination of snow loads. [DSA-SS] *The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA. See Section 106.1.2 for snow load posting requirements.*

SECTION 1609*A*
WIND LOADS

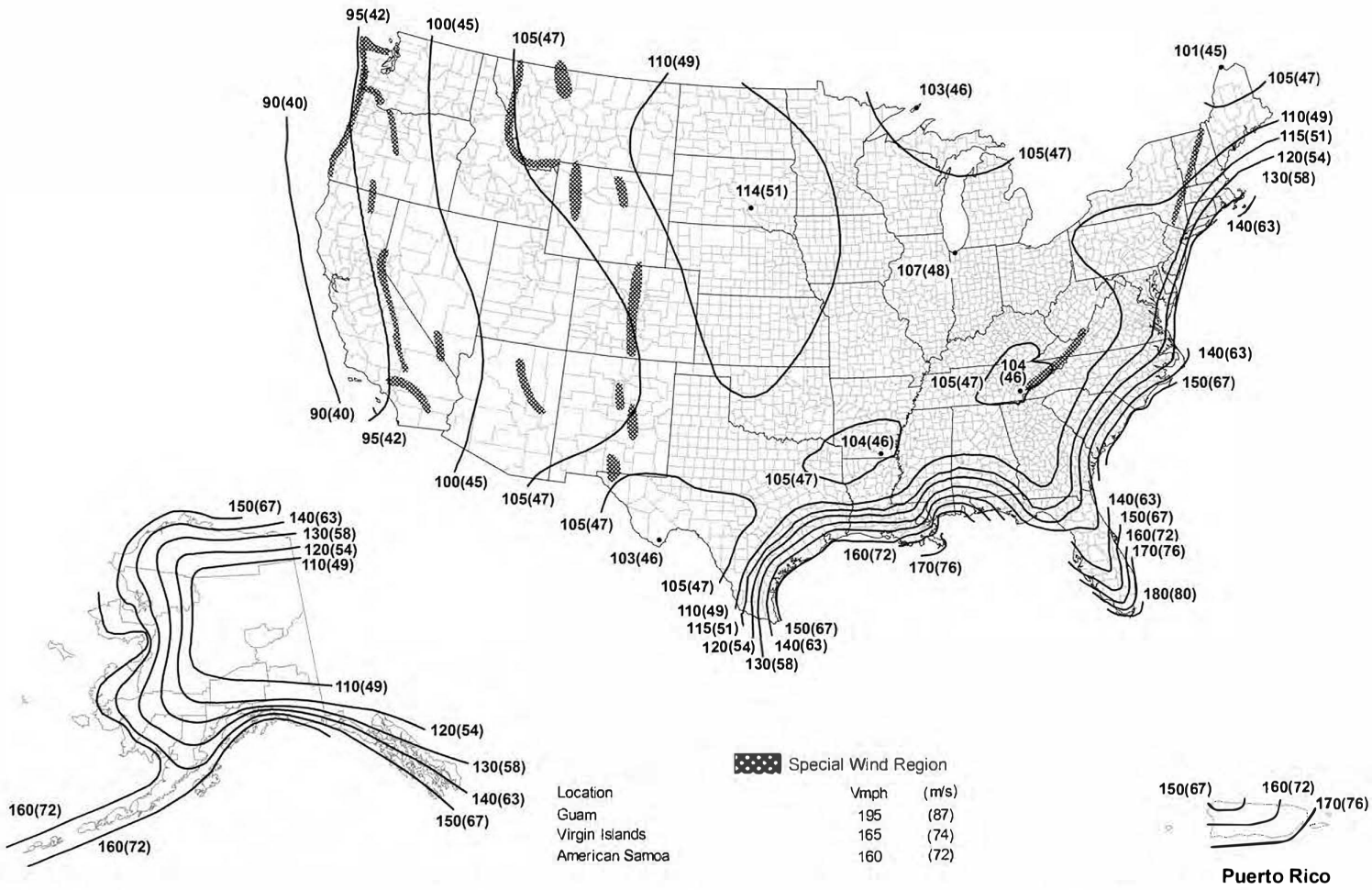
1609*A*.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

1609*A*.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*A* 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*A*.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*A*.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609*A*.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.

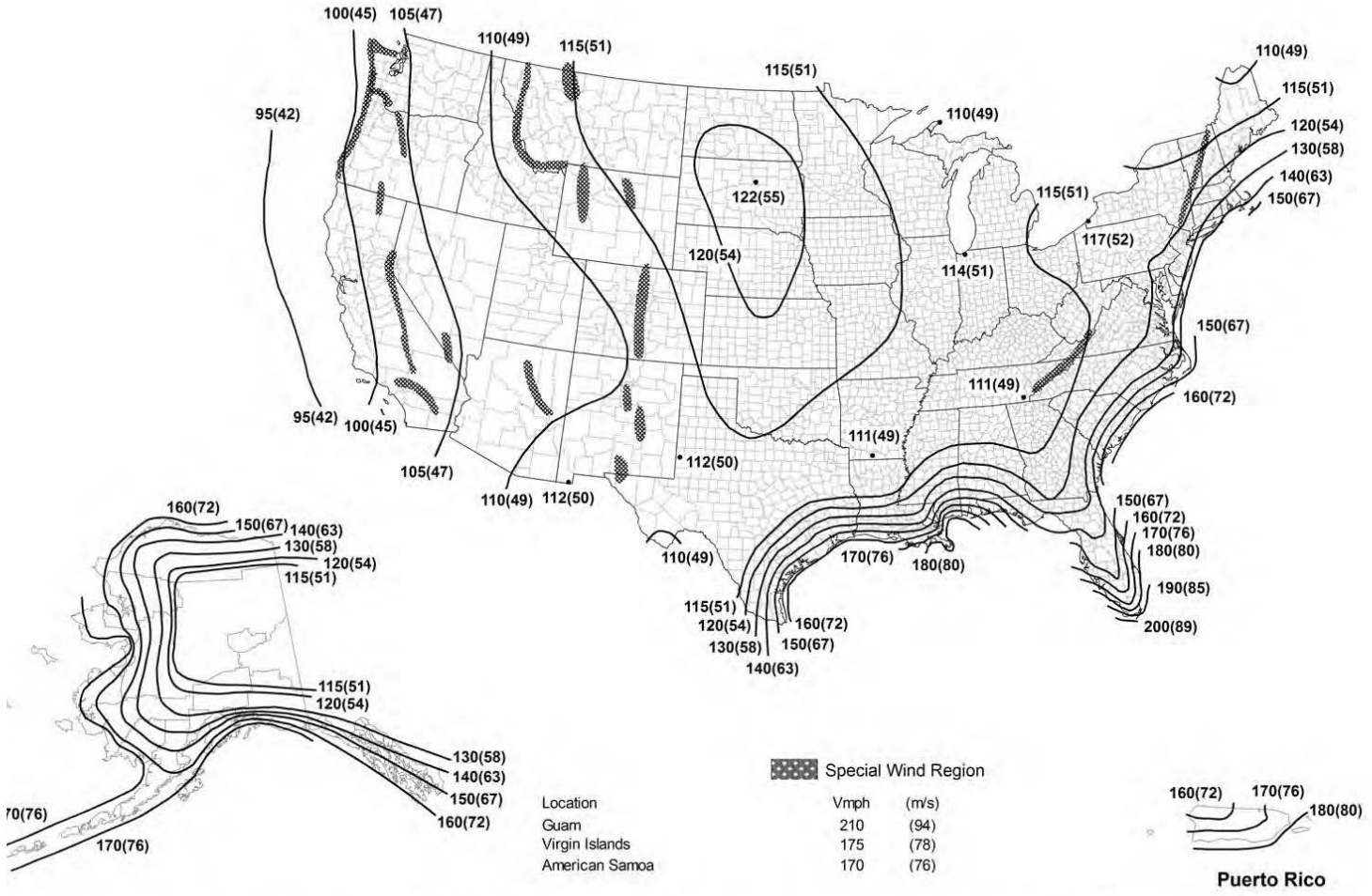
The wind speeds in Figures 1609*A*.3(1) through 1609*A*.3(8) are basic design wind speeds, *V*, and shall be



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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.hazards.atcouncil.org.

FIGURE 1609*A*.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 ft (10m) above ground for Exposure C category.

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

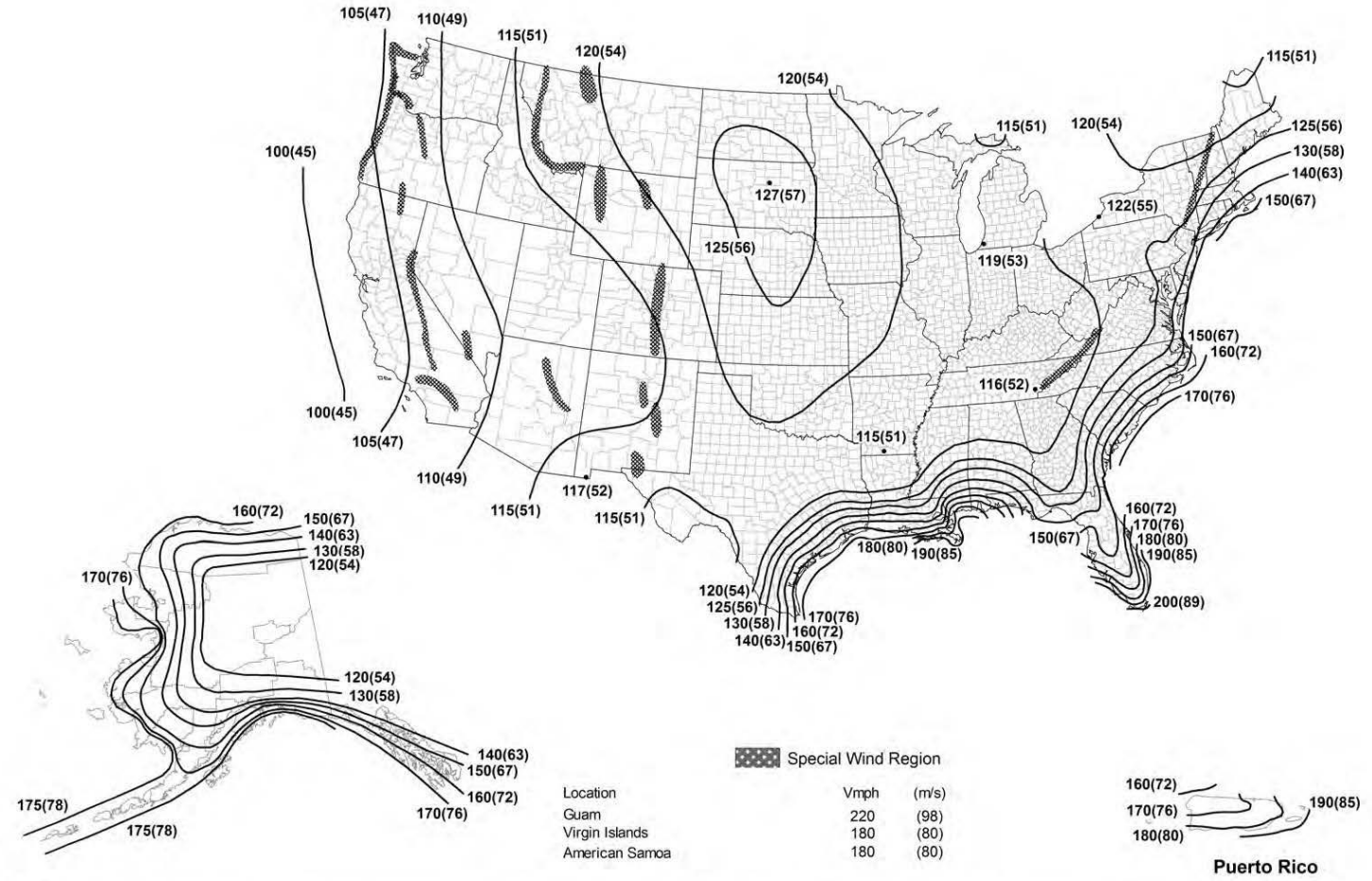
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.

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 = 0.000588, MRI = 1700 Years).

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

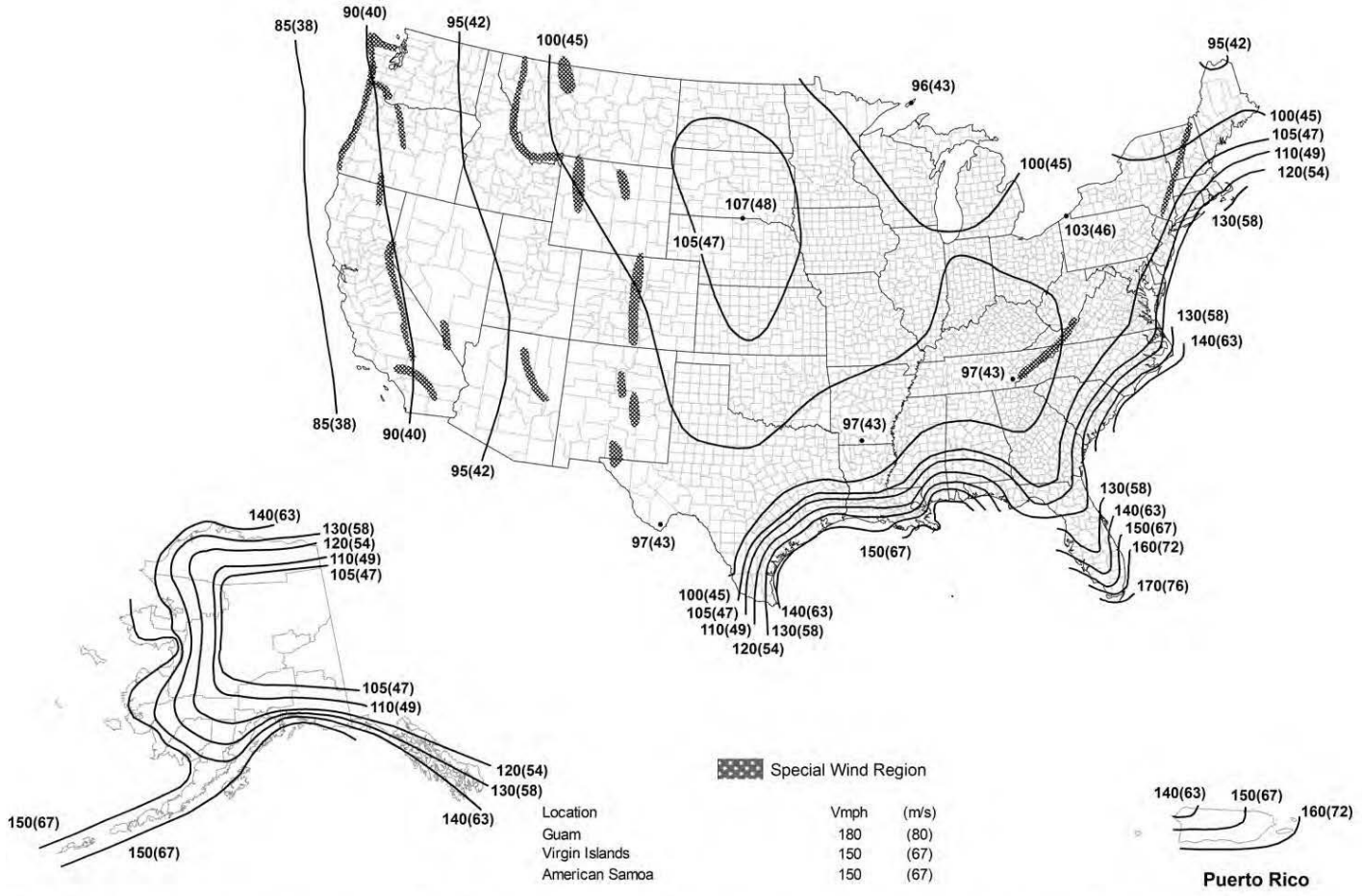
FIGURE 1609*A*.3(2)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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.hazards.atcouncil.org.

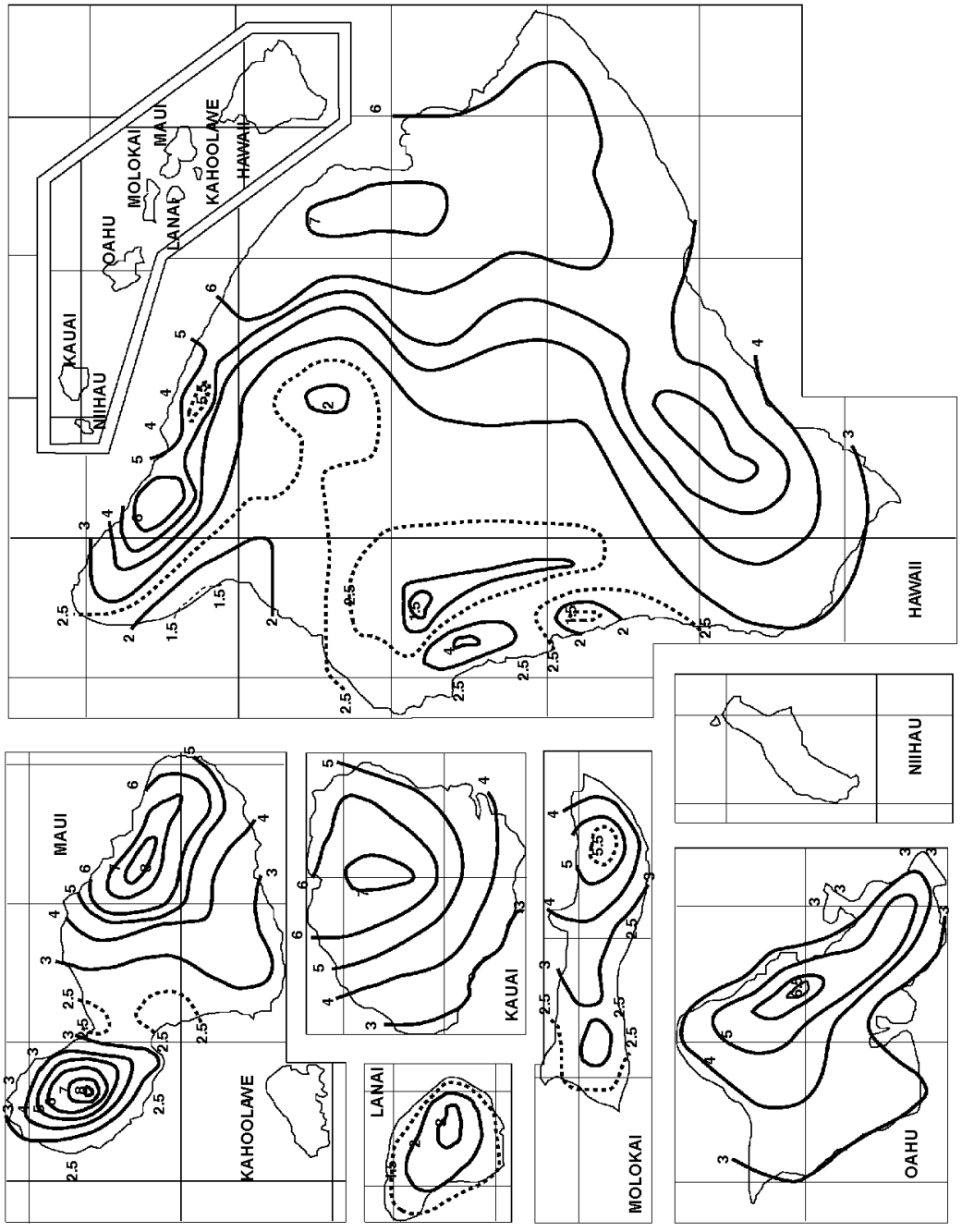
FIGURE 1609*A*.3(3)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted 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.hazards.atcouncil.org.

FIGURE 1609*A*.3(4)
BASIC DESIGN WIND SPEEDS, *V*, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES



[P] FIGURE 1611A.1—continued
100-YEAR, 1-HOUR RAINFALL (INCHES) HA

For SI: 1 inch = 25.4 mm.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

SECTION 1612*A*
FLOOD LOADS

1612*A*.1 General. Within flood hazard areas as established in Section 1612*A*.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

1612*A*.2 Design and construction. The design and construction of buildings and structures located in flood hazard areas, including coastal high hazard areas and coastal A zones, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

1612*A*.3 Establishment of flood hazard areas. To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management *Agency's Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located,* as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

1612*A*.3.1 Design flood elevations. Where design flood elevations are not included in the flood hazard areas established in Section 1612*A*.3, or where floodways are not designated, the building official is authorized to require the applicant to do one of the following:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source.
2. Determine the design flood elevation or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

1612*A*.3.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612*A*.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:
   - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110*A*.3.3 and for the final inspection in Section 110*A*.3.11.1.
   - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
   - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.
2. For construction in coastal high hazard areas and coastal A zones:
   - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110*A*.3.3 and for the final inspection in Section 110*A*.3.11.1.
   - 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
   - 2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

SECTION 1613*A*
EARTHQUAKE LOADS

1613*A*.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The seismic design category for a structure *shall* be determined in accordance with Section 1613*A*.

1613*A*.2 Seismic ground motion values. Seismic ground motion values shall be determined in accordance with this section.

1613*A*.2.1 Mapped acceleration parameters. The parameters S_S and S_1 shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures 1613.2.1(1) through 1613.2.1(8). <

1613*A*.2.2 Site class definitions. Based on the site soil properties, the site shall be classified as Site Class A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7.

Where the soil properties are not known in sufficient detail to determine the site class, Site Class D, subjected to the requirements of Section 1613*A*.2.3, shall be used unless the building official or geotechnical data determines that Site Class E or F soils are present at the site.

Where site investigations that are performed in accordance with Chapter 20 of ASCE 7 reveal rock conditions consistent with Site Class B, but site-specific velocity measurements are not made, the site coefficients F_a and F_v shall be taken at unity (1.0).

1613*A*.2.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters. The maximum considered earthquake spectral response acceleration for short periods, S_{MS}, and at 1-second period, S_{M1}, adjusted for site class effects shall be determined by Equations 16*A*-36 and 16*A*-37, respectively:

$$S_{MS} = F_a S_s \quad \textbf{(Equation 16A-36)}$$

$$S_{M1} = F_v S_1 \quad \textbf{(Equation 16A-37)}$$

but S_{MS} shall not be taken less than S_{M1} except when determining the seismic design category in accordance with Section 1613*A*.2.5.

where:

F_a = Site coefficient defined in Table 1613*A*.2.3(1).

F_v = Site coefficient defined in Table 1613*A*.2.3(2).

S_S = The mapped spectral accelerations for short periods as determined in Section 1613*A*.2.1.

S_1 = The mapped spectral accelerations for a 1-second period as determined in Section 1613*A*.2.1.

Where Site Class D is selected as the default site class per Section 1613*A*.2.2, the value of F_a shall be not less than 1.2.

1613*A*.2.4 Design spectral response acceleration parameters. Five-percent damped design spectral response acceleration at short periods, $S_{DS,}$ and at 1-second period, S_{D1}, shall be determined from Equations 16*A*-38 and 16*A*-39, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \quad \textbf{(Equation 16A-38)}$$

$$S_{D1} = \frac{2}{3} S_{M1} \quad \textbf{(Equation 16A-39)}$$

where:

TABLE 1613*A*.2.3(1)
VALUES OF SITE COEFFICIENT F_a [a]

SITE CLASS	MAPPED RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) SPECTRAL RESPONSE ACCELERATION PARAMETER AT SHORT PERIOD					
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s = 1.25$	$S_s \geq 1.5$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.9	0.9	0.9	0.9	0.9	0.9
C	1.3	1.3	1.2	1.2	1.2	1.2
D	1.6	1.4	1.2	1.1	1.0	1.0
E	2.4	1.7	1.3	Note b	Note b	Note b
F	Note b	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period, S_s.
b. Values shall be determined in accordance with Section 11.4.8 of ASCE 7.

TABLE 1613*A*.2.3(2)
VALUES OF SITE COEFFICIENT F_V [a]

SITE CLASS	MAPPED RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) SPECTRAL RESPONSE ACCELERATION PARAMETER AT 1-SECOND PERIOD					
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 = 0.5$	$S_1 \geq 0.6$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.8	0.8	0.8	0.8	0.8	0.8
C	1.5	1.5	1.5	1.5	1.5	1.4
D	2.4	2.2[c]	2.0[c]	1.9[c]	1.8[c]	1.7[c]
E	4.2	3.3[c]	2.8[c]	2.4[c]	2.2[c]	2.0[c]
F	Note b	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period, S_1.
b. Values shall be determined in accordance with Section 11.4.8 of ASCE 7.
c. See requirements for site-specific ground motions in Section 11.4.8 of ASCE 7.

S_{MS} = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613*A*.2.3.

S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613*A*.2.3.

1613*A*.2.5 Determination of seismic design category. Structures classified as Risk Category I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period, S_1, is greater than or equal to 0.75 shall be assigned to Seismic Design Category E. Structures classified as Risk Category IV that are located where the mapped spectral response acceleration parameter at 1-second period, S_1, is greater than or equal to 0.75 shall be assigned to Seismic Design Category F. Other structures shall be assigned to *Seismic Design Category D.*

1613*A*.2.5.1 Alternative seismic design category determination. *Not permitted by DSA-SS and OSHPD.*

1613*A*.2.5.2 Simplified design procedure. *Not permitted by DSA-SS and OSHPD.*

1613*A*.3 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure.

Exception: [DSA-SS] *Ballasted, roof-mounted photovoltaic panel systems shall comply with ASCE 7 13.6.12.*

[OSHPD 1 & 4] *Ballasted photovoltaic panel systems shall be considered as an alternative system.*

SECTION 1614*A*
ATMOSPHERIC ICE LOADS

1614*A*.1 General. Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

SECTION 1615*A*
TSUNAMI LOADS

1615*A*.1 General. The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones defined in the *ASCE* Tsunami Design Geodatabase*, or other data determined applicable by the enforcement agency,* shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code. ***[DSA-SS]*** *Tsunami Risk Category for public school, community college and state-owned or state-leased essential services buildings and structures shall be identified and submitted for acceptance by DSA. Determination of the Tsunami Risk Category shall be proposed by the design professional in general responsible charge in coordination with the owner and local community based upon the relative importance of that facility to provide vital services, provide important functions, and protect special populations. The determination of relative importance shall include consideration of a tsunami warning and evacuation plan and procedure when adopted by the local community.*

SECTION 1616*A*
STRUCTURAL INTEGRITY

1616*A*.1 General. High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of Section 1617*A*.2 if they are frame structures, or Section 1616*A*.3 if they are bearing wall structures.

1616*A*.2 Frame structures. Frame structures shall comply with the requirements of this section.

1616*A*.2.1 Concrete frame structures. Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of Section 4.10 of ACI 318. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1616*A*.2.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures. Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

1616*A*.2.2.1 Columns. Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

1616*A*.2.2.2 Beams. End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or

3. *Systems listed in this section can be used for seismically isolated buildings, when permitted by ASCE 7 Section 17.2.5.4.*

1617A.1.5 ASCE 7, Section 12.2.3.1. *Replace ASCE 7, Section 12.2.3.1, Items 1 and 2, by the following:*

The value of the response modification coefficient, R, used for design at any story shall not exceed the lowest value of R that is used in the same direction at any story above that story. Likewise, the deflection amplification factor, C_d, and the system over strength factor, Ω_0, used for the design at any story shall not be less than the largest value of these factors that are used in the same direction at any story above that story.

1617A.1.6 ASCE 7, Section 12.2.3.2. *Modify ASCE 7, Section 12.2.3.2, by adding the following additional requirements:*

f. *Where design of vertical elements of the upper portion is governed by special seismic load combinations, the special loads shall be considered in the design of the lower portion.*

1617A.1.7 ASCE 7, Section 12.2.5.6.1 [DSA-SS] *The exception after the first paragraph is not permitted by DSA-SS.*

1617A.1.8 ASCE 7, Section 12.2.5.7.1 [DSA-SS] *The exception after the first paragraph is not permitted by DSA-SS.*

1617A.1.9 ASCE 7, Section 12.2.5.7.2 [DSA-SS] *The exception after the first paragraph is not permitted by DSA-SS.*

1617A.1.10 ASCE 7, Section 12.3.3. *Modify first sentence of ASCE 7, Section 12.3.3.1, as follows:*

12.3.3.1 Prohibited horizontal and vertical irregularities for Seismic Design Categories D through F. *Structures assigned to Seismic Design Category D, E or F having horizontal structural irregularity Type 1b of Table 12.3-1 or vertical structural irregularities Type 1b, 5a or 5b of Table 12.3-2 shall not be permitted.*

Exception: *Structures with reinforced concrete or reinforced masonry shear wall systems and rigid or semi-rigid diaphragms, consisting of concrete slabs or concrete-filled metal deck having a span-to-depth ratio of 3 or less, having a horizontal structural irregularity Type 1b of Table 12.3-1 are permitted, provided that the maximum story drift in the direction of the irregularity, computed including the torsional amplification factor from Section 12.8.4.3, is less than 10 percent of the allowable story drift in ASCE 7 Table 12.12-1.*

1617A.1.11 ASCE 7, Section 12.7.2. *Modify ASCE 7, Section 12.7.2, by adding Item 6 to read as follows:*

6. *Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a geotechnical engineer qualified in soils engineering plus the difference in earth pressures shall be added to the lateral forces provided in this section.*

1617A.1.12 Reserved.

1617A.1.13 Reserved.

1617A.1.14 Reserved.

1617A.1.15 ASCE 7, Section 12.12.3. [OSHPD 1 & 4] *Replace ASCE 7 Equation 12.12-1 by the following:*

$$\delta_M = C_d \delta_{max} \qquad \textbf{(Equation 12.12-1)}$$

1617A.1.16 ASCE 7, Section 12.13.1. *Modify ASCE 7 Section 12.13.1 by adding Section 12.13.1.1 as follows:*

12.13.1.1 Foundations and superstructure-to-foundation connections. *The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605A.1.1.*

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. *The strength of the superstructure elements.*
2. *The maximum forces that can be delivered to the foundation in a fully yielded structural system.*
3. *Forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3.1.*

Exceptions:

1. *Where referenced standards specify the use of higher design loads.*
2. *When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.*
3. *Where seismic force-resisting system consists of light framed walls with shear panels, unless the reference standard specifies the use of higher design loads.*

Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the modal analysis method, reduction in overturning moment permitted by section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

1617A.1.17 ASCE 7, Section 13.1.3. [OSHPD 1 & 4] *Modify ASCE 7 Section 13.1.3 by the following:*

All nonstructural components shall have a component importance factor, I_p, equal to 1.5.

Exception: *Hospital buildings rated SPC-1 and SPC-2 not providing services/systems, utilities, or access/ egress to general acute care buildings designated as SPC 3 or higher in accordance with Chapter 6 of the California Administrative Code, shall be permitted to use component importance factor, I_p, as given in ASCE 7 Section 13.3.1.*

1617A.1.18 ASCE 7, Section 13.1.4. *Replace ASCE 7, Section 13.1.4, with the following:*

13.1.4 Exemptions. *The following nonstructural components are exempt from the requirements of this section:*

1. *Furniture except storage cabinets as noted in Table 13.5-1.*
2. *Temporary, movable or mobile equipment.*

   Exceptions:

   a) *Equipment shall be anchored if it is permanently attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "permanently attached" shall include all electrical connections except plugs for 110/220 volt receptacles having a flexible cable.*

   b) ***[DSA-SS]*** *Movable or mobile equipment which is heavier than 400 pounds or has a center of mass located 4 feet (1.22 m) or more above the adjacent floor or roof level that directly support the component, shall be restrained in a manner approved by the enforcement agency. Mobile equipment shall be restrained when not in use and is stored, unless the equipment is stored in a storage room that does not house hazardous materials or any facility systems or fixed equipment that can be affected by mobile equipment lacking restraint.*

   c) ***[OSHPD 1 & 4]*** *Movable equipment shall be anchored by detachable anchors or restraints in a manner approved by the enforcement agency, when utilities and services at the equipment have flexible connections to allow for necessary movement.*

   d) ***[OSHPD 1 & 4]*** *Mobile equipment heavier than 400 pounds that has a center of mass located 4 feet (1.22 m) or more above the adjacent floor or roof level that directly support the equipment shall be restrained in a manner approved by the enforcement agency when not in use and is stored, unless the equipment is stored in an equipment storage room.*

3. *Discrete architectural, mechanical and electrical components and fixed equipment in Seismic Design Category D, E or F that are positively attached to the structure and anchorage is detailed on the plans, provided that either:*

   a. *The component weighs 400 pounds (1780 N) or less, the center of mass is located 4 feet (1.22 m) or less above the adjacent floor or roof level that directly supports the component, and flexible connections are provided between the component and associated ductwork, piping and conduit.*

      Exception: *Special Seismic Certification requirements of this code in accordance with Section 1705A.13.3 shall be applicable.*

   or

   b. *The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 lb/ft (73 N/m) or less.*

      Exception: *The enforcement agency shall be permitted to require attachments for equipment with hazardous contents to be shown on construction documents irrespective of weight.*

1617A.1.19 ASCE 7, Section 13.4 *Replace ASCE 7, Sections 13.4.2.3, with the following:*

13.4.2.3 Prequalified post-installed anchors and specialty inserts in concrete and masonry.

Post-installed anchors and specialty inserts in concrete that are pre-qualified for seismic applications in accordance with ACI 355.2, ACI 355.4, ICC-ES AC193, ICC-ES AC232, ICC-ES AC308 or ICC-ES AC446 shall be permitted. Post-installed anchors in masonry shall be pre-qualified for seismic applications in accordance with ICC-ES AC01, AC58 or AC106.

Use of screw anchors shall be limited to dry interior conditions and shall not be used in building enclosures. Re-use of screw anchors or screw anchor holes shall not be permitted.

Exception: [DSA-SS] *Screw anchors are permitted for use in building enclosures.*

1617A.1.20 ASCE 7, Section 13.4.5 *Modify ASCE 7 Section 13.4.5 by adding Section 13.4.5.1 as follows:*

13.4.5.1 Power actuated fasteners. *Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of Section 13.4.5.*

Power actuated fasteners shall be permitted in seismic shear for components exempt from permit requirements by Section 1617A.1.18 of this code and for interior non-bearing non-shear wall partitions only. Power actuated fastener shall not be used to anchor seismic bracing, exterior cladding or curtain wall systems.

Exception: *Power actuated fasteners in steel to steel connections prequalified for seismic application by cyclic tests in accordance with ICC-ES AC 70 shall be permitted for seismic design.*

1617A.1.21 ASCE 7, Section 13.5.6.2. *Modify ASCE 7, Section 13.5.6.2 by the following exception added to the end of Section 13.5.6.2.2 and by adding Section 13.5.6.2.3 as follows:*

Exception to Section 13.5.8.1 shall not be used in accordance with ASTM E580 Section 5.5.

13.5.6.2.3 Modification to ASTM E580. *Modify ASTM E580 by the following:*

1. ***Exitways.*** *Lay-in ceiling assemblies in exitways shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors. Lateral force diagonal bracing may be omitted in the short or transverse direction of exitways, not exceeding 8 feet wide, when perimeter support in accordance with ASTM E580 Sections 5.2.2 and 5.2.3 is provided and the perimeter wall laterally supporting the ceiling in the short or transverse direction is designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces.*
2. ***Corridors and lobbies.*** *Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.*
3. ***Lay-in panels.*** *Metal panels and panels weighing more than $^1/_2$ pounds per square foot (24 N/m^2) other than acoustical tiles shall be positively attached to the ceiling suspension runners.*
4. ***Lateral force bracing.*** *Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E580, Sections 5.2.2 and 5.2.3, are provided and perimeter walls are designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces. Horizontal restraint point spacing shall be justified by analysis or test and shall not exceed a spacing of 12 feet by 12 feet. Bracing wires shall be secured with four tight twists in $1^1/_2$ inches, or an approved alternate connection.*
5. *Ceiling support and bracing wires shall be spaced a minimum of 6 inches from all pipes, ducts, conduits and equipment that are not braced for horizontal forces, unless approved otherwise by the building official.*

1617A.1.22 ASCE 7, Section 13.5.7. [OSHPD 1 & 4] *Modify ASCE 7, Section 13.5.7, by the following:*

All access floors shall be special access floors in accordance with Section 13.5.7.2, except for raised roof or exterior floor paver systems.

1617A.1.23 ASCE 7 Section 13.6.2.1 and ASCE 7 Tables 13.5-1 and 13.6-1. *Modify Section 13.6.2.1 by adding the following to the end of the section:*

[OSHPD 1 & 4] *Use of this section shall be considered as an alternative system. Alternatively, HVACR systems shall require special seismic certification in accordance with Section 1705A.13.3.*

ASCE 7 Tables 13.5-1 and 13.6-1. *Modify ASCE 7, Tables 13.5-1 & 13.6-1 by the following:*

Where I_p = 1.5, overstrength factor (Ω_0) need not exceed the values of R_p for design of anchorage to concrete.

1617A.1.24 ASCE 7, Section 13.6.5. *Replace ASCE 7, Section 13.6.5 as follows:*

13.6.5 Distribution Systems: Conduit, Cable Tray, and Raceways. *Cable trays and raceways shall be designed for seismic forces and seismic relative displacements as required in Section 13.3. Conduit equal to or greater than 2.5 inches (64 mm) trade size and attached to panels, cabinets, or other equipment subject to seismic relative displacement, D_{pl}, shall be provided with flexible connections or designed for seismic forces and seismic relative displacements as required in Section 13.3.*

Exceptions:

1. *Design for the seismic forces and relative displacements of Section 13.3 shall not be required for raceways where flexible connections or other assemblies are provided between the cable tray or raceway and associated components to accommodate the relative displacement, where the cable tray or raceway is positively attached to the structure, and one of the following apply:*
   a. *Trapeze assemblies with $^3/_8$ inch (10 mm) or $^1/_2$ inch (13-mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the conduit, cable tray, or raceway support point to the connection at the supporting structure are used to support the cable tray or raceway, and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or*
   b. *The conduit, cable tray, or raceway is supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the raceway run is 12 inches (305 mm) or less in length from the conduit, cable*

tray, or raceway support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

2. *Design for the seismic forces and relative displacements of Section 13.3 shall not be required for conduit, regardless of the value of I_p, where the conduit is less than 2.5 inches (64 mm) trade size.*

Design for the displacements across seismic joints shall be required for conduit, cable trays, and raceways with I_p = 1.5 without consideration of conduit size.

1617A.1.25 ASCE 7, Section 13.6.6. *Replace ASCE 7, Section 13.6.6 with the following:*

13.6.6 Distribution Systems: Duct Systems*. HVACR and other duct systems shall be designed for seismic forces and seismic relative displacements as required in Section 13.3.*

Exceptions: *The following exceptions pertain to ductwork not designed to carry toxic, highly toxic, or flammable gases or not used for smoke control:*

1. *Design for the seismic forces and relative displacements of Section 13.3 shall not be required for duct systems where flexible connections or other assemblies are provided to accommodate the relative displacement between the duct system and associated components, the duct system is positively attached to the structure, and where one of the following apply:*
   a. *Trapeze assemblies with $^3/_8$-inch (10 mm) or $^1/_2$-inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the duct support point to the connection at the supporting structure are used to support duct, and the total weight supported by any single trapeze is less than 10 lb/ft (146 N/m) and 100 pounds or less; or*
   b. *The duct is supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.*
2. *Design for the seismic forces and relative displacements of Section 13.3 shall not be required where provisions are made to avoid impact with other ducts or mechanical components or to protect the ducts in the event of such impact, the distribution system is positively attached to the structure; and HVACR ducts have a cross-sectional area of less than 6 square feet (0.557 m^2) and weigh 20 lb/ft (292 N/m) or less.*

Components that are installed in line with the duct system and have an operating weight greater than 75 pounds (334 N), such as fans, terminal units, heat exchangers, and humidifiers, shall be supported and laterally braced independent of the duct system, and such braces shall meet the force requirements of Section 13.3.1. Components that are installed in line with the duct system, have an operating weight of 75 pounds (334 N) or less, such as small terminal units, dampers, louvers, and diffusers, and are otherwise not independently braced shall be positively attached with mechanical fasteners to the rigid duct on both sides. Piping and conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate the seismic relative displacements of Section 13.3.2.

1617A.1.26 ASCE 7, Section 13.6.7.3. *Replace ASCE 7, Section 13.6.7.3 with the following:*

13.6.7.3 Additional Provisions for Piping and Tubing Systems.

A) Design for the seismic forces of Section 13.3 shall not be required for piping systems where flexible connections, expansion loops, or other assemblies are provided to accommodate the relative displacement between component and piping, where the piping system is positively attached to the structure, and where any of the following conditions apply:

1. *Trapeze assemblies are supported by $^3/_8$-inch (10 mm) or $^1/_2$-inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the pipe support point to the connection at the supporting structure, do not support piping with I_p greater than 1.0, and no single pipe exceeds the diameter limits set forth in item 2b below or 2 inches (50 mm) for Seismic Design Category D, E, or F where I_p is greater than 1.0 and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or*
2. *Piping that has an R_p in Table 13.6-1 of 4.5 or greater supported by rod hangers and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact, or pipes with I_p = 1.0 supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, where each hanger in the pipe run is 12 inches (305 mm) or less in length from the pipe support point to the connection at the supporting structure; and the total weight supported by any single hanger is 50 pounds (220 N) or less. In addition, the following limitations on the size of piping shall be observed:*
   a. *In structures assigned to Seismic Design Category D, E, or F where I_p is greater than 1.0, the nominal pipe size shall be 1 inch (25 mm) or less.*

b. *In structures assigned to Seismic Design Categories D, E, or F where I_p = 1.0, the nominal pipe size shall be 3 inches (80 mm) or less.*

3. *Pneumatic tube systems supported with trapeze assemblies using $^3/_8$ inch (10 mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the tube support point to the connection at the supporting structure and the total weight supported by any single trapeze is 100 pounds (445 N) or less.*

4. *Pneumatic tube systems supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the run is 12 inches (305 mm) or less in length from the tube support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.*

B) Flexible connections in piping required in Section 13.6.7.3 are not required where pipe is rigidly attached to the same floor or wall that provides vertical and lateral support for the equipment, or to a fixture.

C) Flexible connections in piping are required at seismic separation joints and shall be detailed to accommodate the seismic relative displacements at connections.

1617A.1.27 ASCE 7, Section 13.6.11.1. *Modify ASCE 7, Section 13.6.11.1, by adding Section 13.6.11.1.1 as follows:*

13.6.11.1.1 Elevators guide rail support. *The design of guide rail support-bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not less than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one third to the top guiding members and two thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7, Section 13.6.11.1, the minimum seismic forces shall be 0.5g acting in any horizontal direction.*

1617A.1.28 ASCE 7, Section 13.6.11.4. *Replace ASCE 7, Section 13.6.11.4, as follows:*

13.6.11.4 Retainer plates. *Retainer plates are required at the top and bottom of the car and counterweight, except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:*

1. *The seismic force shall be computed per the requirements of ASCE 7 Section 13.6.11.1. The minimum horizontal acceleration shall be 0.5g for all buildings.*

2. *W_p shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.*

3. *With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below:*

RAIL SIZE (weight per foot of length, pounds)	WIDTH OF MACHINED SURFACE (inches)	ALLOWABLE RAIL DEFLECTION (inches)
8	$1\ ^1/_4$	0.20
11	$1\ ^1/_2$	0.30
12	$1\ ^3/_4$	0.40
15	$1\ ^{31}/_{32}$	0.50
$18\ ^1/_2$	$1\ ^{31}/_{32}$	0.50
$22\ ^1/_2$	2	0.50
30	$2\ ^1/_4$	0.50

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.

Note: *Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.*

4. *Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.*

5. *The use of spreader brackets is allowed.*

6. *Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g.*

1617A.1.29 Reserved.

1617A.1.30 Reserved.

1617A.1.31 Reserved.

1617A.1.32 Reserved.

1617A.1.33 Reserved.

1617A.1.34 Reserved.

1617A.1.35 ASCE 7, Section 17.2.4.7. *Modify ASCE 7, Section 17.2.4.7, by adding the following:*

The effects of uplift shall be explicitly accounted for in the testing of the isolator units.

1617A.1.36 ASCE 7, Section 17.4. *Modify ASCE 7, Section 17.4.2, by adding the following:*

17.4.2.3 Linear procedures. *Linear procedures shall not be used in Seismic Design Category E & F structures.*

1617A.1.37 Reserved.

1617A.1.38 ASCE 7, Section 18.3. *Replace exception to ASCE 7, Section 18.3 with the following:*

Exception: *If the calculated force in an element of the seismic force-resisting system does not exceed 1.5 times its nominal strength for the Risk-Targeted Maximum Considered Earthquake (MCE_R) the element is permitted to be modeled as linear. For this section, the MCE_R response shall be based on largest response due to a single ground motion and not the average response of suite of ground motions.*

1617A.1.39 Earthquake Motion Measuring Instrumentation and Post-earthquake Structural Monitoring/Verification. [OSHPD 1 & 4] *Modify ASCE 7 by the following:*

Scope: *For buildings with a seismic isolation system, a damping system or a lateral force-resisting system (LFRS) not listed in ASCE 7 Table 12.2-1, earthquake motion measuring instrumentation and monitoring shall be required. For buildings with welded steel moment frames constructed under a permit issued prior to October 25, 1994 post-earthquake verification shall be in accordance with this section.*

Instrumentation: *Earthquake monitoring instrumentation shall be installed in accordance with Section 104.11.4.*

Monitoring: *After every significant seismic event, where the ground shaking acceleration at the site exceeds 0.3g or the acceleration at any monitored building level exceeds 0.8g as measured by the seismic monitoring system in the building, the owner shall retain a structural engineer to make an inspection of the structural system. The inspection shall include viewing the performance of the building, reviewing the strong motion records, and a visual examination of the isolators, dampers and connections for deterioration, offset or physical damage. A report for each inspection, including conclusions on the continuing adequacy of the structural system, shall be submitted to the enforcement agency.*

Verification: *After every seismic event that generates ground motions specified in the California Administrative Code, Chapter 6, Section 4.2.0.1 or the damage indicators specified in the California Administrative Code, Chapter 6, Section 4.2.0.2 at a welded steel moment frame building constructed under a permit issued prior to October 25, 1994, the owner shall retain a structural engineer to perform detailed joint evaluations required to meet the following requirements:*

1. *A detailed joint evaluation program shall be submitted to the enforcement agency for approval prepared in accordance with the requirements of the California Administrative Code, Chapter 6, Section 4.2.0.3.*
2. *Upon approval of the joint evaluation program required by Item 1 above for the joint inspections, a project to perform the joint inspections, detailed in the program, shall be submitted and a building permit shall be obtained by the owner no later than 6 months from the date of occurrence of the seismic event.*

   Exception: *Where the ground motions at the building site are less than 0.4g, the permit shall be obtained no later than 12 months from the date of occurrence of the seismic event.*
3. *A detailed joint evaluation report shall be submitted to the enforcement agency no later than 6 months of obtaining the building permit. The report shall document the findings from the inspections of the joints and include conclusions on the adequacy of the structural system. Where unsafe conditions are discovered, the provisions of Section 116 shall apply.*

Where the detailed joint evaluation report is not submitted within the timeframes specified above, the building shall not be issued a building permit for any projects except for those for seismic compliance, maintenance and repair until the detailed joint evaluation work is complete.

1617A.1.40 Operational nonstructural performance level requirements. [OSHPD 1 & 4] *New general acute care hospitals and new building(s) required for general acute care services shall satisfy Operational Nonstructural Performance Level (NPC-5) requirements.*

Exception: *A new building which is required for general acute care services that is added to an existing general acute care hospital and which has a building area of 4,000 square feet (371 m^2) or less, need not satisfy the NPC-5 requirements until the deadline specified in California Administrative Code (Part 1, Title 24 CCR), Chapter 6.*

Hospitals and buildings designed and constructed to the provisions of this code for new construction shall be deemed to satisfy Operational Nonstructural Performance Level (NPC-5) requirements when:

1. *The facility has on-site supplies of water and holding tanks for sewage and liquid waste, sufficient to support 72 hours of emergency operations for the hospital or building, which are integrated into the building plumbing systems in accordance with the California Plumbing Code.*
2. *An on-site emergency system as defined in the California Electrical Code is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.*

Emergency and standby generators shall not be located below the higher of the Design Flood Eleva-

TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	CBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	1908.4
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum $^{5}/_{16}''$; and c. Inspect all other welds.	— X	X X 	AWS D1.4 ACI 318: 26.6.4	—
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X	 X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	1908.10
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	1908.6, 1908.7, 1908.8
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	1908.9
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	 X X	 — —	ACI 318: 26.10	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.12, Special inspections for seismic resistance.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

c. ***[OSHPD 1R, 2 & 5]*** *Installation of all adhesive anchors in horizontal and upwardly inclined positions shall be performed by an ACI/CRSI Certified Adhesive Anchor Installer, except where the factored design tension on the anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents or where the anchors are shear dowels across cold joints in slabs on grade where the slab is not part of the lateral force-resisting system.*

1705.3.4 Inspection and testing of prestressed concrete. [OSHPD 1R, 2 & 5] *Inspections and tests for prestressed concrete work shall be in accordance with this section. Tests for prestressing steel and anchorage shall be per Section 1910A.3. Inspection shall be in accordance with the following:*

1. *In addition to the general inspection required for concrete work, all plant fabrication of prestressed concrete members or tensioning of post-tensioned members constructed at the site shall be continuously inspected by an inspector specially approved for this purpose by the enforcement agency.*

   Exception: *The special inspector need not be continuously present for the placement of prestress or post-tensioned cables or tendons.*

2. *The prestressed concrete plant fabrication inspector shall check the materials, equipment, tensioning procedure and construction of the prestressed members and prepare daily written reports. The approved agency shall make a verified report identifying the members by mark and shall include such pertinent data as lot numbers of tendons used, tendon jacking forces, age and strength of concrete at time of tendon release and such other information that may be required.*

3. *The inspector of prestressed members post-tensioned at the site shall check the condition of the prestressing tendons, anchorage assemblies and concrete in the area of the anchorage, the tensioning equipment and the tensioning procedure and prepare daily written reports. The approved agency shall make a verified report of the prestressing operation identifying the members or tendons by mark and including such pertinent data as the initial cable slack, net elongation of tendons, jacking force developed, and such other information as may be required.*

4. *The verified reports of construction shall show that of the inspector's own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site post-tensioning inspections the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure*

1705.3.5 Concrete pre-placement inspection. [OSHPD 1R, 2 & 5] *Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the Inspector of Record.*

1705.3.6 Placing record. [OSHPD 1R, 2 & 5] *A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.*

1705.3.7 Composite construction cores. [OSHPD 1R, 2 & 5] *Composite construction cores shall be taken and tested in accordance with Section 1910A.4.*

1705.3.8 Special Inspections and tests for post-installed anchors in concrete. [OSHPD 1R, 2 & 5] *Special inspections and tests for post-installed anchors in concrete shall be in accordance with Table 1705.3 and Section 1901.3.*

1705.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602, ***[OSHPD 1R, 2 & 5]*** *as set forth in Tables 3 and 4, Level 3 requirements, and Chapter 21. Testing shall be performed in accordance with Section 2105. Special inspection and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17 and 19.*

Exception: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Special inspections and tests shall not be required for:

1. Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

1705.4.1 Empirically designed masonry, glass unit masonry and masonry veneer in Risk Category IV. Special inspections and tests for empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

[OSHPD 1R, 2 & 5] Glass unit masonry and masonry veneer in Risk Category II, III or IV. *Special inspections and tests for glass unit masonry or masonry veneer designed by Section 2110 or Chapter 14, respectively, in structures classified as Risk Category II, III or IV, shall be performed in accordance with TMS 602 Tables 3 and 4, Level 2 Quality Assurance.*

1705.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705.4.

1705.5 Wood construction. Special inspections of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704.2.5. Special inspections of site-built assemblies shall be in accordance with this section.

1705.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. The special inspector shall inspect the wood struc-

2. ***[DSA-SS, DSA-SS/CC]*** *Reference to Section 105 and Section 110 shall be to the California Administrative Code instead.*

1704*A*.2.1 Special inspector qualifications. Prior to the start of the construction, the approved agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspections and tests during construction. Experience or training shall be considered to be relevant where the documented experience or training is related in complexity to the same type of special inspection or testing activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as the approved agency and their personnel are permitted to act as special inspectors for the work designed by them, provided they qualify as special inspectors.

1704*A*.2.2 Access for special inspection. The construction or work for which special inspection or testing is required shall remain accessible and exposed for special inspection or testing purposes until completion of the required special inspections or tests.

1704*A*.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections *prepared by the registered design professional in general responsible charge* in accordance with Section 107.1 as a condition for *construction documents review*. This statement shall be in accordance with Section 1704*A*.3.

[DSA-SS, DSA-SS/CC] *Reference to Section 107.1 shall be to the California Administrative Code instead.*

1704*A*.2.4 Report requirement. *The inspector(s) of record and* approved agencies shall keep records of special inspections and tests. The *inspector of record and* approved agency shall submit reports of special inspections and tests to the building official and to the registered design professional in responsible charge *as required by the California Administrative Code*. Reports shall indicate that work inspected or tested was or was not completed in conformance to approved construction documents *as required by the California Administrative Code and this code*. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official.

1704*A*.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication.

1704*A*.2.5.1 Fabricator approval. *Not permitted by DSA-SS, DSA-SS/CC, or OSHPD.*

1704*A*.3 Statement of special inspections. Where special inspections or tests are required by Section 1705A, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704*A*.3.1 for submittal by the applicant in accordance with Section 1704*A*.2.3.

Exception: The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

1704*A*.3.1 Content of statement of special inspections. The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspections or tests by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspections or tests for seismic or wind resistance as specified in Sections 1705*A*.11, 1705*A*.12 and 1705*A*.13.
5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined.

1704*A*.3.2 Seismic requirements in the statement of special inspections. Where Section 1705*A*.12 or 1705*A*.13 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the *equipment/components that require special seismic certification* and seismic force-resisting systems that are subject to the special inspections or tests.

1704*A*.3.3 Wind requirements in the statement of special inspections. Where Section 1705*A*.11 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to special inspections.

1704*A*.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic force-resisting system, *installation of equipment/components requiring special seismic certification* or a wind- or seismic force-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections.

1704*A*.5 Submittals to the building official. In addition to the submittal of reports of special inspections and tests in accordance with Section 1704*A*.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the building official for each of the following:

1. Certificates of compliance for the *manufacturer's certification* of nonstructural components, supports and attachments in accordance with Section 1705*A*.13.2.
2. Certificates of compliance for *equipment/components requiring special seismic certification* in accordance with Section 1705*A*.13.3.
3. Reports of preconstruction tests for shotcrete in accordance with Section 1908*A*.5.
4. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207*A*.5.
5. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.
6. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category B, C, D, E or F.

1704*A*.6 Structural observations. *T*he owner shall employ a registered design professional to perform structural observations. Structural observation does not include or waive the responsibility for the inspections in Section 110A or the special inspections in Section 1705*A* or other sections of this code.

Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations.

At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

[DSA-SS, DSA-SS/CC] *Reference to Section 110 shall be to the California Administrative Code instead.*

SECTION 1705*A*
REQUIRED SPECIAL INSPECTIONS AND TESTS

1705*A*.1 General. Special inspections and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705*A*.1.1 Special cases. Special inspections and tests shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

1705*A*.2 Steel construction. The special inspections and nondestructive testing of steel construction in buildings, structures, and portions thereof shall be in accordance with this section.

Exception: Special inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements where required by the approved construction documents.

1705*A*.2.1 Structural steel. Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance requirements of *this section, Chapter 22A and quality control requirements of AISC 360, AISC 341 and AISC 358.*

Exception: Special inspection of railing systems composed of structural steel elements shall be limited to welding inspection of welds at the base of cantilevered rail posts.

AISC 360, Chapter N and AISC 341, Chapter J are adopted, except as noted below:

The following provisions of AISC 360, Chapter N are not adopted:

1. N4, Item 2 (Quality Assurance Inspector Qualifications).

2. N5, Item 2 (Quality Assurance).

3. N5, Item 3 (Coordinated Inspection).

4. N5, Item 4 (Inspection of Welding).

5. N6 (Approved Fabricators and Erectors).

6. N7 (Nonconforming Material and Workmanship).

Additionally, the requirements of Table 1705A.2.1 of the California Building Code shall apply.

In addition to the quality assurance requirements contained in AISC 341, Chapter J, Section J5 (Inspection Tasks), the requirements of Section 1704A.3 and Table 1705A.2.1 of the California Building Code shall apply.

[DSA-SS, DSA-SS/CC] Modify AISC 360, Section N5.5(b), as follows:

For structures in Risk Category II, III or IV, UT shall be performed by QA on all complete-joint-penetration (CJP) groove welds subject to transversely applied tension loading in butt, T- and corner joints, in material $^{5}/_{16}$ in. (8 mm) thick or greater.

1705*A*.2.2 Cold-formed steel deck. Special inspections for cold-formed steel floor and roof deck shall be in accordance with the quality assurance inspection requirements of SDI QA/QC.

Deck weld special inspection and testing shall also satisfy requirements in Table 1705A.2.1 and Section 1705A.2.5.

1705*A*.2.3 Open-web steel joists and joist girders. Special inspections of open-web steel joists and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705*A*.2.3.

1705A.2.3.1 Steel joist and joist girder inspection. *Special inspection is required during the manufacture and welding of steel joists or joist girders. The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process.*

1705*A*.2.4 Cold-formed steel trusses spanning 60 feet or greater. Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705A.2.4.1 Light-framed steel truss inspection and testing. *Regardless of truss span, the manufacture of cold-formed light framed steel trusses shall be continuously inspected by an approved agency. The approved agency shall verify conformance of materials and manufacture with approved plans and specifications. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected truss. This mark or tag shall remain on the truss throughout the job site receiving and erection process. Refer to Section 2211A.1.3.3 for requirements applicable to manufactured trusses specified therein.*

1705A.2.5 Inspection and tests of structural welding. *Inspection and testing (including nondestructive testing) of all shop and field welding operations shall be in accordance with this section, Section 1705A.2.1, and Table 1705A.2.1. Inspections shall be made by a qualified welding inspector approved by the enforcement agency. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the AWS QC1.*

[DSA-SS, DSA-SS/CC] *Welding inspector approval by the enforcement agency shall occur when specified in the California Administrative Code. Nondestructive testing shall be performed by qualified NDT Level II personnel employed by the approved agency.*

The welding inspector shall make a systematic daily record of all welds. In addition to other required records, this record shall include:

1. *Identification marks of welders.*
2. *List of defective welds.*
3. *Manner of correction of defects.*

*The welding inspector shall check the material, details of construction and procedure, as well as workmanship of the welds. The inspector shall verify that the installation of end-welded stud shear connectors is in accordance with the requirements of Section 2213A.2 (**[DSA-SS/CC]** 2212.6.2) and the approved plans and specifications. The approved agency shall furnish the architect, structural engineer, and the enforcement agency with a verified report that the welding has been done in conformance with AWS D1.1, D1.3, D1.4, D1.8, and the approved construction documents.*

1705A.2.6 Special inspection and tests of high-strength fastener assemblies. *Special inspections and tests for high-strength fasteners shall be in accordance with this section, Section 1705A.2.1, and Table 1705A.2.1. Tests of high-strength bolts, nuts, and washers shall be in accordance with Section 2213A.1 ([DSA-SS/CC] 2212.6.1).*

[DSA-SS, DSA-SS/CC] *The minimum requirements for a qualified high-strength bolting special inspector shall be an International Code Council certified Structural Steel and Bolting Special Inspector (S1).*

1705*A*.3 Concrete construction. Special inspections and tests of concrete construction shall be performed in accordance with this section and Table 1705*A*.3.

Exception: Special inspections and tests shall not be required for concrete patios, driveways and sidewalks, on grade.

1705*A*.3.1 Welding of reinforcing bars. *S*pecial inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with *1705A.2.5,* the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.

1705*A*.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19, 20*, and 26* of ACI 318, *as modified by Chapter 19A,* the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19, 20*, and 26* of ACI 318 *as modified by Chapter 19A. Tests of reinforcing bars shall be in accordance with Section 1910A.2 (**[DSA-SS/CC]** 1909.2.4).*

TABLE 1705A.2.1
REQUIRED SPECIAL INSPECTIONS AND TESTS OF STEEL CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	CBC REFERENCE[a]
1. Material identification and testing of high-strength bolts, nuts and washers:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	RCSC: 1.5, AISC 360: A3.3, J3.1 and applicable ASTM material standards	2202A.1, [DSA-SS/CC] 2202.1
b. Manufacturer's certificate of compliance required.	—	X	RCSC: 1.5 & 2.1; AISC 360: A3.3 & N3.2	—
c. Testing of high-strength bolts, nuts and washers.	—	—	RCSC: 7.2, Applicable ASTM material standards	2213A.1, [DSA-SS/CC] 2212.6.1
2. Inspection of high-strength bolting:				
a. Snug-tight joints.	—	X	RCSC: 7-9, AISC 360: J3.1, J3.2, M2.5 & N5.6	1705A.2.6, 2204A.2, [DSA-SS/CC] 2204.2
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation	—	X		
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X	—		
3. Material identification and testing of structural steel and cold-formed steel deck:				
a. For structural steel, identification markings to conform to AISC 360.	—	X	AISC 360: A3.1	2202A.1, [DSA-SS/CC] 2202.1
b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	Applicable ASTM material standards	2202A.1, [DSA-SS/CC] 2202.1
c. Manufacturer's certified test reports.	—	X	AISC 360: A3.1& N3.2	—
d. Testing of unidentified steel.	—	—	Applicable ASTM material standards	2202A.1, [DSA-SS/CC] 2202.1
4. Material identification of welding consumables and testing of welded elements:				
a. Identification markings to conform to AWS specification in the approved construction documents.	—	X	AISC 360, A3.5 & N3.2 and applicable AWS A5 documents	—
b. Manufacturer's certificate of compliance required.	—	X	AISC 360: N3.2	—
c. Nondestructive testing of welded joints.	—	—	AISC 360: N5.5	
5. Inspection of welding:				
a. Structural steel and cold-formed steel deck:				
1. Complete and partial joint penetration groove welds	X	—	AISC 360: J2, M2.4, & M4.5, AWS D1.1 AWS D1.8	1705A.2.1, 1705A.2.5
2. Multipass fillet welds.	X	—		
3. Single-pass fillet welds > $^5/_{16}$"	X	—		
4.Plug and slot welds.	X	—		
5. Single-pass fillet welds ≤ $^5/_{16}$"	—	X		
6. Floor and roof deck welds.	—	X	AWS D1.3, SDI QA/QC	1705A.2.1, 1705A.2.2 1705A.2.5
7. End-welded studs.	—	X	AWS D1.1	1705A.2.5, 2213A.2, [DSA-SS/CC] 2212.6.2
8. Welded sheet steel for cold-formed framing members	—	X	AWS D1.3	1705A.2.5, 1705A.2.4.1
b. Reinforcing steel:				
1. Verification of weldability of reinforcing steel other than ASTM A706.	—	X	AWS D1.4, ACI 318: 18.2.8, 25.5.7.4, 26.6.4.1	1705A.3.1, 1903A.8
2. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	X	—		
3. Shear reinforcement.	X			
4. Other reinforcing steel.	—	X		
5. Tests of reinforcing bars.	—	—	—	1910A.2, [DSA-SS/CC] 1909.2.4
6. Inspection of steel frame joint details for compliance:				
a. Details such as bracing and stiffening.	—	X	AISC 360: N5.8	1705A.2.1
b. Member locations.	—	X		
c. Application of joint details at each connection.	—	X		

For SI: 1 inch = 25.4 mm.

compliance with the duly approved plans and specifications for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site post-tensioning inspections the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure.

1705A.3.5 Concrete preplacement inspection. *Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the inspector of record.*

1705A.3.6 Placing record. *A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.*

1705A.3.7 Composite construction cores*. Composite construction cores shall be taken and tested in accordance with Section 1910A.4 (**[DSA-SS/CC]** 1909.2.6).*

1705A.3.8 Special Inspections and tests for post-installed anchors in concrete*. Special inspections and tests for post-installed anchors in concrete shall be in accordance with Table 1705A.3 and Section 1910A.5 (**[DSA-SS/CC]** 1909.2.7).*

1705*A*.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602*, as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21A. Testing shall be performed in accordance with Section 2105A ([DSA-SS/CC] 2115.8). Special inspection and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17A and 19A.*

1705*A*.4.1 Glass unit masonry and masonry veneer in Risk Category *II, III or* IV. Special inspections and tests for glass unit masonry or masonry veneer designed in accordance with Section 2110*A* or Chapter 14, respectively, where they are part of a structure classified as Risk *Category II, III or* IV shall be performed in accordance with TMS 602 *Tables 3 and 4,* Level 2 Quality Assurance.

1705*A*.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705*A*.4.

1705*A*.5 Wood construction. Special inspections of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704*A*.2.5 *except as modified in this section*. Special inspections of site-built assemblies shall be in accordance with this section.

1705*A*.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306*A*.2 shall be installed with special inspections as indicated in Section 1704*A*.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved construction documents. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved construction documents.

1705*A*.5.2 Metal-plate-connected wood trusses. Special inspections of wood trusses with overall heights of 60 inches (1524 mm) or greater shall be performed to verify that the installation of the permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package. For wood trusses with a clear span of 60 feet (18 288 mm) or greater, the special inspector shall verify during construction that the temporary installation restraint/bracing is installed in accordance with the approved truss submittal package.

1705A.5.3 Wood structural elements and assemblies. *Special inspection of wood structural elements and assemblies is required, as specified in this section, to ensure conformance with approved construction documents, and applicable standards.*

The approved agency shall furnish a verified report to the design professional in general responsible charge of construction observation, the structural engineer, and the enforcement agency, in accordance with the California Administrative Code and this chapter. The verified report shall list all inspected members or trusses, and shall indicate whether or not the inspected members or trusses conform with applicable standards and the approved drawings and specifications. Any nonconforming items shall be indicated on the verified report.

1705A.5.4 Structural glued laminated timber. *Manufacture of all structural glued laminated timber shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the approved agency with an identification mark.

Exception: *Special Inspection is not required for noncustom members of $5^{1}/_{8}$-inch maximum width and 18-inch maximum depth, and with a maximum clear span of 32 feet, manufactured and marked in accordance with ANSI/APA A 190.1 Section 13.1 for noncustom members.*

1705A.5.5 Manufactured open web trusses. *The manufacture of open web trusses shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected truss shall be stamped with an identification mark by the approved agency.

1705A.5.6 Timber connectors. *The installation of all split ring and shear plate timber connectors, and timber rivets*

shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report verifying that the materials, timber connectors and workmanship conform to the approved construction documents.

1705*A*.6 Soils. Special inspections and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with this section and Table 1705*A*.6. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance. During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report.

Exception: Where Section 1803*A* does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557.

1705A.6.1 Soil fill. *All fills used to support the foundations of any building or structure shall be continuously inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of the geotechnical engineer to verify that fills meet the requirements of the approved construction documents and to coordinate all fill inspection and testing during the construction involving such fills.*

The duties of the geotechnical engineer or his or her qualified representative shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill; inspection of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; the inspection or review of geotechnical drainage devices, buttress fills or other similar protective measures in accordance with the approved construction documents.

A verified report shall be submitted by the geotechnical engineer as required by the California Administrative Code. The report shall indicate that all tests and inspection required by the approved construction documents were completed and that the tested materials and/or inspected work meet the requirements of the approved construction documents.

1705A.6.2 Earth-retaining shoring. *Special inspections and tests of earth-retaining shoring shall be in accordance with applicable portions of Section 1812A.*

1705A.6.3 Vibro stone columns. *Special inspections and tests of vibro stone columns for ground improvement shall be in accordance with applicable portions of Section 1813A.*

1705*A*.7 Driven deep foundations. Special inspection*s* and tests shall be performed during installation of driven deep foundation elements as specified in *1810A.3.3.1.2 and* Table 1705*A*.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

1705A.7.1 Driven deep foundations observation. *The installation of driven deep foundations shall be continuously observed by a qualified representative of the geotechnical engineer responsible for that portion of the project.*

The representative of the geotechnical engineer shall make a report of the deep foundation pile-driving operation giving such pertinent data as the physical characteristics of the deep foundation pile-driving equipment, identifying marks for each deep foundation pile, the total depth of embedment for each deep foundation; and when the allowable deep foundation pile loads are determined by a dynamic load formula, the design formula used, and the permanent penetration under the last 10 blows. One copy of the report shall be sent to the enforcement agency.

1705*A*.8 Cast-in-place deep foundations. Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in *1810A.3.3.1.2 and* Table 1705*A*.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

1705*A*.9 Helical pile foundations. Continuous special inspections shall be performed during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent instal-

TABLE 1705*A*.6
REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X

1705*A*.13.1.2 Structural steel elements. Nondestructive testing of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category D, E or F other than those covered in Section 1705*A*.13.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341.

1705*A*.13.2 Nonstructural components. For structures assigned to Seismic Design Category D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by *manufacturer's certification* as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic *certification* by analysis *or* testing. *Certificates* of compliance for the *manufacturer's certification* shall be submitted to the building official as specified in Section 1704.5.

Seismic sway bracing components satisfying requirements of FM 1950 or using an alternative testing protocol approved by the building official shall be deemed to satisfy the requirements of this section.

1705*A*.13.3 *Special seismic certification*. For structures assigned to Seismic Design Category D, E or F, *equipment and components* that are subject to the requirements of Section 13.2.2 of ASCE 7 for *special seismic* certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis *or* testing as specified therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704.5.

Active or energized equipment and components shall be certified exclusively on the basis of approved shake table testing in accordance with ICC-ES AC 156 or equivalent shake table testing criteria approved by the building official. Minimum of two equipment/components shall be tested for a product line with similar structural configuration. Where a range of products are tested, the two equipment/components shall be either the largest and a small unit, or approved alternative representative equipment/components.

Exception: *When a single product (and not a product line with more than one product with variations) is certified and manufacturing process is ISO 9001 certified, one test shall be permitted.*

For a multi-component system, where active or energized components are certified by tests, connecting elements, attachments, and supports can be justified by supporting analysis.

1705A.13.3.1 [OSHPD 1 & 4] *Special seismic certification shall be required for the following systems, equipment, and components:*

1. *Emergency and standby power systems.*
2. *Elevator equipment (excluding elevator cabs).*
3. *Components with hazardous contents.*
4. *Exhaust and smoke control fans.*
5. *Switchgear and switchboards.*
6. *Motor control centers.*
7. *Fluoroscopy and x-ray equipment required for radiological/diagnostic imaging service (for service requirements see CBC Section 1224.18.1), and any fluoroscopy and/or radiographic system provided in support of diagnostic assessment of trauma injuries.*
8. *CT (Computerized Tomography) systems used for diagnostic assessment of trauma injuries.*

   Exception: *CT equipment used for treatment or in hybrid operating rooms, including those used for interventional CT, unless used for diagnostic assessment of trauma injuries.*
9. *Air conditioning units excluding Variable/Constant Air Volume (VAV/CAV) boxes up to 75 lbs.*
10. *Air handling units.*
11. *Chillers, including associated evaporators, and condensers.*
12. *Cooling towers.*
13. *Transformers.*
14. *Electrical substations.*
15. *UPS and batteries.*
16. *Panelboards as defined in the California Electrical Code (CEC) Article 100.*
17. *Industrial control panels as defined in the California Electrical Code (CEC) Article 100.*
18. *Power isolation and correction systems.*
19. *Motorized surgical lighting systems.*
20. *Motorized operating table systems.*
21. *Internal communication servers and routers.*
22. *Medical gas and vacuum systems.*
23. *Electrical busways as defined in UL 857.*
24. *Electrical control panels powered by the life safety branch in accordance with the California Electrical Code (CEC) Article 517.33 or the critical branch in accordance with the California Electrical Code (CEC) Article 517.34.*

Exceptions:

1. *Equipment and components weighing not more than 50 lbs. supported directly on structures or surface mounted on equipment or components that are not required to have special seismic certification by this section.*
2. *Mobile equipment/components.*
3. *Pipes, ducts, conduits and cable trays, excluding in-line equipment and components.*

4. *Underground tanks.*
5. *Electric motors, base-mounted horizontal pumps, and compressors.*
6. *Based-mounted vertical pumps up to 20 hp.*
7. *Certified subcomponents up to operating weight of 10 lbs.*
8. *Components where importance factor, I_p, is permitted to be 1.0 by this code.*
9. *Emergency generators up to 25 kilowatts.*
10. *Equipment and components used for clinical trials only.*
11. *Elevator machines and governors.*

For Exceptions 5, 6, and 7:

Exempt subcomponents, which are an integral part of equipment that require special seismic certification, shall be tested attached to the equipment. Exempt subcomponents shall be permitted to be substituted without testing, provided that the substituted subcomponent relative to the certified subcomponent has:

1. *Similar configuration with equivalent function.*
2. *Supports and attachments of similar configuration with equivalent strength and stiffness.*
3. *Same attachment location.*
4. *Changes in dimensions, center of gravity, and mass, of not more than 10 percent of the certified subcomponent and still meets Exception 5, 6, or 7.*
5. *Manufacturing process with ISO 9001 certification.*

1705*A*.13.4 Seismic isolation *and damping* systems. Seismic isolation *and damping* systems in structures assigned to Seismic Design Category D, E or F shall be tested in accordance with Sections 17.8 *and 18.6* of ASCE 7.

Prototype and production testing and associated acceptance criteria for isolator units and damping devices shall be subject to preapproval by the building official. Testing exemption for similar units shall require approval by the building official.

[BF] 1705*A*.14 Sprayed fire-resistant materials. Special inspections and tests of sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections 1705*A*.14.1 through 1705*A*.14.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections and tests shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, where applicable.

[BF] 1705*A*.14.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.
2. Thickness of application.
3. Density in pounds per cubic foot (kg/m^3).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

[BF] 1705*A*.14.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the special inspector before the application of the sprayed fire-resistant material.

[BF] 1705*A*.14.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

[BF] 1705*A*.14.4 Thickness. Not more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, and none shall be less than the minimum allowable thickness required by Section 1705*A*.14.4.1.

[BF] 1705*A*.14.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus $^1/_4$ inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705*A*.14.4.2 and 1705*A*.14.4.3.

[BF] 1705*A*.14.4.2 Floor, roof and wall assemblies. The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705*A*.14.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area.

[BF] 1705*A*.14.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetri-

2. At not more than 4 inches (102 mm), for the remainder of the first 2 feet (610 mm) from each end; and then
3. At not more than 6 inches (152 mm) elsewhere.

The size of ties and spirals shall be as follows:

1. For piles having a least horizontal dimension of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).
2. For piles having a least horizontal dimension of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage).
3. For piles having a least horizontal dimension of 20 inches (508 mm) and larger, wire shall not be smaller than $^1/_4$ inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

1810.3.8.2 Precast nonprestressed piles. Precast nonprestressed concrete piles shall comply with the requirements of Sections 1810.3.8.2.1 through 1810.3.8.2.3.

1810.3.8.2.1 Minimum reinforcement. Longitudinal reinforcement shall consist of not fewer than four bars with a minimum longitudinal reinforcement ratio of 0.008.

1810.3.8.2.2 Seismic reinforcement in Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, precast nonprestressed piles shall be reinforced as specified in this section. The minimum longitudinal reinforcement ratio shall be 0.01 throughout the length. Transverse reinforcement shall consist of closed ties or spirals with a minimum $^3/_8$ inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of eight times the diameter of the smallest longitudinal bar or 6 inches (152 mm) within a distance of three times the least pile dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm) throughout the remainder of the pile.

1810.3.8.2.3 Additional seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, transverse reinforcement shall be in accordance with Section 1810.3.9.4.2.

1810.3.8.3 Precast prestressed piles. Precast prestressed concrete piles shall comply with the requirements of Sections 1810.3.8.3.1 through 1810.3.8.3.3.

1810.3.8.3.1 Effective prestress. The effective prestress in the pile shall be not less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

1810.3.8.3.2 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, precast prestressed piles shall have transverse reinforcement in accordance with this section. The volumetric ratio of spiral reinforcement shall not be less than the amount required by the following formula for the upper 20 feet (6096 mm) of the pile.

$$\rho_s = 0.04(f'_c/f_{yh})[2.8 + 2.34P/f'_c A_g)] \quad \textbf{(Equation 18-5)}$$

where:

A_g = Pile cross-sectional area square inches (mm^2).

f'_c = Specified compressive strength of concrete, psi (MPa).

f_{yh} = Yield strength of spiral reinforcement ≤ 85,000 psi (586 MPa).

P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

ρ_s = Spiral reinforcement index or volumetric ratio (vol. spiral/vol. core).

Not less than one-half the volumetric ratio required by Equation 18-5 shall be provided below the upper 20 feet (6096 mm) of the pile.

Exception: The minimum spiral reinforcement index required by Equation 18-5 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_0. In such cases, minimum spiral reinforcement index shall be as specified in Section 1810.3.8.1.

1810.3.8.3.3 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, precast prestressed piles shall have transverse reinforcement in accordance with the following:

1. Requirements in ACI 318, Chapter 18, need not apply, unless specifically referenced.
2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand or 8 inches (203 mm), whichever is smallest.

4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of each spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Section 25.5.7 of ACI 318.

5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region shall comply with the following:

$$\rho_s = 0.06(f'_c/f_{yh})[2.8 + 2.34P/f'_cA_g)] \quad \textbf{(Equation 18-6)}$$

but not exceed:

$$\rho_s = 0.021 \quad \textbf{(Equation 18-7)}$$

where:

A_g = Pile cross-sectional area, square inches (mm^2).

f'_c = Specified compressive strength of concrete, psi (MPa).

f_{yh} = Yield strength of spiral reinforcement ≤ 85,000 psi (586 MPa).

P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-7.

ρ_s = Volumetric ratio (vol. spiral/vol. core).

This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.

Exception: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* The minimum spiral reinforcement required by Equation 18-6 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 and the applicable overstrength factor, Ω_0. In such cases, minimum spiral reinforcement shall be as specified in Section 1810.3.8.1.

6. Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing, s, and perpendicular dimension, h_c, shall conform to:

$$A_{sh} = 0.3s\,h_c\,(f'_c/f_{yh})(A_g/A_{ch} - 1.0)[0.5 + 1.4P/(f'_cA_g)] \quad \textbf{(Equation 18-8)}$$

but not less than:

$$A_{sh} = 0.12s\,h_c\,(f'_c/f_{yh})\,[0.5 + 1.4P/(f'_cA_g)] \quad \textbf{(Equation 18-9)}$$

where:

f_{yh} = yield strength of transverse reinforcement ≤ 70,000 psi (483 MPa).

h_c = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).

s = Spacing of transverse reinforcement measured along length of pile, inch (mm).

A_{sh} = Cross-sectional area of transverse reinforcement, square inches (mm^2).

f'_c = Specified compressive strength of concrete, psi (MPa).

The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.

Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.

1810.3.8.3.4 Axial load limit in Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E, or F, the maximum factored axial load on precast prestressed piles subjected to a combination of seismic lateral force and axial load shall not exceed the following values:

1. $0.2f'_cA_g$ for square piles
2. $0.4f'_cA_g$ for circular or octagonal piles

[OSHPD 1R, 2 & 5] Exception*: Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_o, the axial load limits may be increased by 2 times.*

1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through 1810.3.9.6.

1810.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3\sqrt{f'_c}S_m \quad \textbf{(Equation 18-10)}$$

For SI: $\phi M_n = 0.25\sqrt{f'_c}S_m$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa).

S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm^3).

1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of Section 1605.2 exceeds the design cracking moment determined in accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

1810.3.9.3 Placement of reinforcement. Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided that the construction method can be demonstrated to the satisfaction of the building official.

1810.3.9.4 Seismic reinforcement. Where a structure is assigned to Seismic Design Category C, reinforcement shall be provided in accordance with Section 1810.3.9.4.1. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810.3.9.4.2.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load, *E*, to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810.2.1.
4. Closed ties or spirals where required by Section 1810.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1810.3.9.4.1 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals with a minimum $^3/_8$ inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than the manufacturer's standard

No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through D. For Site Class A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension *at* the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(f) of ACI 318 shall be permitted. ***[OSHPD 1R, 2 & 5]*** *A transverse spiral reinforcement ratio of not less than one-half of that required in Section 18.7.5.4 of ACI 318 shall be permitted for concrete deep foundation elements.*

1810.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

1810.3.9.5 Belled drilled shafts. Where drilled shafts are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810.3.9.6 Socketed drilled shafts. Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

1810.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810.3.10.1 through 1810.3.10.4.

1810.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not

Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810*A*.3.9.4.2.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810*A*.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load, *E*, to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810*A*.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810*A*.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810*A*.2.1.
4. Closed ties or spirals where required by Section 1810*A*.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1810*A*.3.9.4.1 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810*A*.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605*A*.2.

Transverse reinforcement shall consist of closed ties or spirals with a minimum $^3/_8$ inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than the manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810*A*.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810*A*.3.9.1 exceeds the required moment

strength determined using the load combinations of Section 1605*A*.2.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810*A*.3.9.4.2.1 or 1810*A*.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810*A*.3.9.4.2.1 Site Classes A through D. For Site Class A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension *at* the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(f) of ACI 318 shall be permitted *for concrete deep foundation elements*.

1810*A*.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension *at the bottom* of the pile cap and within seven times the least element dimension *at* the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

1810*A*.3.9.5 Belled drilled shafts. Where drilled shafts are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810*A*.3.9.6 Socketed drilled shafts. Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

1810*A*.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810*A*.3.10.1 through 1810*A*.3.10.4.

1810*A*.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810*A*.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of $^{3}/_{16}$ inch (4.8 mm). Splices shall comply with Section 1810*A*.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810*A*.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

1810A.3.10.4 Seismic requirements. *For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness*

SECTION 1907
MINIMUM SLAB PROVISIONS

1907.1 General. The thickness of concrete floor slabs supported directly on the ground shall be not less than $3^1/_2$ inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exceptions: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where approved based on local site conditions.

1907.1.1 [HCD 1] Capillary break. *When a vapor retarder is required, a capillary break shall be installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

SECTION 1908
SHOTCRETE

1908.1 General. Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for reinforced concrete, ***[OSHPD 1R, 2 & 5]*** *and the provisions of ACI 506R. The specified compressive strength of shotcrete shall not be less than 3,000 psi (20.69 MPa).*

[OSHPD 1R, 2 & 5] *Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a method acceptable to the enforcement agency, and just prior to receiving shotcrete shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be wetted before shotcrete is deposited, but not so wet as to overcome suction.*

1908.2 Proportions and materials. Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in finished in-place hardened shotcrete meeting the strength requirements of this code.

1908.3 Aggregate. Coarse aggregate, if used, shall not exceed $^3/_4$ inch (19.1 mm).

[OSHPD 1R, 2 & 5] *For structural walls, when total rebar in any direction is more than 0.31 in^2/ft. or rebar size is larger than No. 5, shotcrete shall conform to coarse aggregate grading No. 2 in accordance with Table 1.1.1 of ACI 506R.*

1908.4 Reinforcement. Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1908.4.1 through 1908.4.4.

1908.4.1 Size. The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.

1908.4.2 Clearance. Where No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of $2^1/_2$ inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. Where two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

Exception: Subject to the approval of the building official, required clearances shall be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.

1908.4.3 Splices. Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of 2 inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted where approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.

1908.4.4 Spirally tied columns. Shotcrete shall not be applied to spirally tied columns.

1908.5 Preconstruction tests. Where preconstruction tests are required by Section 1908.4, a test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. ***[OSHPD 1R, 2 & 5]*** *a preconstruction test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project for all shotcrete work.* The sample panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704.5.

1908.6 Rebound. Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.

1908.7 Joints. Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

[OSHPD 1R, 2 & 5] The film of laitance which forms on the surface of the shotcrete shall be removed within approximately 2 hours after application by brushing with a stiff broom. If this film is not removed within 2 hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over 8 hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

1908.8 Damage. In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

1908.9 Curing. During the curing periods specified herein, shotcrete shall be maintained above 40°F (4°C) and in moist condition. *[OSHPD 1R, 2 & 5] Maintain above 50°F (10°C) and in moist condition.*

1908.9.1 Initial curing. Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

1908.9.2 Final curing. Final curing shall continue for seven days after shotcreting, or for three days if high-early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with an approved moisture-retaining cover.

1908.9.3 Natural curing. Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent, and is authorized by the registered design professional and approved by the building official.

1908.10 Strength tests. Strength tests for shotcrete shall be made by an approved agency on specimens that are representative of the work and that have been water soaked for not fewer than 24 hours prior to testing. Where the maximum-size aggregate is larger than $^3/_8$ inch (9.5 mm), specimens shall consist of not less than three 3-inch-diameter (76 mm) cores or 3-inch (76 mm) cubes. Where the maximum-size aggregate is $^3/_8$ inch (9.5 mm) or smaller, specimens shall consist of not less than 2-inch-diameter (51 mm) cores or 2-inch (51 mm) cubes.

1908.10.1 Sampling. Specimens shall be taken from the in-place work or from test panels, and shall be taken not less than once each shift, but not less than one for each 50 cubic yards (38.2 m^3) of shotcrete.

1908.10.2 Panel criteria. Where the maximum-size aggregate is larger than $^3/_8$ inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). Where the maximum-size aggregate is $^3/_8$ inch (9.5 mm) or smaller, the test panels shall have minimum dimensions of 12 inches by 12 inches (305 mm by 305 mm). Panels shall be shot in the same position as the work, during the course of the work and by the nozzlemen doing the work. The conditions under which the panels are cured shall be the same as the work. *[OSHPD 1R, 2 & 5] Approval from the enforcement agency shall be obtained prior to performing the test panel method.*

1908.10.3 Acceptance criteria. The average compressive strength of three cores from the in-place work or a single test panel shall equal or exceed $0.85 f'_c$ with no single core less than $0.75 f'_c$. The average compressive strength of three cubes taken from the in-place work or a single test panel shall equal or exceed f'_c with no individual cube less than $0.88 f'_c$. To check accuracy, locations represented by erratic core or cube strengths shall be retested.

1908.11 Forms and ground wires for shotcrete. [OSHPD 1R, 2 & 5] *Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.*

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

1908.12 Placing. [OSHPD 1R, 2 & 5] *Shotcrete shall be placed in accordance with ACI 506R.*

SECTION 1909
ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

1909.1 General.

1909.1.1 Construction documents. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1909.2 Tests and materials. *Where required, special inspections and tests shall be in accordance with Chapter 17A and this section.*

1909.2.1 Aggregates *- Modify ACI 318 Section 26.4.1.2.1(a).(1) as follows:*

(1) ***Normal weight aggregate:*** *Aggregate shall be non-reactive as determined by one of the methods in ASTM C33 Appendix XI Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official.*

1909.2.2 Steel fiber reinforcement *- Not permitted.*

1909.2.3 Cementitious material. *The concrete supplier shall furnish to the enforcement agency certification that*

line shall meet the requirements of ACI 318 Section 11.6 and 11.7.

1909.3.2 ACI 318, Section 12.7.3. *Add Section 12.7.3.4 to ACI 318 as follows:*

12.7.3.4 *– At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.*

1909.3.3 ACI 318, Chapter 14. *Plain concrete is not permitted.*

1909.3.4 ACI 318, Section 18.10.6.5. *Modify ACI 318, Section 18.10.6.5 by adding the following:*

Where boundary members are not required by ACI 318 Section 18.10.6.2 or 18.10.6.3, minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot of wall. Horizontal extent of boundary element shall be per ACI 318 Section 18.10.6.4 (a), (b) and (c).

1909.3.5 ACI 318, Section 18.12.6. *Add Section 18.12.6.2 to ACI 318 as follows:*

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or 6 d_b thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1909.3.6 ACI 318, Table 21.2.2. *Replace Table 21.2.2 as follows:*

TABLE 21.2.2
STRENGTH REDUCTION FACTOR ϕ FOR MOMENT, AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE

NET TENSILE STRAIN ε_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\varepsilon_t \le \varepsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\varepsilon_{ty} < \varepsilon_t < 0.005$	Transition[1, 2]	$0.75 + 0.15\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(c)	$0.65 + 0.25\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(d)
$\varepsilon_t \ge 0.005$	Tension-controlled[3]	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
2. *ε_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_g f'_c$ and 0.005.*
3. *For sections with factored axial compression force $P_u \ge 0.1A_g f'_c$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.*

1909.3.7 ACI 318, Section 26.12.2.1(a). *Replace ACI 318 Section 26.12.2.1(a) by the following:*

26.12.2.1(a) - Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (38.2 m^3) of concrete, or not less than once for each 2,000 square feet (186 m^2) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

1909.4 Shotcrete.

1909.4.1 General. *Shotcrete shall also conform to the provisions of ACI 506.2. The specified compressive strength of shotcrete shall not be less than 4,000 psi (27.6 MPa).*

1909.4.2 Preconstruction tests. *A test panel prepared in accordance with Section 1908.5 is required. Approval from the enforcement agency must be obtained prior to performing test panels.*

1909.4.3 Aggregate. *For structural walls, when total rebar in any direction is more than 0.31 $in^2/ft.$ or rebar size is larger than No. 5, shotcrete shall conform to coarse aggregate grading No. 2 in accordance with Table 1.1.1 of ACI 506R.*

1909.4.4 Surface preparation. *Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a suitable method, and just prior to receiving shotcrete shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be wetted before shotcrete is deposited, but not so wet as to overcome suction.*

1909.4.5 Joints. *The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.*

1909.4.6 Curing. *Shotcrete shall be maintained above 50°F (10°C) during the curing periods specified in Section 1908.9.*

1909.4.7 Forms and ground wires for shotcrete. *Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.*

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

1909.4.8 Placing. *Shotcrete shall be placed in accordance with ACI 506.2 and ACI 506R. In addition to testing requirements in Section 1908, special inspection and testing shall be in accordance with Section 1705A.19.*

1909.5 Existing concrete structures. *The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.*

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m^2) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diame-

ter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed $^3/_4$ inch (19 mm).

SECTION 1910
ADDITIONAL REQUIREMENTS FOR SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES, ACUTE PSYCHIATRIC AND NON-GAC BUILDINGS [OSHPD 1R, 2 & 5]

1910.1 General.

1910.1.1 Construction documents. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1910.2 Tests and materials. *Where required, special inspections and tests shall be in accordance with Chapter 17 and this section.*

1910.2.1 Cementitious material. *The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for Portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used.*

1910.2.2 Tests of reinforcing bars. *Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.*

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each $2^1/_2$ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the building official for one-story buildings or nonbuilding structures, provided that they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1910.2.3 Tests for prestressing steel and anchorage*. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the job site. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.*

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site shall be furnished by the contractor and tested by an approved independent testing agency:

1. *For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.*
2. *For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with the anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.*

   Variations of the bearing plate size need not be considered.

   The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

   Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.
3. *If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.*
4. *Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.*

1910.2.4 Composite construction cores. *Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).*

At least one core shall be taken from each building for each 5,000 square feet (465 m^2) of area of composite concrete construction and not fewer than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

where d_b is the diameter of the largest reinforcement in the topping slab.

1905A.1.13 ACI 318, Table 21.2.2. *Replace Table 21.2.2 as follows:*

TABLE 21.2.2
STRENGTH REDUCTION FACTOR ϕ FOR MOMENT, AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE

NET TENSILE STRAIN ε_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\varepsilon_t \le \varepsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\varepsilon_{ty} < \varepsilon_t < 0.005$	Transition[1, 2]	$0.75 + 0.15\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(c)	$0.65 + 0.25\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(d)
$\varepsilon_t \ge 0.005$	Tension-controlled[3]	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
2. *ε_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_g f'_c$ and 0.005.*
3. *For sections with factored axial compression force $P_u \ge 0.1A_g f'_c$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.*

1905A.1.14 ACI 318, Section 24.2.1. *Add Section 24.2.1.1 to ACI 318 as follows:*

24.2.1.1 – Span to depth ratio. Prestressed beam and slab span to depth ratios for continuous prestressed concrete members shall not exceed the following, except when calculations of deflections and vibration effects prove that greater values may be used without adverse effects:

Beams 30

One-way slabs 40

Two-way floor slabs 40

Two-way roof slabs 44

These ratios should be decreased for special conditions such as heavy loads and simple spans.

Maximum deflection criteria shall be in accordance with ACI 318 Section 24.2.2.

1905A.1.15 ACI 318, Section 26.12.2.1(a). *Replace ACI 318 Section 26.12.2.1(a) by the following:*

26.12.2.1(a) Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (345 m^3) of concrete, or not less than once for each 2,000 square feet (186 m^2) of surface area for slabs or walls. Additional samples for 7-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

SECTION 1906*A*
STRUCTURAL PLAIN CONCRETE

Not permitted by OSHPD and DSA-SS

SECTION 1907*A*
MINIMUM SLAB PROVISIONS

1907*A*.1 General. The thickness of concrete floor slabs supported directly on the ground shall not be less than $3^1/_2$ inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where approved based on local site conditions.

SECTION 1908*A*
SHOTCRETE

1908*A*.1 General. Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for reinforced concrete *and the provisions of ACI 506R. The specified compressive strength of shotcrete shall not be less than 4,000 psi (27.6 MPa).*

[DSA-SS] Exception: *The reference to ACI 506R shall be to ACI 506.2, unless otherwise approved by the enforcing agent.*

Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a mechanical method acceptable to the enforcement agency, and just prior to receiving shotcrete shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be wetted before shotcrete is deposited, but not so wet as to overcome suction.

1908*A*.2 Proportions and materials. Shotcrete proportions shall be selected that allow suitable placement procedures

using the delivery equipment selected and shall result in finished in-place hardened shotcrete meeting the strength requirements of this code.

1908*A*.3 Aggregate. Coarse aggregate, if used, shall not exceed $^3/_4$ inch (19.1 mm). *For structural walls, when total rebar in any direction is more than 0.31 in^2/ft. or rebar size is larger than No. 5, shotcrete shall conform to coarse aggregate grading No. 2 in accordance with Table 1.1.1 of ACI 506R.*

1908*A*.4 Reinforcement. Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1908*A*.4.1 through 1908*A*.4.4.

1908*A*.4.1 Size. The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.

1908*A*.4.2 Clearance. Where No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of $2^1/_2$ inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. Where two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

Exception: Subject to the approval of the building official, required clearances shall be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.

1908*A*.4.3 Splices. Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of 2 inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted where approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.

1908*A*.4.4 Spirally tied columns. Shotcrete shall not be applied to spirally tied columns.

1908*A*.5 Preconstruction tests. *A* test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The sample panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704*A*.5.

1908*A*.6 Rebound. Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.

1908*A*.7 Joints. Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

1908*A*.8 Damage. In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

1908*A*.9 Curing. During the curing periods specified herein, shotcrete shall be maintained above *50°F (10°C)* and in moist condition.

1908*A*.9.1 Initial curing. Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

1908*A*.9.2 Final curing. Final curing shall continue for seven days after shotcreting, or for three days if high-early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with an approved moisture-retaining cover.

1908*A*.9.3 Natural curing. Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent, and is authorized by the registered design professional and approved by the building official.

1908*A*.10 Strength tests. Strength tests for shotcrete shall be made *in accordance with ASTM C1604* by an approved agency on specimens that are representative of the work and that have been water soaked for not fewer than 24 hours prior to testing. Where the maximum-size aggregate is larger than $^3/_8$ inch (9.5 mm), specimens shall consist of not less than three 3-inch-diameter (76 mm) cores or 3-inch (76 mm) cubes. Where the maximum-size aggregate is $^3/_8$ inch (9.5 mm) or smaller, specimens shall consist of not less than 2-inch-diameter (51 mm) cores or 2-inch (51 mm) cubes.

1908*A*.10.1 Sampling. Specimens shall be taken from the in-place work or from test panels, and shall be taken not less than once each shift, but not less than one for each 50 cubic yards (38.2 m^3) of shotcrete.

CHAPTER 20
ALUMINUM

User notes:

About this chapter: *Chapter 20 contains standards for the use of aluminum in building construction. Only the structural applications of aluminum are addressed so it would not apply to the use of aluminum in specialty products such as storefront or window framing or architectural hardware. The use of aluminum in heating, ventilating or air-conditioning systems is addressed in the* California Mechanical Code*. This chapter references national standards from the Aluminum Association for use of aluminum in building construction, AA ASM 35,* Aluminum Sheet Metal Work in Building Construction*, and AA ADM 1,* Aluminum Design Manual*.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2019 (Group B) Code Development Cycle. See explanation on page ix.*

SECTION 2001
GENERAL

2001.1 Scope. This chapter shall govern the quality, design, fabrication and erection of aluminum. ***[OSHPD]***

2001.1.1 Application. [DSA-SS, DSA-SS/CC] *The scope of application of Chapter 20 is as follows:*

1. *Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.*
2. *Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1* ***[DSA-SS],*** *and 1.9.2.2* ***[DSA-SS/CC]****. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*

2001.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] *DSA-SS, DSA-SS/CC, and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. ***[OSHPD 1, 1R, 2, 4 & 5]*** *Office of Statewide Health Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

   [OSHPD 1] *- For applications listed in Section 1.10.1.*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 4] *- For applications listed in Section 1.10.4.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*

2. *Division of the State Architect - Structural Safety:*

   [DSA-SS] *- For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2.*

SECTION 2002
MATERIALS

2002.1 General. Aluminum used for structural purposes in buildings and structures shall comply with AA ASM 35 and AA ADM. The nominal loads shall be the minimum design loads required by Chapter 16. <

Exception: [DSA – SS] *The reference to Chapter 16 shall be to Chapter 16A.*

SECTION 2003
TESTING AND INSPECTION

2003.1 Testing and Inspection. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] *Testing and inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17A, except references to AWS D1.1 shall be to AWS D1.2.*

[OSHPD 1R, 2 & 5] *Testing and inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17, except references to AWS D1.1 shall be to AWS D1.2.*

2. ***Minimum reinforcement for masonry columns.*** *The spacing of column ties shall be as follows: not greater than 8 bar diameters, 24 tie diameters, or one half the least dimension of the column for the full column height. Ties shall be at least $^3/_8$ inch (10 mm) diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.*

3. ***Lateral support.*** *Lateral support of masonry may be provided by cross walls, columns, pilasters, counterforts or buttresses where spanning horizontally or by floors, beams, girts or roofs where spanning vertically. Where walls are supported laterally by vertical elements, the stiffness of each vertical element shall exceed that of the tributary area of the wall.*

4. ***Anchor bolts.*** *Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $^1/_2$-inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, $^3/_4$-inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, $^7/_8$-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25mm) diameter for 12-inch (304.8 mm) nominal masonry.*

SECTION 2107*A*
ALLOWABLE STRESS DESIGN

2107*A*.1 General. The design of masonry structures using allowable stress design shall comply with Section 2106*A* and the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2107*A*.2 through *2107A.6*.

2107*A*.2 TMS 402, Section 6.1.6.1.1, lap splices. As an alternative to Section 6.1.6.1.1, it shall be permitted to design lap splices in accordance with Section 2107*A*.2.1.

2107*A*.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be:

$$l_d = 0.002 d_b f_s \qquad \textbf{(Equation 21A-1)}$$

For SI: $l_d = 0.29 d_b f_s$

but not less than 12 inches (305 mm). The length of the lapped splice shall be not less than 40 bar diameters.

where:

d_b = Diameter of reinforcement, inches (mm).

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress, F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107*A*.3 TMS 402, Section *6.1.6.1*, splices of reinforcement. Modify Section *6.1.6.1* as follows:

6.1.6.1 – Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. Welding shall conform to AWS D1.4. Welded splices shall be of ASTM A706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section *6.1.6.1.3*.

2107A.4 TMS 402. *Modify by adding Section 8.3.8, as follows:*

8.3.8 - Walls and Piers.

Thickness of Walls. *For thickness limitations of walls as specified in this chapter, nominal thickness shall be used. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.*

The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Also, no masonry wall shall exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 2107A.4.

Piers. *Every pier or wall section which width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section which width is between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hairpins.*

TABLE 2107A.4
MINIMUM THICKNESS OF MASONRY WALLS[1, 2]

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS[2,3]	NOMINAL MINIMUM THICKNESS (inches)
BEARING OR SHEAR WALLS:		
1. Stone masonry	*14*	*16*
2. Reinforced grouted masonry	*25*	*6*
3. Reinforced hollow-unit masonry	*25*	*6*
NONBEARING WALLS:		
4. Exterior reinforced walls	*30*	*6*
5. Interior partitions reinforced	*36*	*4*

1. For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.

2. In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.

3. Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.

2107A.5 [OSHPD 1 & 4] Modify TMS402, Section 8.3.4.4 by the following:

All reinforced masonry components that are subjected to in-plane forces shall have a maximum reinforcement ratio, ρ_{max}, not greater than that computed by Equation 8-20.

SECTION 2108*A*
STRENGTH DESIGN OF MASONRY

2108*A*.1 General. The design of masonry structures using strength design shall comply with Section 2106*A* and the requirements of Chapters 1 through 7 and Chapter 9 of TMS 402, except as modified by Sections 2108*A*.2 through 2108*A*.3.

2108*A*.2 TMS 402, Section 6.1.5.1.1, development. Modify the second paragraph of Section 6.1.5.1.1 as follows:

The required development length of reinforcement shall be determined by Equation (6-1), but shall be not less than 12 inches (305 mm) and need not be greater than 72 d_b.

2108*A*.3 TMS 402, Section 6.1.6.1.1, splices. Modify Sections 6.1.6.1.2 and 6.1.6.1.3 as follows:

6.1.6.1.2 – A welded splice shall have the bars butted and welded to develop not less than 125 percent of the yield strength, f_y, of the bar in tension or compression, as required. Welded splices shall be of ASTM A706 steel reinforcement. Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls.

6.1.6.1.3 – Mechanical splices shall be classified as Type 1 or 2 in accordance with Section 18.2.7.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls. Type 2 mechanical splices are permitted in any location within a member.

SECTION 2109*A*
EMPIRICAL DESIGN OF ADOBE MASONRY

Not permitted by OSHPD and DSA.

SECTION 2110*A*
GLASS UNIT MASONRY

2110*A*.1 General. Glass unit masonry construction shall comply with Chapter 13 of TMS 402 and this section.

Masonry glass block walls or panels shall be designed for seismic forces. Stresses in glass block shall not be utilized.

2110*A*.1.1 Limitations. Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers, fire partitions or smoke barriers, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $^3/_4$ hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways and ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404*A*.6, Exception 2.

SECTION 2111*A*
MASONRY FIREPLACES

2111*A*.1 General. The construction of masonry fireplaces, consisting of concrete or masonry, shall be in accordance with this section.

2111*A*.2 Fireplace drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

2111*A*.3 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2111*A*.3.1 Ash dump cleanout. Cleanout openings, located within foundation walls below fireboxes, where provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111*A*.4 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry fireplaces shall be reinforced and anchored in accordance with Sections 2111*A*.4.1, 2111*A*.4.2 and 2111*A*.5. In structures assigned to Seismic Design Category E or F, masonry fireplaces shall be reinforced in accordance with the requirements of Sections 2101*A* through 2108*A*.

2111*A*.4.1 Vertical reinforcing. For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103*A*.3. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 22 – STEEL

(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	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X			X	X			X	X														
Adopt entire chapter as amended (amended sections listed below)											X	X			X								
Adopt only those sections that are listed below																							
Chapter / Section																							
2201.1.1									X		X	X			X								
2201.1.2									X		X	X			X								
2201.1.3									X														
2201.1.4									X		X	X			X								
2212									X														
2204.1.1											*X*	*X*			*X*								
2204.4											*X*	*X*			*X*								
2205.1											*X*	*X*			*X*								
2205.2.1.2											*X*	*X*			*X*								
2205.3											*X*	*X*			*X*								
2205.4											*X*	*X*			*X*								
2206.2.1											*X*	*X*			*X*								
2207.4											*X*	*X*			*X*								
2207.6											*X*	*X*			*X*								
2208.1											*X*	*X*			*X*								
2210.1.1.2											*X*	*X*			*X*								
2210.2											*X*	*X*			*X*								
2211.1.1.2											*X*	*X*			*X*								
2211.1.3											*X*	*X*			*X*								
2211.2											*X*	*X*			*X*								
2213											*X*	*X*			*X*								

The state agency does not adopt sections identified with the following symbol: †
The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 22

STEEL

User notes:

About this chapter: *Chapter 22 provides the minimum requirements for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. This chapter specifies appropriate design and construction standards for these types of structures. It also provides a road map of the applicable technical requirements for steel structures. Chapter 22 requires that the design and use of steel structures and components be in accordance with the applicable specifications and standards of the American Institute of Steel Construction, the American Iron and Steel Institute, the Steel Joist Institute and the American Society of Civil Engineers.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2019 (Group B) Code Development Cycle. See explanation on page ix.*

SECTION 2201 GENERAL

2201.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 22 is as follows:*

1. *Office of Statewide Health Planning and Development (OSHPD).*

   Buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings regulated by OSHPD. Applications listed in Sections 1.10.1, 1.10.2 and 1.10.5.

2. *Structures regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.*

2201.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Office of Statewide Health Planning and Development:*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 5] *- For applications listed in Section 1.10.5*

2. *Division of the State Architect - Structural Safety/ Community Colleges:*

[DSA-SS/CC] *- For applications listed in Section 1.9.2.2*

2201.1.3 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapter 17, the provisions in Chapter 17A shall apply instead.*

2201.1.4 Amendments. [DSA-SS/CC, OSHPD] *See Section 2212 for additional requirements.*

[OSHPD 1R, 2 & 5] *See Section 2213 for additional requirements.*

SECTION 2202 IDENTIFICATION OF STEEL FOR STRUCTURAL PURPOSES

2202.1 General. Identification of structural steel elements shall be in accordance with AISC 360. Identification of cold-formed steel members shall be in accordance with AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S240 or AISI S220, as applicable. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.

SECTION 2203 PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

2203.1 General. Painting of structural steel elements shall be in accordance with AISC 360. Painting of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall be in accordance with AISI S240 or AISI S220, as applicable.

SECTION 2204 CONNECTIONS

2204.1 Welding. The details of design, workmanship and technique for welding and qualification of welding personnel shall be in accordance with the specifications listed in Sec-

tions 2205, 2206, 2207, 2208, 2210 and 2211. For special inspection of welding, see Section 1705.2.

2204.1.1 Restrained welded connections. [OSHPD 1R, 2 & 5] *Welded structural steel connections having a medium or high level of restraint, as defined by AWS D1.1 Annex H, shall have a minimum pre-heat temperature of not less than 150°F (66°C). Welded structural steel connections with welds to flange, web, wall or plate having a high level of restraint shall maintain a post-heat temperature of 300°F (149°C) for a minimum of 1 hour after completion of welding.*

2204.2 Bolting. The design, installation and inspection of bolts shall be in accordance with the requirements of Sections 2205, 2206, 2207, 2210 and 2211. For special inspection of the installation of high-strength bolts, see Section 1705.2.

2204.3 Anchor rods. Anchor rods shall be set in accordance with the approved construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts but shall not be greater than the length of the threads on the bolts.

2204.4 Column base plate. [OSHPD 1R, 2 & 5] *When shear and / or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs into the reinforced concrete foundation element and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than $^1/_8$ inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.*

SECTION 2205
STRUCTURAL STEEL

2205.1 General. The design, fabrication and erection of structural steel elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exceptions: [OSHPD 1R, 2 & 5]

1. *For members designed on the basis of tension, the slenderness ratio (L/r) shall not exceed 300, except for the design of hangers and bracing in accordance with NFPA 13 and for rod hangers in tension.*
2. *For members designed on the basis of compression, the slenderness ratio (KL/r) shall not exceed 200, except for the design of hangers and bracing in accordance with NFPA 13.*

2205.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2205.2.1 or 2205.2.2, as applicable.

2205.2.1 Structural steel seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems shall be in accordance with the provisions of Section 2205.2.1.1 or 2205.2.1.2, as applicable.

2205.2.1.1 Seismic Design Category B or C. Structures assigned to Seismic Design Category B or C shall be of any construction permitted in Section 2205. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of structures assigned to Seismic Design Category B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

Exception: The response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

2205.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1. ***[OSHPD 1R, 2 & 5]*** *All structural steel seismic force-resisting systems in ASCE 7 Table 15.4-1 shall be designed in accordance with AISC 341.*

2205.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting systems other than those covered in Section 2205.2.1, including struts, collectors, chords and foundation elements, shall be in accordance with AISC 341 where either of the following applies:

1. The structure is assigned to Seismic Design Category D, E or F, except as permitted in ASCE 7, Table 15.4-1.
2. A response modification coefficient, R, greater than 3 in accordance with ASCE 7, Table 12.2-1, is used for the design of the structure assigned to Seismic Design Category B or C.

2205.3 Modifications to AISC 341. [OSHPD 1R, 2 & 5]

2205.3.1 Section A4. *Replace Section A4.1 Item (c) as follows:*

(c) Locations and dimensions of protected zones. The fabricator shall permanently mark protected zones of structural elements in the seismic force-resisting system in the building that are designated on the construction documents. If these markings are obscured during construction, such as after the application of fire protection, the owner's designated representative shall re-mark the protected zones as they are designated on the construction documents. Primers or paints used to mark protected zones on steel surfaces, which are to receive sprayed fire-resistance material, shall comply with California Building Code Section 704.13.3.2.

2205.3.2 Section I2. *Replace Section I2.1 item (d) as follows:*

(d) Decking attachments that penetrate the beam flange shall not be placed on beam flanges within the protected zone, except power-actuated fasteners up to 0.18 in. diameter are permitted, provided that the penetration is less than 85% of beam flange thickness.

2205.4 Modifications to AISC 358. [OSHPD 1R, 2 & 5]

2205.4.1 Design Requirements, 2.1 Special and Intermediate Moment Frame Connection Types, Table 2-1 Prequalified Moment Connections modifications. *The prequalified bolted moment connections are not permitted in buildings.*

Exceptions:

1. *Erection bolts are permitted.*
2. *The approved moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206.2.*
3. *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

2205.4.2 Moment Connection - Chapter 11. *The welded sideplate steel moment connection shall be permitted provided:*

1. *The beams shall consist of either rolled or built-up wide flange sections.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *For SMF and IMF systems, U-shaped cover plates shall be used and the hinge-to-hinge span to beam depth, L_h/d, shall be greater than or equal to 5.*
4. *The width-to-thickness ratios for beam flanges shall not be less than 3.*
5. *The spacing for lateral bracing of wide flange beams, L_b, shall include the length of the side plate at beam ends.*
6. *The extension of the side plates beyond the face of the column shall be within the range of 0.77d to 1.0d.*
7. *The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.*
8. *Demand critical fillet welds {2}, {5}, {5a} and {7} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the start/stop location.*

SECTION 2206
COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

2206.1 General. Systems of structural steel elements acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 14.

2206.2 Seismic design. Where required, the seismic design, fabrication and erection of composite steel and concrete systems shall be in accordance with Section 2206.2.1.

2206.2.1 Seismic requirements for composite structural steel and concrete construction. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

[OSHPD 1R, 2 & 5] *Seismic requirements for composite structural steel and concrete construction shall be considered as an alternative system.*

Exception:

Steel and concrete composite special moment frame with the approved moment connection in accordance with AISC 358 Chapter 10 shall be permitted provided:

a. *Beams are provided with Reduced Beam Sections (RBS);*
b. *Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $^1/_4$ inch fillet weld; and*
c. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^1/_2$ inch.*

SECTION 2207
STEEL JOISTS

2207.1 General. The design, manufacture and use of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200, as applicable.

2207.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205.2 or 2211.1.1.

2207.2 Design. The registered design professional shall indicate on the construction documents the steel joist and steel joist girder designations from the specifications listed in Section 2207.1; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from the SJI specifications listed in Section 2207.1, bridging termination connections and bearing

connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
    1.1. Concentrated loads.
    1.2. Nonuniform loads.
    1.3. Net uplift loads.
    1.4. Axial loads.
    1.5. End moments.
    1.6. Connection forces.
2. Special considerations including:
    2.1. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
    2.2. Oversized or other nonstandard web openings.
    2.3. Extended ends.
3. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.

2207.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and steel joist girders in accordance with the SJI specifications listed in Section 2207.1 to support the load requirements of Section 2207.2. The registered design professional shall be permitted to require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. Where requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from the SJI specifications listed in Section 2207.1, such as cantilevered conditions and net uplift.
2. Connection design for:
    2.1. Connections that differ from the SJI specifications listed in Section 2207.1, such as flush-framed or framed connections.
    2.2. Field splices.
    2.3. Joist headers.

2207.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the approved construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207.2 and used in the design of the steel joists and joist girders as specified in the approved construction documents.
2. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
3. Connection requirements for:
    3.1. Joist supports.
    3.2. Joist girder supports.
    3.3. Field splices.
    3.4. Bridging attachments.
4. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
5. Size, location and connections for bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

2207.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that work was performed in accordance with approved construction documents and with SJI specifications listed in Section 2207.1.

2207.6 Joist chord bracing. [OSHPD 1R, 2 & 5] *The chords of all joists shall be laterally supported at all points where the chords change direction.*

SECTION 2208
STEEL CABLE STRUCTURES

2208.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19. ***[OSHPD 1R, 2 & 5]*** *Steel cables with glass or polymer fabric material acting as a tensile membrane structure is an alternative system.*

SECTION 2209
STEEL STORAGE RACKS

2209.1 Storage racks. The design, testing and utilization of storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.1. Where required by ASCE 7, the seismic design of storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.2 Cantilevered steel storage racks. The design, testing, and utilization of cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3. Where required by ASCE 7, the seismic design of cantilevered steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

SECTION 2210
COLD-FORMED STEEL

2210.1 General. The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-

formed steel light-frame construction shall comply with Section 2211. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210.2.

*[**OSHPD 1R, 2 & 5**] Modify AISI S100 Chapter J (Connections and Joints, Section J7.2) by the following: Power-actuated fastener allowable design strength shall not exceed that permitted in the evaluation report qualified by ICC AC 70 or ASCE 7 Section 13.4.5.*

2210.1.1 Steel decks. The design and construction of cold-formed steel decks shall be in accordance with this section.

2210.1.1.1 Noncomposite steel floor decks. Noncomposite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

2210.1.1.2 Steel roof deck. Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0. ***[OSHPD 1R, 2 & 5]*** *The base material thickness of the steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: *For single-story, nonbuilding structures similar to buildings, the minimum deck thickness need not apply if the steel roof deck is not being used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

2210.1.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C.

2210.2 Seismic requirements for cold-formed steel structures. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100, ASCE 8, or, for cold-formed steel special-bolted moment frames, AISI S400. ***[OSHPD 1R, 2 & 5]*** *Cold-formed steel structures shall be designed and detailed in accordance with the requirements of AISI S100 and AISI S400. Cold-formed steel special bolted moment frames are not permitted by OSHPD.*

SECTION 2211
COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2211.1 Structural framing. For cold-formed steel light-frame construction, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections 2211.1.1 through 2211.1.3, as applicable:

1. Floor and roof systems.
2. Structural walls.
3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

2211.1.1 Seismic requirements for cold-formed steel structural systems. The design of cold-formed steel light-frame construction to resist seismic forces shall be in accordance with the provisions of Section 2211.1.1.1 or 2211.1.1.2, as applicable.

2211.1.1.1 Seismic Design Categories B and C. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel light-frame construction assigned to Seismic Design Category B or C, the seismic force-resisting system shall be designed and detailed in accordance with the requirements of AISI S400.

Exception: The response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISI S240 and need not be designed and detailed in accordance with AISI S400

2211.1.1.2 Seismic Design Categories D through F. In cold-formed steel light-frame construction assigned to Seismic Design Category D, E or F, the seismic force-resisting system shall be designed and detailed in accordance with AISI S400.

[OSHPD 1R, 2 & 5]:

1. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*
2. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI S400 are not permitted within the seismic force-resisting system of buildings.*

2211.1.2 Prescriptive framing. Detached one- and two-family dwellings and townhouses, less than or equal to three stories above grade plane, shall be permitted to be constructed in accordance with AISI S230 subject to the limitations therein.

2211.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2211.1.3.1. through 2211.1.3.3.

*[**OSHPD 1R, 2 & 5**] Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required, the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.*

2211.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing.

2211.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705.2.

2211.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704.2.5 and 1705.2, as applicable.

2211.2 Nonstructural members. For cold-formed steel light-frame construction, the design and installation of nonstructural members and connections shall be in accordance with AISI S220. ***[OSHPD 1R, 2 & 5]*** *for noncomposite assembly design. Where nonstructural members do not qualify for design under AISI S220, the design and installation of nonstructural members and connections shall be in accordance with AISI S240 or S100.*

SECTION 2212
ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

2212.1 Connections.

2212.1.1 Column base plate. *When shear and/or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs into the reinforced concrete foundation element and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than $^1/_8$ inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.*

2212.2 Modifications to AISC 341.

2212.2.1 Section B5. *Modify Section B5.2(a) as follows:*

(a) The forces specified in this section need not be applied to the diagonal members of the truss diaphragms and their connections, where *each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance and where* these members and connections conform to the requirements of Sections F2.4a, F2.5a, F2.5b and F2.6c. Braces in K- or V- configurations and braces supporting gravity loads other than self-weight are not permitted under this exception.

2212.2.2 Section D2. *Modify Section D2.6c(b)(2) as follows:*

(2) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

2212.3 Seismic requirements for composite structural steel and concrete construction. *In addition to the requirements of Section 2206.2, steel and concrete composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted provided:*

1. *Beams are provided with reduced beam sections (RBS);*
2. *Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $^1/_4$-inch fillet weld; and*
3. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^1/_2$ inch.*

2212.4 Steel joists.

2212.4.1 Design approval. *Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with Title 24, Part 1. Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.*

2212.4.2 Joist chord bracing. *The chords of all joists shall be laterally supported at all points where the chords change direction.*

2212.5 Cold-formed steel light-frame construction.

2212.5.1 Trusses.

2212.5.1.1 Analysis submittals. *Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.*

2212.5.1.2 Deferred submittals. *Deferred submittal per Section I1.4.2 of AISI 202 is not permitted by DSA-SS/CC.*

2212.5.2 Anchorage for shear. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*

CHAPTER 22*A*

STEEL

SECTION 2201*A* GENERAL

2201*A*.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201A.1.1 Application. *The scope of application of Chapter 22A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state- owned or state-leased essential services buildings.*
2. *Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1, and 1.10.4. These applications include hospitals and correctional treatment centers.*

2201A.1.2 Amendments in this chapter. *DSA-SS and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:* ***[DSA-SS]*** *For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Health Planning and Development:*

   [OSHPD 1] - *For applications listed in Section 1.10.1.*

   [OSHPD 4] - *For applications listed in Section 1.10.4.*

SECTION 2202*A* IDENTIFICATION OF STEEL FOR STRUCTURAL PURPOSES

2202*A*.1 General. Identification of structural steel elements shall be in accordance with AISC 360. Identification of cold-formed steel members shall be in accordance with AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S240 or AISI S220, as applicable. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.

SECTION 2203*A* PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

2203*A*.1 General. Painting of structural steel elements shall be in accordance with AISC 360. Painting of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall be in accordance with AISI S240 or AISI S220, as applicable.

SECTION 2204*A* CONNECTIONS

2204*A*.1 Welding. The details of design, workmanship and technique for welding and qualification of welding personnel shall be in accordance with the specifications listed in Sections 2205*A*, 2206*A*, 2207*A*, 2208*A*, 2210*A* and 2211*A*. For special inspection of welding, see Section 1705*A*.2.

2204A.1.1 Restrained welded connections. [OSHPD 1 & 4] *Welded structural steel connections having a medium or high level of restraint, as defined by AWS D1.1 Annex H, shall have a minimum pre-heat temperature of not less than 150°F (66°C). Welded structural steel connections with welds to flange, web, wall or plate having a high level of restraint shall maintain a post-heat temperature of 300°F (149°C) for a minimum of 1 hour after completion of welding.*

2204*A*.2 Bolting. The design, installation and inspection of bolts shall be in accordance with the requirements of Sections 2205*A*, 2206*A*, 2207*A*, 2210*A* and 2211*A*. For special inspection of the installation of high-strength bolts, see Section 1705*A*.2.

2204*A*.3 Anchor rods. Anchor rods shall be set in accordance with the approved construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts but shall not be greater than the length of the threads on the bolts.

2204A.4 Column base plate. *When shear and/or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted*

in base plates by AISC 360 by use of shear lugs into the reinforced concrete foundation element and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than $^{1}/_{8}$ inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.

SECTION 2205*A*
STRUCTURAL STEEL

2205*A*.1 General. The design, fabrication and erection of structural steel elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exceptions: [OSHPD 1 & 4]

1. *For members designed on the basis of tension, the slenderness ratio (L/r) shall not exceed 300, except for design of hangers and bracing in accordance with NFPA 13 and for rod hangers in tension.*
2. *For members designed on the basis of compression, the slenderness ratio (KL/r) shall not exceed 200, except for design of hangers and bracing in accordance with NFPA 13.*

2205*A*.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2205*A*.2.1 or 2205*A*.2.2, as applicable.

2205*A*.2.1 Structural steel seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems shall be in accordance with the provisions of Section 2205*A*.2.1.1 or 2205*A*.2.1.2, as applicable.

2205*A*.2.1.1 Seismic Design Category B or C. *Not permitted by DSA-SS and OSHPD.*

2205*A*.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341.

2205*A*.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting systems other than those covered in Section 2205*A*.2.1, including struts, collectors, chords and foundation elements, shall be in accordance with AISC 341.

2205A.3 Modifications to AISC 341. [DSA-SS]

2205A.3.1 Section B5. *Modify Section B5.2(a) as follows:*

(a) The forces specified in this section need not be applied to the diagonal members of the truss diaphragms and their connections, where *each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance and where* these members and connections conform to the requirements of Sections F2.4a, F2.5a, F2.5b and F2.6c. Braces in K- or V- configurations and braces supporting gravity loads other than self-weight are not permitted under this exception.

2205A.3.2 Section D2. *Modify Section D2.6c(b)(2) as follows:*

(2) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

2205A.4 Modifications to AISC 341. [OSHPD 1 and 4]

2205A.4.1 Glossary. *Modify glossary by adding the following:*

Inelastic Rotation: *The permanent or plastic portion of the rotation angle between a beam and the column, or between a link and the column of the test specimen, measured in radians. The inelastic rotation shall be computed based upon an analysis of the test specimen deformations. Sources of inelastic rotation include yielding of members and connectors, yielding of connection elements and slip between members and connection elements. For beam-to-column moment connections in special moment frames, the inelastic rotation is represented by the plastic chord rotation angle calculated as the plastic deflection of the beam or girder, at the center of its span divided by the distance between the center of the beam span and the centerline of the panel zone of the beam-column connection. For link-to-column connections in eccentrically braced frames, inelastic rotation shall be computed based upon the assumption that inelastic action is concentrated at a single point located at the intersection of the centerline of the link with the face of the column.*

2205A.4.2 Section A4. *Replace Section A4.1 Item (c) as follows:*

(c) Locations and dimensions of protected zones. The fabricator shall permanently mark protected zones of structural elements in the seismic force-resisting system in the building that are designated on the construction documents. If these markings are obscured during construction, such as after the application of fire protection, the owner's designated representative shall re-mark the protected zones as they are designated on the construction documents. [OSHPD 1 & 4] Primers or paints used to mark protected zones on steel surfaces, which are to receive sprayed fire-resistance material, shall comply with California Building Code Section 704.13.3.2.

2205A.4.3 Section I2. [OSHPD 1 & 4] *Replace Section I2.1 Item (d) as follows:*

(d) Decking attachments that penetrate the beam flange shall not be placed on beam flanges within the

protected zone, except power-actuated fasteners up to 0.18 inch in diameter are permitted, provided that the penetration is less than 85 percent of beam flange thickness.

2205A.4.4 Section E2. *Replace Section E2.6c Item (a) by the following:*

(a) Use of IMF connections designed in accordance with ANSI/AISC 358 shall be as modified in Section 2205A.5.2.

2205A.4.5 Section E3. *Replace Section E3.6b Item (a) by the following:*

(a) The connection shall be capable of sustaining an interstory drift angle of at least 0.04 radians and an inelastic rotation of 0.03 radians.

2205A.4.6 Section E3. *Replace Section E3.6c Item (a) by the following:*

(a) Use of SMF connections designed in accordance with ANSI /AISC 358 shall be as modified in Section 2205A.5.

2205A.4.7 Section F2. *Special concentrically braced frames (SCBF) modifications*

5b. Diagonal braces, Add a new section as follows.

(d) The use of rectangular or square HSS are not permitted for bracing members, unless filled solid with cement grout having a minimum compressive strength of 3000 psi at 28 days. The effects of composite action in the filled composite brace shall be considered in the sectional properties of the system where it results in the more severe loading condition or detailing.

2205A.4.8 Section F3. *Modify Section F3.6e Item 2 as follows:*

Exception is not permitted.

2205A.4.9 Section K2. *Replace Section K2.3b as follows:*

The size of the beam or link used in the test specimen shall be within the following limits:

1. *At least one of the test beams or links shall be no less than 100 percent of the depth of the prototype beam or link. For the remaining specimens, the depth of the test beam or link shall be no less than 90 percent of the depth of the prototype beam or link.*
2. *At least one of the test beams or links shall be no less than 100 percent of the weight per foot of the prototype beam or link. For the remaining specimens, the weight per foot of the test beam or link shall be no less than 75 percent of the weight per foot of the prototype beam or link.*

The size of the column used in the test specimen shall properly represent the inelastic action in the column, as per the requirements in Section K2.3a. In addition, the depth of the test column shall be no less than 90 percent of the depth of the prototype column.

Extrapolation beyond the limitations stated in this section shall be permitted subject to peer review and approval by the enforcement agency.

2205A.4.10 Section K2. *Modify Section K2.8 by the following:*

The test specimen must sustain the required interstory drift angle, or link rotation angle, and inelastic rotation for at least two complete loading cycles.

2205A.5 Modifications to AISC 358. [OSHPD 1 and 4]

2205A.5.1. *Design Requirements, 2.1 Special and Intermediate Moment Frame Connection Types, Table 2-1 Prequalified Moment Connections modifications.*

The prequalified bolted moment connections are not permitted in buildings.

Exceptions:

1. *Erection bolts are permitted.*
2. *The approved moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206A.2.*

2205A.5.2 Moment Connection - Chapter 11. *The welded side plate steel moment connection shall be permitted provided:*

1. *The beams shall consist of either rolled or built-up wide flange sections.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *For SMF and IMF systems, U-shaped cover plates shall be used and the hinge-to-hinge span to beam depth, L_h/d, shall be greater than or equal to 5.*
4. *The width-to-thickness ratios for beam flanges shall not be less than 3.*
5. *The spacing for lateral bracing of wide flange beams, L_b, shall include the length of the side plate at beam ends.*
6. *The extension of the side plates beyond the face of the column shall be within the range of 0.77d to 1.0d.*
7. *The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.*
8. *Demand critical fillet welds {2}, {5}, {5a} and {7} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the start/stop location.*

SECTION 2206*A*
COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

2206*A*.1 General. Systems of structural steel elements acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 14.

2206*A*.2 Seismic design. Where required, the seismic design, fabrication and erection of composite steel and concrete systems shall be in accordance with Section 2206*A*.2.1.

2206*A*.2.1 Seismic requirements for composite structural steel and concrete construction. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1, is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341 *and shall be considered as an alternative system.*

Exception: *Steel and concrete composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted, provided:*

1. *Beams are provided with reduced beam sections (RBS);*
2. *Web extension to beam web two-sided fillet weld welds are sized to develop expected strength of the beam web and shall not be less than a $^1/_4$ inch fillet weld; and*
3. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^1/_2$ inch.*

SECTION 2207*A*
STEEL JOISTS

2207*A*.1 General. The design, manufacture and use of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200, as applicable.

2207*A*.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205*A*.2 or 2211*A*.1.1.

2207*A*.2 Design. The registered design professional shall indicate on the construction documents the steel joist and steel joist girder designations from the specifications listed in Section 2207*A*.1; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from the SJI specifications listed in Section 2207*A*.1, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
   - 1.1. Concentrated loads.
   - 1.2. Nonuniform loads.
   - 1.3. Net uplift loads.
   - 1.4. Axial loads.
   - 1.5. End moments.
   - 1.6. Connection forces.
2. Special considerations including:
   - 2.1. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207*A*.1.
   - 2.2. Oversized or other nonstandard web openings.
   - 2.3. Extended ends.
3. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207*A*.1.

2207*A*.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and steel joist girders in accordance with the SJI specifications listed in Section 2207*A*.1 to support the load requirements of Section 2207*A*.2. The registered design professional shall be permitted to require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. Where requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from the SJI specifications listed in Section 2207*A*.1, such as cantilevered conditions and net uplift.
2. Connection design for:
   - 2.1. Connections that differ from the SJI specifications listed in Section 2207*A*.1, such as flush-framed or framed connections.
   - 2.2. Field splices.
   - 2.3. Joist headers.

2207*A*.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the approved construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207*A*.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207*A*.2 and used in the design of the steel joists and joist girders as specified in the approved construction documents.
2. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207*A*.1.
3. Connection requirements for:
   - 3.1. Joist supports.
   - 3.2. Joist girder supports.
   - 3.3. Field splices.
   - 3.4. Bridging attachments.

4. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207*A*.1.
5. Size, location and connections for bridging.
6. Joist headers.

2207A.4.1 Design approval. [DSA-SS] *Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.*

2207*A*.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704*A*.5 stating that work was performed in accordance with approved construction documents and with SJI specifications listed in Section 2207*A*.1.

2207A.6 Joist chord bracing. *The chords of all joists shall be laterally supported at all points where the chords change direction.*

SECTION 2208*A*
STEEL CABLE STRUCTURES

2208*A*.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19. *Steel cables with glass or polymer fabric material acting as a tensile membrane structure is an alternative system.*

SECTION 2209*A*
STEEL STORAGE RACKS

2209*A*.1 Storage racks. The design, testing and utilization of storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.1. Where required by ASCE 7, the seismic design of storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209*A*.2 Cantilevered steel storage racks. The design, testing, and utilization of cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3. Where required by ASCE 7, the seismic design of cantilevered steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

SECTION 2210*A*
COLD-FORMED STEEL

2210*A*.1 General. ***[DSA-SS, OSHPD 1 & 4]*** The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-frame construction shall comply with Section 2211*A*. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210*A*.2.

[OSHPD 1 & 4] *Modify AISI S100 Chapter J (Connections and Joints, Section J7.2) by the following: Power-actuated fastener available strength shall not exceed those strengths determined in accordance with Section 1617A.1.20 of this code.*

2210*A*.1.1 Steel decks. The design and construction of cold-formed steel decks shall be in accordance with this section.

2210*A*.1.1.1 Noncomposite steel floor decks. Noncomposite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

2210*A*.1.1.2 Steel roof deck. Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0. *The base material thickness of steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: [DSA-SS] *For single-story open structures, the minimum deck thickness may be waived if the steel roof deck need not be used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

2210*A*.1.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C.

2210*A*.2 Seismic requirements for cold-formed steel structures. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100 *and* AISI S400.

SECTION 2211*A*
COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2211*A*.1 Structural framing. For cold-formed steel light-frame construction, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections 2211*A*.1.1 through 2211*A*.1.3, as applicable:

1. Floor and roof systems.
2. Structural walls.

3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

2211*A*.1.1 Seismic requirements for cold-formed steel structural systems. The design of cold-formed steel light-frame construction to resist seismic forces shall be in accordance with the provisions of Section 2211*A*.1.1.1 or 2211*A*.1.1.2, as applicable.

2211*A*.1.1.1 Seismic Design Categories B and C. *Not permitted by DSA-SS and OSHPD.*

2211*A*.1.1.2 Seismic Design Categories D through F. In cold-formed steel light-frame construction assigned to Seismic Design Category D, E or F, the seismic force-resisting system shall be designed and detailed in accordance with AISI S400. *The following additional requirements apply:*

1. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*
2. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI 400 are not permitted within the seismic force-resisting system of buildings.*

2211*A*.1.2 Prescriptive framing. *Not permitted by DSA-SS and OSHPD.*

2211*A*.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2211*A*.1.3.1. through 2211*A*.1.3.3.

2211*A*.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing. *Deferred submittal per Section I1.4.2 is not permitted by DSA-SS.*

2211*A*.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705*A*.2.

2211*A*.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704*A*.2.5 and 1705*A*.2, as applicable.

2211*A*.2 Nonstructural members. For cold-formed steel light-frame construction, the design and installation of nonstructural members and connections shall be in accordance with AISI S220 *for noncomposite assembly design. Where nonstructural members do not qualify for design under AISI S220, the design and installation of nonstructural members and connections shall be in accordance with AISI S240 or S100.*

SECTION 2212A [DSA-SS] LIGHT MODULAR STEEL MOMENT FRAMES FOR PUBLIC ELEMENTARY AND SECONDARY SCHOOLS, AND COMMUNITY COLLEGES

2212A.1 General.

2212A.1.1 Configuration. *Light modular steel moment frame buildings shall be constructed of factory-assembled modules comprising a single-story moment-resisting space frame supporting a floor and roof. Individual modules shall not exceed a width of 14 feet (4.25 m) nor a length of 72 feet (22 m). All connections of beams to corner columns shall be designed as moment-resisting in accordance with the criteria of Section 2212A.2. Modules may be stacked to form multistory structures not exceeding 35 feet or two stories in height. When stacked modules are evaluated separately, seismic forces on each module shall be distributed in accordance with Section 12.8.3 of ASCE 7, considering the modules in the stacked condition. See Section 2212A.2.5 of this code.*

2212A.1.2 Design, fabrication and erection. *The design, fabrication and erection of light modular steel moment-frame buildings shall be in accordance with the AISC Specification for Structural Steel Buildings (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold Formed Structural Members (AISI/COS/NASPEC), as applicable, and the requirements of this section. The maximum dead load of the roof and elevated floor shall not exceed 25 psf and 50 psf (1197 Pa and 2394 Pa), respectively. The maximum dead load of the exterior walls shall not exceed 45 psf (2155 Pa).*

2212A.2 Seismic requirements. *In addition to the other requirements of this code, the design, materials and workmanship of light modular steel moment frames shall comply with the requirements of this section. The response modification coefficient R shall be equal to $3^1/_2$. C_d and Ω_0 shall be equal to 3.0.*

2212A.2.1 Base materials. *Beams, columns and connection materials shall be limited to those materials permitted under the AISC Specification for Structural Members (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold-Formed Structural Members (AISI/COS/NASPEC).*

2212A.2.2 Beam-to-column strength ratio. *At each moment-resisting connection the following shall apply:*

$$\frac{\sum S_{bi}F_{ybi}}{\sum S_{cj}F_{ycj}} \geq 1.4 \qquad \textbf{(Equation 22A-1)}$$

where:

F_{ybi} = *The specified yield stress of beam "i."*

F_{ycj} = *The specified yield stress of column "j."*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 23 – WOOD

(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	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	**X**																						
Adopt entire chapter as amended (amended sections listed below)				**X**	**X**			**X**	**X**	**X**	**X**	**X**		**X**	**X**								
Adopt only those sections that are listed below			**X**																		**X**		
Chapter / Section																							
2301.1				X																			
2301.1.1								X	X	X	X	X		X	X								
2301.1.2								X	X	X	X	X		X	X								
2301.1.3								X	X	X				X									
2301.1.3.1								X		X				X									
2301.1.3.2									X														
2301.1.4								X	X	X	X	X		X	X								
2301.2, Item 4, Exception										X		X		X									
2303.1.3.1								X	X	X	X	X		X	X								
2303.1.4.1								X	X	X	X	X		X	X								
2303.2 – 2303.2.9			X																				
2303.4.1.4.1, Exception 3								X	X	X	X	X		X	X								
2303.4.3.1								X	X	X	X	X		X	X								
2304.3.1.1				X																			
2304.3.4								X	X	X	X	X		X	X								
2304.4.1								X	X	X	X	X			X								
2304.10.1.1								X		X	X	X		X	X								
2304.12.1.1.1																					X		
2304.12.1.2, Exception								X		X	X	X		X	X								
2304.12.1.4.1								X		X	X	X		X	X								
2304.12.8																					X		
2304.12.9																					X		
2305.1.2								X	X	X	X	X		X	X								
2308.1				X	X																		
2308.2.7								X	X		X	X			X								
2309.1.1								X	X		X	X			X								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

SECTION 2305
GENERAL DESIGN REQUIREMENTS FOR LATERAL FORCE-RESISTING SYSTEMS

2305.1 General. Structures using wood-frame shear walls or wood-frame diaphragms to resist wind, seismic or other lateral loads shall be designed and constructed in accordance with AWC SDPWS and the applicable provisions of Sections 2305, 2306 and 2307.

2305.1.1 Openings in shear panels. Openings in shear panels that materially affect their strength shall be detailed on the plans and shall have their edges adequately reinforced to transfer all shearing stresses.

2305.1.2 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *See Section 2301.1.4 for modifications to AWC SDPWS.*

2305.2 Diaphragm deflection. The deflection of wood-frame diaphragms shall be determined in accordance with AWC SDPWS. The deflection (Δ_{dia}) of a blocked wood structural panel diaphragm uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-1. If not uniformly fastened, the constant 0.188 (For SI: 1/1627) in the third term shall be modified by an approved method.

$$\Delta_{dia} = 5vL^3/8EAW + vL/4Gt + 0.188Le_n + \Sigma(x\Delta_c)/2W \quad \textbf{(Equation 23-1)}$$

For SI: $\Delta_{dia} = 0.052vL^3/EAW + vL/4Gt + Le_n/1627 + \Sigma(x\Delta_c)/2W$

where:

A = Area of chord cross section, in square inches (mm^2).

E = Modulus of elasticity of diaphragm chords, in pounds per square inch (N/mm^2).

e_n = Staple slip, in inches (mm) [see Table 2305.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2(2)].

L = Diaphragm length (dimension perpendicular to the direction of the applied load), in feet (mm).

v = Induced unit shear in pounds per linear foot (plf) (N/mm).

W = Diaphragm width [in the direction of applied force, in feet (mm)].

x = Distance from chord splice to nearest support, in feet (mm).

Δ_c = Diaprhagm chord splice slip at the induced unit shear, in inches (mm).

Δ_{dia} = Maximum mid-span diaphragm deflection determined by elastic analysis, in inches (mm).

TABLE 2305.2(1)
e_n VALUES (inches) FOR USE IN CALCULATING DIAPHRAGM AND SHEAR WALL DEFLECTION DUE TO FASTENER SLIP (Structural I)[a, c]

LOAD PER FASTENER[b] (pounds)	FASTENER DESIGNATIONS
	14-Ga staple x 2 inches long
60	0.011
80	0.018
100	0.028
120	0.04
140	0.053
160	0.068

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

a. Increase e_n values 20 percent for plywood grades other than Structural I.

b. Load per fastener = maximum shear per foot divided by the number of fasteners per foot at interior panel edges.

c. Decrease e_n values 50 percent for seasoned lumber (moisture content < 19 percent).

2305.3 Shear wall deflection. The deflection of wood-frame shear walls shall be determined in accordance with AWC SDPWS. The deflection (Δ_{sw}) of a blocked wood structural panel shear wall uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-2.

$$\Delta_{sw} = 8vh^3/EAb + vh/4Gt + 0.75he_n + d_a h/b \quad \textbf{(Equation 23-2)}$$

For SI: $vh^3/3EAb + vh/Gt + \dfrac{he_n}{407.6} + d_a h/b$

where:

A = Area of end-post cross section in square inches (mm^2).

b = Shear wall length, in feet (mm).

d_a = Total vertical elongation of wall anchorage system (such as fastener slip, device elongation, rod elongation) at the induced unit shear in the shear wall (v).

E = Modulus of elasticity of end posts, in pounds per square inch (N/mm^2).

e_n = Staple slip, in inches (mm) [see Table 2305.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2(2)].

h = Shear wall height, in feet (mm).

v = Induced unit shear, in pounds per linear foot (N/mm).

Δ_{sw} = Maximum shear wall deflection determined by elastic analysis, in inches (mm).

TABLE 2305.2(2)
VALUES OF *Gt* FOR USE IN CALCULATING DEFLECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS AND DIAPHRAGMS

PANEL TYPE	SPAN RATING	VALUES OF *Gt* (lb/in. panel depth or width)							
		Structural Sheathing				Structural I			
		Plywood			OSB	Plywood			OSB
		3-ply	4-ply	5-ply[a]		3-ply	4-ply	5-ply[a]	
Sheathing	24/0	25,000	32,500	37,500	77,500	32,500	42,500	41,500	77,500
	24/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	32/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	40/20	28,500	37,000	43,000	88,500	37,000	48,000	47,500	88,500
	48/24	31,000	40,500	46,500	96,000	40,500	52,500	51,000	96,000
Single Floor	16 o.c.	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	20 o.c.	28,000	36,500	42,000	87,000	36,500	47,500	46,000	87,000
	24 o.c.	30,000	39,000	45,000	93,000	39,000	50,500	49,500	93,000
	32 o.c.	36,000	47,000	54,000	110,000	47,000	61,000	59,500	110,000
	48 o.c.	50,500	65,500	76,000	155,000	65,500	85,000	83,500	155,000

		Structural Sheathing			Structural I		
	Thickness (in.)	A-A, A-C	Marine	All Other Grades	A-A, A-C	Marine	All Other Grades
Sanded Plywood	1/4	24,000	31,000	24,000	31,000	31,000	31,000
	11/32	25,500	33,000	25,500	33,000	33,000	33,000
	3/8	26,000	34,000	26,000	34,000	34,000	34,000
	15/32	38,000	49,500	38,000	49,500	49,500	49,500
	1/2	38,500	50,000	38,500	50,000	50,000	50,000
	19/32	49,000	63,500	49,000	63,500	63,500	63,500
	5/8	49,500	64,500	49,500	64,500	64,500	64,500
	23/32	50,500	65,500	50,500	65,500	65,500	65,500
	3/4	51,000	66,500	51,000	66,500	66,500	66,500
	7/8	52,500	68,500	52,500	68,500	68,500	68,500
	1	73,500	95,500	73,500	95,500	95,500	95,500
	1 1/8	75,000	97,500	75,000	97,500	97,500	97,500

For SI: 1 inch = 25.4 mm, 1 pound/inch = 0.1751 N/mm.

a. 5-ply applies to plywood with five or more layers. For 5-ply plywood with three layers, use values for 4-ply panels.

SECTION 2306
ALLOWABLE STRESS DESIGN

2306.1 Allowable stress design. The design and construction of wood elements in structures using allowable stress design shall be in accordance with the following applicable standards:

American Wood Council.

ANSI/AWC NDS National Design Specification for Wood Construction

SDPWS Special Design Provisions for Wind and Seismic

American Society of Agricultural and Biological Engineers.

ASABE EP 484.3 Diaphragm Design of Metal-clad, Wood-Frame Rectangular Buildings

ASABE EP 486.2 Shallow Post Foundation Design

ASABE EP 559.1 Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies

APA—The Engineered Wood Association.

ANSI 117 Standard Specifications for Structural Glued Laminated Timber of Softwood Species

ANSI A190.1 Structural Glued Laminated Timber

Panel Design Specification

Plywood Design Specification Supplement 1—Design & Fabrication of Plywood Curved Panel

Plywood Design Specification Supplement 2—Design & Fabrication of Glued Plywood-lumber Beams

Plywood Design Specification Supplement 3—
Design & Fabrication of Plywood Stressed-skin Panels

Plywood Design Specification Supplement 4—
Design & Fabrication of Plywood Sandwich Panels

Plywood Design Specification Supplement 5—
Design & Fabrication of All-plywood Beams

APA T300	Glulam Connection Details
APA S560	Field Notching and Drilling of Glued Laminated Timber Beams
APA S475	Glued Laminated Beam Design Tables
APA X450	Glulam in Residential Construction
APA X440	Product and Application Guide: Glulam
APA R540	Builders Tips: Proper Storage and Handling of Glulam Beams

Truss Plate Institute, Inc.

TPI 1	National Design Standard for Metal Plate Connected Wood Truss Construction

West Coast Lumber Inspection Bureau

AITC 104	Typical Construction Details
AITC 110	Standard Appearance Grades for Structural Glued Laminated Timber
AITC 113	Standard for Dimensions of Structural Glued Laminated Timber
AITC 119	Standard Specifications for Structural Glued Laminated Timber of Hardwood Species
AITC 200	Inspection Manual

2306.1.1 Joists and rafters. The design of rafter spans is permitted to be in accordance with the AWC STJR.

2306.1.2 Plank and beam flooring. The design of plank and beam flooring is permitted to be in accordance with the AWC *Wood Construction Data No. 4*.

2306.1.3 Treated wood stress adjustments. The allowable unit stresses for preservative-treated wood need not be adjusted for treatment, but are subject to other adjustments.

The allowable unit stresses for fire-retardant-treated wood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and the redrying process. Other adjustments are applicable except that the impact load duration shall not apply.

2306.1.4 Lumber decking. The capacity of lumber decking arranged according to the patterns described in Section 2304.9.2 shall be the lesser of the capacities determined for flexure and deflection according to the formulas in Table 2306.1.4.

2306.2 Wood-frame diaphragms. Wood-frame diaphragms shall be designed and constructed in accordance with AWC SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AWC SDPWS shall be met and the allowable shear values set forth in Table 2306.2(1) or 2306.2(2) shall be permitted. The allowable shear values in Tables 2306.2(1) and 2306.2(2) are permitted to be increased 40 percent for wind design.

2306.2.1 Gypsum board diaphragm ceilings. Gypsum board diaphragm ceilings shall be in accordance with Section 2508.6.

2306.3 Wood-frame shear walls. Wood-frame shear walls shall be designed and constructed in accordance with AWC SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AWC SDPWS shall be met and the allowable shear values set forth in Table 2306.3(1), 2306.3(2) or 2306.3(3) shall be permitted. The allowable shear values in Tables 2306.3(1) and 2306.3(2) are permitted to be increased 40 percent for wind design. Panels complying with ANSI/APA PRP-210 shall be permitted to use design values for Plywood Siding in the AWC SDPWS.

TABLE 2306.1.4
ALLOWABLE LOADS FOR LUMBER DECKING

PATTERN	ALLOWABLE AREA LOAD[a, b]	
	Flexure	Deflection
Simple span	$\sigma_b = \frac{8F_b'd^2}{l^2 6}$	$\sigma_\Delta = \frac{384\Delta E'd^3}{5l^4 12}$
Two-span continuous	$\sigma_b = \frac{8F_b'd^2}{l^2 6}$	$\sigma_\Delta = \frac{185\Delta E'd^3}{l^4 12}$
Combination simple- and two-span continuous	$\sigma_b = \frac{8F_b'd^2}{l^2 6}$	$\sigma_\Delta = \frac{131\Delta E'd^3}{l^4 12}$
Cantilevered pieces intermixed	$\sigma_b = \frac{20F_b'd^2}{3l^2 6}$	$\sigma_\Delta = \frac{105\Delta E'd^3}{l^4 12}$
Controlled random layup		
Mechanically laminated decking	$\sigma_b = \frac{20F_b'd^2}{3l^2 6}$	$\sigma_\Delta = \frac{100\Delta E'd^3}{l^4 12}$
2-inch decking	$\sigma_b = \frac{20F_b'd^2}{3l^2 6}$	$\sigma_\Delta = \frac{100\Delta E'd^3}{l^4 12}$
3-inch and 4-inch decking	$\sigma_b = \frac{20F_b'd^2}{3l^2 6}$	$\sigma_\Delta = \frac{116\Delta E'd^3}{l^4 12}$

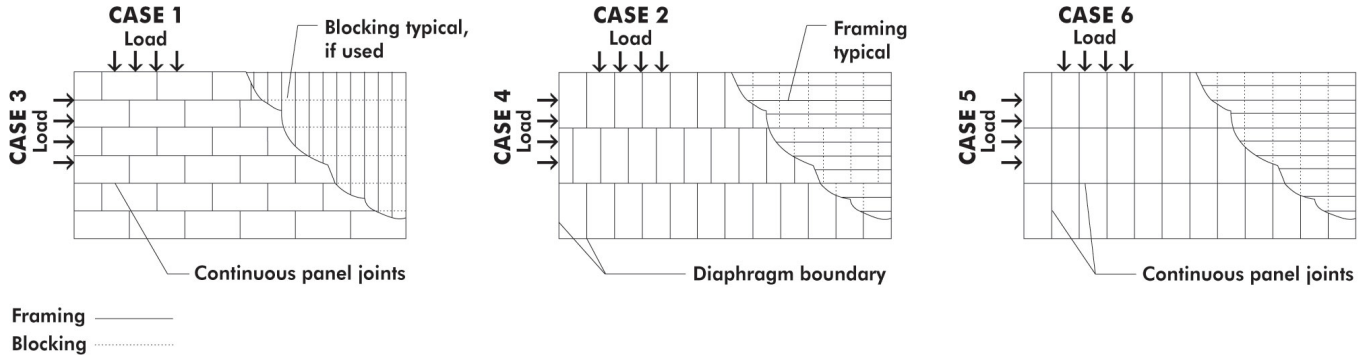
For SI: 1 inch = 25.4 mm.

a. σ_b = Allowable total uniform load limited by bending.
σ_Δ = Allowable total uniform load limited by deflection.

b. d = Actual decking thickness.
l = Span of decking.
F_b' = Allowable bending stress adjusted by applicable factors.
E' = Modulus of elasticity adjusted by applicable factors.

TABLE 2306.2(1)
ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS UTILIZING STAPLES WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING[f]

PANEL GRADE	STAPLE LENGTH AND GAGE[d]	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES[e] (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5, 6)[b]				Fasteners spaced 6 max. at supported edges[b]	
					6	4	$2^1/_2$[c]	2[c]	Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6)
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3		
Structural I grades	$1^1/_2$ 16 gage	1	$^3/_8$	2	175	235	350	400	155	115
				3	200	265	395	450	175	130
			$^{15}/_{32}$	2	175	235	350	400	155	120
				3	200	265	395	450	175	130
Sheathing, single floor and other grades covered in DOC PS 1 and PS 2	$1^1/_2$ 16 gage	1	$^3/_8$	2	160	210	315	360	140	105
				3	180	235	355	400	160	120
			$^7/_{16}$	2	165	225	335	380	150	110
				3	190	250	375	425	165	125
			$^{15}/_{32}$	2	160	210	315	360	140	105
				3	180	235	355	405	160	120
			$^{19}/_{32}$	2	175	235	350	400	155	115
				3	200	265	395	450	175	130



For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of lumber in ANSI/AWC NDS. (2) For staples find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.

b. Space fasteners maximum 12 inches on center along intermediate framing members (6 inches on center where supports are spaced 48 inches on center).

c. Framing at adjoining panel edges shall be 3 inches nominal or wider.

d. Staples shall have a minimum crown width of $^7/_{16}$ inch and shall be installed with their crowns parallel to the long dimension of the framing members.

e. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.

f. For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 24 – GLASS AND GLAZING

(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	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	**X**		**X**	**X**	**X**							**X**											
Adopt entire chapter as amended (amended sections listed below)								**X**	**X**	**X**	**X**			**X**	**X**								
Adopt only those sections that are listed below																							
Chapter / Section																							
2401.1.1								X	X	X	X	X		X	X								
2401.1.2								X	X														
2401.1.2, Exception 1										X	X	X		X	X								
2403.2.1								X	X	X	X	X		X	X								
Table 2403.2.1								X	X	X	X	X		X	X								
2410.1, Exception												X											
2410								X	X	X	X	X		X	X								
2411										X	X	X		X	X								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 25 – GYPSUM BOARD, GYPSUM PANEL PRODUCTS AND PLASTER

(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	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	**X**			**X**	**X**																		
Adopt entire chapter as amended (amended sections listed below)								**X**	**X**	**X**	**X**	**X**		**X**	**X**								
Adopt only those sections that are listed below																							
Chapter / Section																							
2501.1.1								X	X	X	X	X		X	X								
2501.1.2								X	X	X	X	X		X	X								
2501.1.3								X	X	X	X	X		X	X								
2503.2								X	X	X	X	X		X	X								
2503.2, Exception												X											
2504.2								X	X	X	X	X		X	X								
2504.2.1, Exception												X											
2505.3								X	X	X	X	X		X	X								
2505.3, Exception												X											
2507.3								X	X	X	X	X		X	X								
2507.3, Exception												X											
2508.6.6								X	X	X	X	X		X	X								
2508.6.6, Exception												X											
2514.1 *Exception*								X		X	X	X		X	X								

The state agency does not adopt sections identified with the following symbol: †
The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

TABLE 2506.2
GYPSUM BOARD AND GYPSUM PANEL PRODUCTS MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum board	ASTM C1047
Adhesives for fastening gypsum board	ASTM C557
Cold-formed steel studs and track, structural	AISI S240
Cold-formed steel studs and track, nonstructural	AISI S220
Elastomeric joint sealants	ASTM C920
Expandable foam adhesives for fastening gypsum wallboard	ASTM D6464
Factory-laminated gypsum panel products	ASTM C1766
Fiber-reinforced gypsum panels	ASTM C1278
Glass mat gypsum backing panel	ASTM C1178
Glass mat gypsum panel 5	ASTM C1658
Glass mat gypsum substrate	ASTM C1177
Joint reinforcing tape and compound	ASTM C474; C475
Nails for gypsum boards	ASTM C514, F547, F1667
Steel screws	ASTM C954; C1002
Standard specification for gypsum board	ASTM C1396
Testing gypsum and gypsum products	ASTM C22; C472; C473

TABLE 2507.2
LATH, PLASTERING MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum veneer base	ASTM C1047
Blended cement	ASTM C595
Cold-formed steel studs and track, structural	AISI S240
Cold-formed steel studs and track, non-structural	AISI S220
Exterior plaster bonding compounds	ASTM C932
Hydraulic cement	ASTM C1157; C1600
Gypsum casting and molding plaster	ASTM C59
Gypsum Keene's cement	ASTM C61
Gypsum plaster	ASTM C28
Gypsum veneer plaster	ASTM C587
Interior bonding compounds, gypsum	ASTM C631
Lime plasters	ASTM C5; C206
Masonry cement	ASTM C91
Metal lath	ASTM C847
Plaster aggregates Sand Perlite Vermiculite	 ASTM C35; C897 ASTM C35 ASTM C35
Plastic cement	ASTM C1328
Portland cement	ASTM C150
Steel screws	ASTM C1002; C954
Welded wire lath	ASTM C933
Woven wire plaster base	ASTM C1032

2507.3 Lath attachment to horizontal wood supports. [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.*

1. *Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches (76 mm) back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist and the ends of the wire secured together with three twists of the wire.*
2. *Secure lath to each support with $^{1}/_{2}$-inch-wide (12.7 mm), $1^{1}/_{2}$-inch-long (38mm) No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches (76 mm) from edge of each sheet. Such staples may be placed over ribs of $^{3}/_{8}$-inch (9.5 mm) rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.*

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

SECTION 2508
GYPSUM CONSTRUCTION

2508.1 General. Gypsum board, gypsum panel products and gypsum plaster construction shall be of the materials listed in Tables 2506.2 and 2507.2. These materials shall be assembled and installed in compliance with the appropriate standards listed in Tables 2508.1 and 2511.1.1 and Chapter 35.

TABLE 2508.1
INSTALLATION OF GYPSUM CONSTRUCTION

MATERIAL	STANDARD
Gypsum board and gypsum panel products	GA-216; ASTM C840
Gypsum sheathing and gypsum panel products	ASTM C1280
Gypsum veneer base	ASTM C844
Interior lathing and furring	ASTM C841
Steel framing for gypsum board and gypsum panel products	ASTM C754; C1007

2508.2 Limitations. Gypsum wallboard or gypsum plaster shall not be used in any exterior surface where such gypsum construction will be exposed directly to the weather. Gypsum wallboard shall not be used where there will be direct exposure to water or continuous high humidity conditions. Gypsum sheathing shall be installed on exterior surfaces in accordance with ASTM C1280.

2508.2.1 Weather protection. Gypsum wallboard, gypsum lath or gypsum plaster shall not be installed until weather protection for the installation is provided.

2508.3 Single-ply application. Edges and ends of gypsum board and gypsum panel products shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Edges and ends of gypsum board and gypsum panel products shall be in moderate contact except in concealed spaces where fire-resistance-rated construction, shear resistance or diaphragm action is not required.

2508.3.1 Floating angles. Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line are permitted to be omitted except on shear resisting elements or fire-resistance-rated assemblies. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.

2508.4 Adhesives. Gypsum board and gypsum panel products secured to framing with adhesives in ceiling assemblies shall be attached using an approved fastening schedule. Expandable foam adhesives for fastening gypsum wallboard shall conform to ASTM D6464. Other adhesives for the installation of gypsum wallboard shall conform to ASTM C557.

2508.5 Joint treatment. Gypsum board and gypsum panel product fire-resistance-rated assemblies shall have joints and fasteners treated.

Exception: Joint and fastener treatment need not be provided where any of the following conditions occur:

1. Where the gypsum board or the gypsum panel product is to receive a decorative finish such as wood paneling, battens, acoustical finishes or any similar application that would be equivalent to joint treatment.
2. On single-layer systems where joints occur over wood framing members.
3. Square edge or tongue-and-groove edge gypsum board (V-edge), gypsum panel products, gypsum backing board or gypsum sheathing.
4. On multilayer systems where the joints of adjacent layers are offset.
5. Assemblies tested without joint treatment.

2508.6 Horizontal gypsum board or gypsum panel product diaphragm ceilings. Gypsum board or gypsum panel products shall be permitted to be used on wood joists to create a horizontal diaphragm ceiling in accordance with Table 2508.6.

2508.6.1 Diaphragm proportions. The maximum allowable diaphragm proportions shall be $1^1/_2$:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted.

2508.6.2 Installation. Gypsum board or gypsum panel products used in a horizontal diaphragm ceiling shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of gypsum board shall not occur on the same joist.

2508.6.3 Blocking of perimeter edges. Perimeter edges shall be blocked using a wood member not less than 2-inch by 6-inch (51 mm by 152 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board or gypsum panel product.

2508.6.4 Fasteners. Fasteners used for the attachment of gypsum board or gypsum panel products to a horizontal diaphragm ceiling shall be as defined in Table 2508.6. Fasteners shall be spaced not more than 7 inches (178 mm) on center at all supports, including perimeter blocking, and not more than $^3/_8$ inch (9.5 mm) from the edges and ends of the gypsum board or gypsum panel product.

2508.6.5 Lateral force restrictions. Gypsum board or gypsum panel products shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction.

2508.6.6 Diaphragm ceiling connection to partitions. [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by partitions. Connection of diaphragm ceiling to the vertical lateral force resisting elements shall be designed and detailed to transfer lateral forces.*

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

SECTION 2509
SHOWERS AND WATER CLOSETS

2509.1 Wet areas. Showers and public toilet walls shall conform to Section 1209.2.

2509.2 Base for tile. Materials used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas shall be of materials listed in Table 2509.2 and installed in accordance with the manufacturer's recommendations. Water-resistant gypsum backing board shall be used as a base for tile in water closet compartment walls when installed in accordance with GA-216 or ASTM C840 and the manufacturer's recommendations. Regular gypsum wallboard is permitted under tile or wall panels in other wall and ceiling areas when installed in accordance with GA-216 or ASTM C840.

2509.3 Limitations. Water-resistant gypsum backing board shall not be used in the following locations:

1. Over a vapor retarder in shower or bathtub compartments.
2. Where there will be direct exposure to water or in areas subject to continuous high humidity.

CHAPTER 27
ELECTRICAL

User note:

About this chapter: *Electrical systems and components are integral to most structures; therefore it is necessary for the code to address their installation and protection. Structures depend on electricity for the operation of many life safety systems including fire alarm, smoke control and exhaust, fire suppression, fire command and communication systems. Since power supply to these systems is essential, Chapter 27 addresses where standby and emergency power must be provided.*

SECTION 2701
GENERAL

2701.1 Scope. The provisions of this chapter and NFPA 70 shall govern the design, construction, erection and installation of the electrical components, appliances, equipment and systems used in buildings and structures covered by this code. The *California Fire Code,* the *International Property Maintenance Code* and NFPA 70 shall govern the use and maintenance of electrical components, appliances, equipment and systems. The *California Existing Building Code* and NFPA 70 shall govern the alteration, repair, relocation, replacement and addition of electrical components, appliances, or equipment and systems.

SECTION 2702
EMERGENCY AND STANDBY POWER SYSTEMS

[F] 2702.1 General. Emergency power systems and standby power systems shall comply with Sections 2702.1.1 through 2702.1.8.

[F] 2702.1.1 Stationary generators. Stationary emergency and standby power generators required by this code shall be listed in accordance with UL 2200.

[F] 2702.1.2 Fuel-line piping protection. Fuel lines supplying a generator set inside a high-rise building shall be separated from areas of the building other than the room the generator is located in by an approved method, or an assembly that has a fire-resistance rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required fire-resistance rating shall be reduced to 1 hour.

[F] 2702.1.3 Installation. Emergency power systems and standby power systems required by this code or the *California Fire Code* shall be installed in accordance with the *California Fire Code*, NFPA 70, NFPA 110 and NFPA 111.

[F] 2702.1.4 Load transfer. Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. Standby power systems shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

[F] 2702.1.5 Load duration. Emergency power systems and standby power systems shall be designed to provide the required power for a minimum duration of 2 hours without being refueled or recharged, unless specified otherwise in this code.

[F] 2702.1.6 Uninterruptable power source. An uninterrupted source of power shall be provided for equipment where required by the manufacturer's instructions, the listing, this code or applicable referenced standards.

[F] 2702.1.7 Interchangeability. Emergency power systems shall be an acceptable alternative for installations that require standby power systems.

[F] 2702.1.8 Group I-2 occupancies. In Group I-2 occupancies located in flood hazard areas established in Section 1612.3, where new essential electrical systems are installed, and where new essential electrical system generators are installed, the systems and generators shall be located and installed in accordance with ASCE 24. Where connections for hookup of temporary generators are provided, the connections shall be located at or above the elevation required in ASCE 24.

[F] 2702.2 Where required. Emergency and standby power systems shall be provided where required by Sections 2702.2.1 through 2702.2.18.

[F] 2702.2.1 Ambulatory care facilities. Essential electrical systems for ambulatory care facilities shall comply with Section 422.6.

[F] 2702.2.2 Elevators and platform lifts. Standby power shall be provided for elevators and platform lifts as required in Sections 1009.4.1, 1009.5, 3003.1, 3007.8 and 3008.8.

[F] 2702.2.3 Emergency responder radio coverage systems. Standby power shall be provided for emergency responder radio coverage systems required in Section 918 and the *California Fire Code*. The standby power supply shall be capable of operating the emergency responder radio coverage system for a duration of not less than 12 hours at 100-percent system operation capacity.

[F] 2702.2.4 Emergency voice/alarm communication systems. Emergency power shall be provided for emergency voice/alarm communication systems as required in Section 907.5.2.2.5. The system shall be capable of powering the required load for a duration of not less than 24 hours, as required in NFPA 72.

[F] 2702.2.5 Exhaust systems. Standby power shall be provided for common exhaust systems for domestic kitchens located in multistory structures as required in Section 505.5 of the *California Mechanical Code.* Standby power shall be provided for common exhaust systems for clothes dryers located in multistory structures as required in Section 504.10 of the *California Mechanical Code* and Section 614.10 of the *California Fuel Gas Code*.

[F] 2702.2.6 Exit signs. Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] 2702.2.7 Gas detection system. Emergency or standby power shall be provided for gas detection systems in accordance with the *California Fire Code*.

[F] 2702.2.8 Group I-2 occupancies. Essential electrical systems for Group I-2 occupancies shall be in accordance with Section 407.11.

[F] 2702.2.9 Group I-3 occupancies. Emergency power shall be provided for power-operated doors and locks in Group I-3 occupancies as required in Section 408.4.2.

[F] 2702.2.10 Hazardous materials. Emergency or standby power shall be provided in occupancies with hazardous materials where required by the *California Fire Code*.

[F] 2702.2.11 High-rise buildings. Emergency and standby power shall be provided in high-rise buildings as required in Section 403.4.8.

[F] 2702.2.12 Laboratory suites. Standby or emergency power shall be provided in accordance with Section 5004.7 of the *California Fire Code* where laboratory suites are located above the sixth story above grade plane or located in a story below grade plane.

[F] 2702.2.13 Means of egress illumination. Emergency power shall be provided for means of egress illumination as required in Section 1008.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] 2702.2.14 Membrane structures. Standby power shall be provided for auxiliary inflation systems in permanent membrane structures as required in Section 3102.8.2. Standby power shall be provided for a duration of not less than 4 hours. Auxiliary inflation systems in temporary air-supported and air-inflated membrane structures shall be provided in accordance with Section 3103.10.4 of the *California Fire Code.*

[F] 2702.2.15 Semiconductor fabrication facilities. Emergency power shall be provided for semiconductor fabrication facilities as required in Section 415.11.10.

[F] 2702.2.16 Smoke control systems. Standby power shall be provided for smoke control systems as required in Sections 404.7, 909.11, 909.20.6.2 and 909.21.5.

[F] 2702.2.17 Special purpose horizontal sliding, accordion or folding doors. Standby power shall be provided for special purpose horizontal sliding, accordion or folding doors as required in Section 1010.1.4.3. The standby power supply shall have a capacity to operate not fewer than 50 closing cycles of the door.

[F] 2702.2.18 Underground buildings. Emergency and standby power shall be provided in underground buildings as required in Section 405.

2702.2.19 Group L Occupancy. *Secondary power shall be provided in Group L occupancies in accordance with this chapter and Section 453.4.6 and 453.4.6.1.*

[F] 2702.3 Critical circuits. Required critical circuits shall be protected using one of the following methods:

1. Cables, used for survivability of required critical circuits, that are listed in accordance with UL 2196 and have a fire-resistance rating of not less than 1 hour.
2. Electrical circuit protective systems having a fire-resistance rating of not less than 1 hour. Electrical circuit protective systems are installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 1 hour.

[F] 2702.4 Maintenance. Emergency and standby power systems shall be maintained and tested in accordance with the *California Fire Code*.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 31– SPECIAL CONSTRUCTION

(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	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter										X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)				X	X			X	X														
Adopt only those sections that are listed below	X		X			X	X																
Chapter / Section																							
3101			X																				
3102.1			X																				
3102.3.1			X																				
3103			X																				
3104			X																				
3104.2, *Exception 2*						X	X																
3105			X																				
3106			X																				
3109				†	†																		
3109.1								X	X														
3109.2	X																						
3110			X																				
3111			X																				
3111.1.1				X	X																		
3111.1.1, Exception								X	X														
3111.3				X	X			X	X														
3112.2				X																			
3112.3, Exception								X	X														
3113				†	†																		
3113.1								X	X														
3113.1.1								X	X														
3113.2, Exception								X	X														
3113.3, Exception								X	X														
3113.4, Exception								X	X														

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(c) Any backup safety system that an owner of a new swimming pool or spa may choose to install in addition to the requirements set forth in subdivisions (a) and (b) shall meet the standards as published in the document, "Guidelines for Entrapment Hazards: Making Pools and Spas Safer," Publication Number 363, March 2005, United States Consumer Product Safety Commission.

[Amended by Stats. 2012, Ch. 679, Sec. 2. (AB 2114) Effective January 1, 2013.]

115928.5. *Whenever a building permit is issued for the remodel or modification of an existing swimming pool, toddler pool, or spa, the permit shall require that the suction outlet or suction outlets of the existing swimming pool, toddler pool, or spa be upgraded so as to be equipped with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or a successor standard designated by the federal Consumer Product Safety Commission.*

[Amended by Stats. 2012, Ch. 679, Sec. 3. (AB 2114) Effective January 1, 2013.]

115929. *(a) The Legislature encourages a private entity, in consultation with the Epidemiology and Prevention for Injury Control Branch of the department, to produce an informative brochure or booklet, for consumer use, explaining the child drowning hazards of, possible safety measures for, and appropriate drowning hazard prevention measures for, home swimming pools and spas, and to donate the document to the department.*

(b) The Legislature encourages the private entity to use existing documents from the United States Consumer Product Safety Commission on pool safety.

(c) If a private entity produces the document described in subdivisions (a) and (b) and donates it to the department, the department shall review and approve the brochure or booklet.

(d) Upon approval of the document by the department, the document shall become the property of the state and a part of the public domain. The department shall place the document on its Web site in a format that is readily available for downloading and for publication. The department shall review the document in a timely and prudent fashion and shall complete the review within 18 months of receipt of the document from a private entity.

(Added by Stats. 2003, Ch. 422, Sec. 3. Effective January 1, 2004.)

SECTION 3110
AUTOMATIC VEHICULAR GATES

3110.1 General. Automatic vehicular gates shall comply with the requirements of Sections 3110.2 and 3110.3 and other applicable sections of this code.

3110.2 Vehicular gates intended for automation. Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

3110.3 Vehicular gate openers. Vehicular gate openers, where provided, shall be listed in accordance with UL 325.

SECTION 3111
SOLAR ENERGY SYSTEMS

3111.1 General. Solar energy systems shall comply with the requirements of this section.

3111.1.1 Wind resistance. Rooftop-mounted photovoltaic panels and modules and solar thermal collectors shall be designed in accordance with Section 1609.

Exception: [DSA-SS, DSA-SS/CC, HCD-1, HCD-2] *Rooftop-mounted photovoltaic panels and modules and solar thermal collectors shall be designed in accordance with Section 1510.7 of this code.*

3111.1.2 Roof live load. Roof structures that provide support for solar energy systems shall be designed in accordance with Section 1607.13.5.

3111.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with Section 2606.12, the *California Plumbing Code,* the *California Mechanical Code* and the *California Fire Code.*

3111.2.1 Equipment. Solar thermal systems and components shall be listed and labeled in accordance with ICC 900/SRCC 300 and ICC 901/SRCC 100.

3111.3 Photovoltaic solar energy systems. [DSA-SS, DSA-SS/CC, HCD-1, and HCD-2] Photovoltaic solar energy systems shall be designed and installed in accordance with this section, the *California Fire Code, California Electrical Code,* the manufacturer's installation instructions *and Section 1512 of this code.*

3111.3.1 Equipment. Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

3111.3.2 Fire classification. Rooftop-mounted photovoltaic systems shall have a fire classification in accordance with Section 1505.9. Building-integrated photovoltaic systems shall have a fire classification in accordance with Section 1505.8.

3111.3.3 Building-integrated photovoltaic systems. Building-integrated photovoltaic systems that serve as roof coverings shall be designed and installed in accordance with Section 1507.18.

3111.3.4 Access and pathways. Roof access, pathways and spacing requirements shall be provided in accordance with Section 1204 of the *California Fire Code.*

3111.3.5 Ground-mounted photovoltaic systems. Ground-mounted photovoltaic systems shall be designed and installed in accordance with Chapter 16 and the *California Fire Code.*

3111.3.5.1 Fire separation distances. Ground-mounted photovoltaic systems shall be subject to the fire separation distance requirements determined by the local jurisdiction.

SECTION 3112
GREENHOUSES

3112.1 General. The provisions of this section shall apply to greenhouses that are designed and used for the cultivation, maintenance, or protection of plants.

3112.2 Accessibility. ***[HCD 1]*** *Greenhouses accessory to covered multifamily dwellings, as defined in Chapter 2, used as a common use facility, shall be on an accessible route in accordance with Chapter 11A.*

3112.3 Structural design. Greenhouses shall comply with the structural design requirements for greenhouses in Chapter 16.

Exception: [DSA-SS and DSA-SS/CC] *Greenhouses considered to be school buildings shall comply with the structural design requirements in Chapter 16A and in accordance with Part 1, California Administrative Code, Title 24, C.C.R.*

3112.4 Glass and glazing. Glass and glazing used in greenhouses shall comply with Section 2405.

3112.5 Light-transmitting plastics. Light-transmitting plastics shall be permitted in lieu of plain glass in greenhouses and shall comply with Section 2606.

3112.6 Membrane structures. Greenhouses that are membrane structures shall comply with Section 3102.

3112.6.1 Plastic film. Plastic films used in greenhouses shall comply with Section 3102.3.

SECTION 3113
RELOCATABLE BUILDINGS

3113.1 General. The provisions of this section shall apply to relocatable buildings. Relocatable buildings manufactured after the effective date of this code shall comply with the applicable provisions of this code ***[DSA-SS and DSA-SS/CC]*** *as enforced by the enforcement agency.*

Exception: This section shall not apply to manufactured housing used as dwellings.

[HCD] *The provisions of Section 3113 are not applicable to commercial modulars, manufactured homes, mobilehomes, multi-unit manufactured housing, and special purpose commercial modulars as defined in Health and Safety Code Sections 18001.8, 18007, 18008, 18008.7 and 18012.5, respectively. These structures are subject to installation/reinstallation requirements specified in the Mobilehome Parks Act (Health and Safety Code Section 18200 et seq.) and the California Code of Regulations, Title 25, Division 1, Chapter 2. Manufactured homes must meet unit identification (data plate) and certification label requirements as specified in the Code of Federal Regulations, Title 24, Subtitle B, Chapter XX, Part 3280 and Health and Safety Code Section 18032. Commercial modulars and special purpose commercial modulars must meet identification requirements in the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 2.*

3113.1.1 Compliance. A newly constructed relocatable building shall comply with the requirements of this code for new construction ***[DSA-SS and DSA-SS/CC]*** *as enforced by the enforcement agency.* An existing relocatable building that is undergoing alteration, addition, change of occupancy or relocation shall comply with Chapter 14 of the *California Existing Building Code.*

Exception: [DSA-SS and DSA-SS/CC] *An existing relocatable public school building that is undergoing alteration, addition or change of occupancy shall comply with Chapter 3 of the California Existing Building Code.*

3113.2 Supplemental information. Supplemental information specific to a relocatable building shall be submitted to the authority having jurisdiction. It shall, as a minimum, include the following in addition to the information required by Section 105:

Exception: [DSA-SS and DSA-SS/CC] *Supplemental information specific to a relocatable building shall be submitted to the enforcement agency. It shall, as a minimum, include the following in addition to the information required by Section 1603A:*

1. Manufacturer's name and address.
2. Date of manufacture.
3. Serial number of module.
4. Manufacturer's design drawings.
5. Type of construction in accordance with Section 602.
6. Design loads including: roof live load, roof snow load, floor live load, wind load and seismic site class, use group and design category.
7. Additional building planning and structural design data.
8. Site-built structure or appurtenance attached to the relocatable building.

3113.3 Manufacturer's data plate. Each relocatable module shall have a data plate that is permanently attached on or adjacent to the electrical panel, and shall include the following information:

1. Occupancy group.
2. Manufacturer's name and address.
3. Date of manufacture.
4. Serial number of module.
5. Design roof live load, design floor live load, snow load, wind and seismic design.
6. Approved quality assurance agency or approved inspection agency.
7. Codes and standards of construction.
8. Envelope thermal resistance values.
9. Electrical service size.
10. Fuel-burning equipment and size.
11. Special limitations if any.

Exception: [DSA-SS and DSA-SS/CC] *Each relocatable module shall have two metal identification labels permanently attached to the structure as enforced by the enforcement agency.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 31F – MARINE OIL TERMINALS

(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	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter																							X
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

EXAMPLE

GENERAL INFORMATION

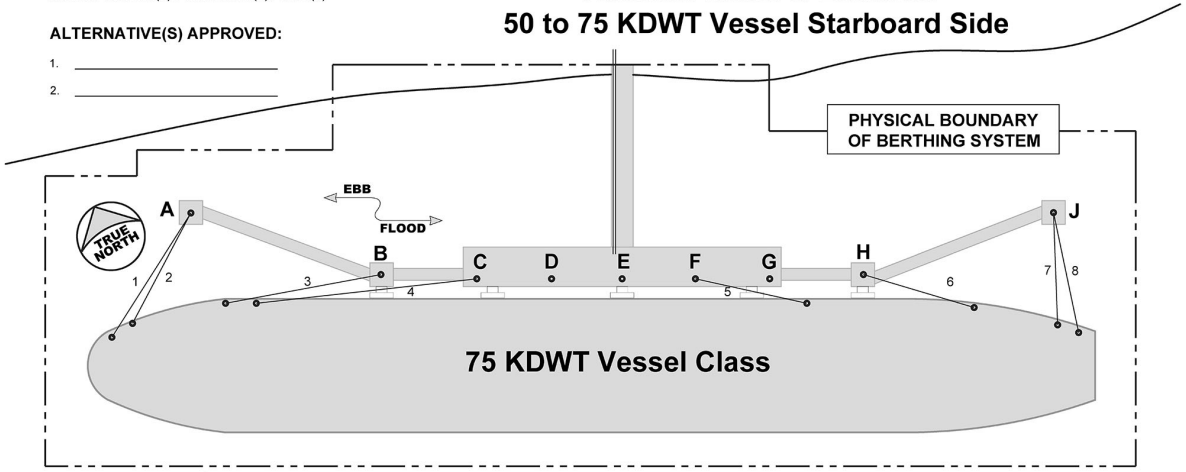
REFERENCE CALCULATION(S):

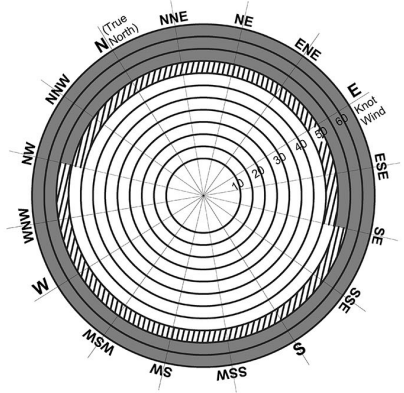
NAME OF REPORT(S) / PREPARER(S) / DATE(S)

ALTERNATIVE(S) APPROVED:

1. _____
2. _____

TERMINAL OPERATING LIMITS
Terminal Name & Location
50 to 75 KDWT Vessel Starboard Side





WIND RESTRICTION DIAGRAM
(WIND DIRECTION FROM)

LEGEND:

- **OPERATIONAL CONDITION**
- **SURVIVAL CONDITION:** TERMINATE PRODUCT TRANSFER & DISCONNECT PRODUCT LINES
- **DEPARTURE CONDITION:** DEPART BERTH

ENVIRONMENTAL CONDITION LIMITS

1. WIND RESTRICTION DIAGRAM IS APPLICABLE FOR:
   - MAXIMUM EBB CURRENT: 3.9 KNOTS TOWARDS, 290 DEG TO 310 DEG FROM NORTH
   - MAXIMUM FLOOD CURRENT: 2.6 KNOTS TOWARDS, 110 DEG TO 130 DEG FROM NORTH
   - WAVE PERIOD: T < 4.0 SEC
2. TERMINATE PRODUCT TRANSFER AND DISCONNECT IF CURRENT EXCEEDS MAGNITUDE OR DIRECTION STATED IN NOTE 1.

MOORING DEVICE INFORMATION

MOORING POINT	DEVICE TYPE	CAPACITY (KIPS)
A	DOUBLE HOOK	300 (150 PER HOOK)
B	DOUBLE HOOK	300 (150 PER HOOK)
C	BOLLARD	200
D	BOLLARD	OUT OF SERVICE
E	BOLLARD	200
F	BOLLARD	200
G	BOLLARD	OUT OF SERVICE
H	DOUBLE HOOK	300 (150 PER HOOK)
J	TRIPLE HOOK	450 (150 PER HOOK)

VESSEL DESCRIPTION:

DWT CAPACITY	74,900 LT
MAXIMUM ARRIVAL DISPLACEMENT	75,700 LT
MAXIMUM DRAFT	47.0 FT
MAXIMUM ARRIVAL DRAFT	38.0 FT
MAXIMUM LOA	750.0 FT
MAXIMUM BEAM	105.0 FT

BERTH DESCRIPTION:

MINIMUM WATER DEPTH	40.0 FT @ MLLW
MINIMUM UNDERKEEL CLEARANCE	2.0 FT

BERTHING NOTES:

1. MAXIMUM IMPACT VELOCITY = 0.33 FPS.
2. BERTHING IS NOT ALLOWED AT AN APPROACH ANGLE GREATER THAN 6 DEGREES.
3. NO BERTHING OPERATION WILL TAKE PLACE WITH WIND VELOCITIES GREATER THAN 38 KNOTS (43.7 MPH).

MOORING NOTES:

1. PASSING VESSEL EFFECTS ARE CONSIDERED IN THE MOORING ANALYSIS.
2. MAXIMUM ALLOWED:
   SURGE : +/- 10 FT.
   SWAY : +/- 2.0 FT.
3. STOP OPERATIONS IF A PASSING VESSEL WITH LOA > 250 FT IS WITHIN 300 FT.
4. DO NOT EXCEED ONE LINE PER HOOK.

MOORING LINE DESCRIPTION :

MINIMUM NO. OF LINES	8
NO. OF HEAD LINES	0
NO. OF AFT LINES	0
NO. OF BREAST LINES	2 FORWARD, 2 AFT
NO. OF SPRING LINES	2 FORWARD, 2 AFT

MINIMUM BREAKING LOAD, MBL: 165 KIPS
ACTUAL LINE LOADS NOT TO EXCEED __% OF MBL

REV. NO. & DATE

FIGURE 31F-2-1

Division 3

SECTION 3103F
STRUCTURAL LOADING CRITERIA

3103F.1 General. *Section 3103F establishes the environmental and operating loads acting on the marine oil terminal (MOT) structures and on moored vessel(s). The analysis procedures are presented in Sections 3104F – 3107F.*

3103F.2 Dead loads.

3103F.2.1 General. *Dead loads shall include the weight of the entire structure, including permanent attachments such as loading arms, pipelines, deck crane, fire monitor tower, gangway structure, vapor control equipment and mooring hardware. Unit weights specified in Section 3103F.2.2 may be used for MOT structures if actual weights are not available.*

3103F.2.2 Unit weights. *The unit weights in Table 31F-3-1 may be used for both existing and new MOTs.*

TABLE 31F-3-1
UNIT WEIGHTS

MATERIAL	UNIT WEIGHT (pcf)*
Steel or cast steel	490
Cast iron	450
Aluminum alloys	175
Timber (untreated)	40-50
Timber (treated)	45-60
Concrete, reinforced (normal weight)	145-160
Concrete, reinforced (lightweight)	90-120
Asphalt paving	150

* pounds per cubic foot

3103F.2.3 Equipment and piping area loads. *The equipment and piping area loads in Table 31F-3-2 may be used, as a minimum, in lieu of detailed as-built data.*

TABLE 31F-3-2
EQUIPMENT AND PIPING AREA LOADS

LOCATION	AREA LOADS (psf)***
Open areas	20*
Areas containing equipment and piping	35**
Trestle roadway	20*

* Allowance for incidental items such as railings, lighting, miscellaneous equipment, etc.

**35 psf is for miscellaneous general items such as walkways, pipe supports, lighting and instrumentation. Major equipment weight shall be established and added into this weight for piping manifold, valves, deck crane, fire monitor tower, gangway structure and similar ma/or equipment.

*** pounds per square foot

3103F.3 Live loads and buoyancy. *The following vertical live loading shall be considered, where appropriate: uniform loading, truck loading, crane loading and buoyancy. Additionally, MOT specific, nonpermanent equipment shall be identified and used in loading computations.*

3103F.4 Earthquake loads.

3103F.4.1 General. *Earthquake loads are described in terms of Peak Ground Acceleration (PGA), spectral acceleration and earthquake magnitude. The required seismic analysis procedures (Tables 31F-4-1 and 31F-4-2) are dependent on the spill classification obtained from Table 31F-1-1.*

3103F.4.2 Design earthquake motion parameters. *The earthquake ground motion parameters of peak ground acceleration, spectral acceleration and earthquake magnitude are modified for site amplification and near fault directivity effects. The resulting values are the Design Peak Ground Acceleration (DPGA), Design Spectral Acceleration (DSA) and Design Earthquake Magnitude (DEM).*

For Site Classes A through E (Section 3103F.4.2.1), peak ground and design spectral accelerations shall be obtained from:

1. *U.S. Geological Survey (USGS) published data as discussed in Section 3103F.4.2.2, or*
2. *A site-specific probabilistic seismic hazard analysis (PSHA) as discussed in Section 3103F.4.2.3.*

Site-specific PSHA is required for Site Class F.

Unless stated otherwise, the DSA values are for 5 percent damping; values at other levels may be obtained as per Section 3103F.4.2.9.

The appropriate probability levels associated with DPGA and DSA for different seismic performance levels are provided in Table 31F-4-1. Deterministic earthquake motions, which are used only for comparison to the probabilistic results, are addressed in Section 3103F.4.2.7.

The evaluation of Design Earthquake Magnitude (DEM), is discussed in Section 3103F.4.2.8. This parameter is required when acceleration time histories (Section 3103F.4.2.10) are addressed or if liquefaction potential (Section 3106F.4) is being evaluated.

3103F.4.2.1 Site classes. *The following Site Classes, defined in Section 3106F.2.1, shall be used in developing values of DSA and DPGA:*

A, B, C, D, E and F

For Site Class F, a site-specific response analysis is required per Section 3103F.4.2.5.

3103F.4.2.2 Earthquake motions from USGS maps. *Earthquake ground motion parameters can be obtained directly from the US Seismic Design Maps tool available at the USGS website (http://earthquake.usgs.gov) for the site condition(s) appropriate for the MOT site and the selected probability of exceedance. For this purpose, select the ASCE/SEI 41 [3.1] as the design code reference document, and specify the appropriate custom parameters, including but not limited to, location, required Probability of Exceedance (in 50 years), and appropriate Site Soil Classification(s) for the MOT*

ignored if it is in poor condition. These assumptions shall be used for the analysis, unless a detailed condition assessment and lateral analysis indicate that the existing bracing and connections may provide reliable lateral resistance.

A series of single pile analyses may be sufficient to establish the nonlinear springs required for the pushover analysis.

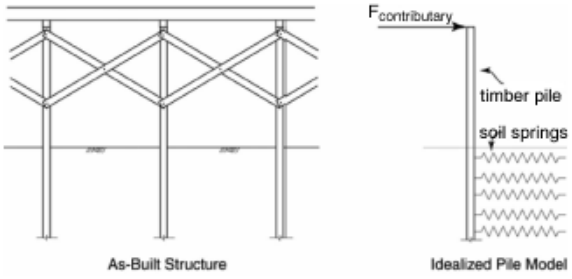


FIGURE 31F-4-3
SIMPLIFIED SINGLE PILE MODEL OF A TIMBER PILE SUPPORTED STRUCTURE

3104F.2.3.2 Nonlinear static demand procedure. *A nonlinear static procedure shall be used to determine the displacement demand for all concrete and steel structures, with the exception of irregular configurations with high or moderate spill classifications. A linear modal procedure is required for irregular structures with high or moderate spill classifications, and may be used for all other classifications in lieu of the nonlinear static procedure.*

In the nonlinear static demand procedure, deformation demand in each element shall be computed at the target node displacement demand. The analysis shall be conducted in each of the two orthogonal directions and results combined as described in Section 3104F.4.2.

The target displacement demand of the structure, Δ_d, shall be calculated from:

$$\Delta_d = S_A(T_e^2/4\pi^2) \qquad (4\text{-}1)$$

where:

T_e = *effective elastic structural period defined in Equation (4-3) or Equation (4-9)*

S_A = *spectral response acceleration corresponding to T_e*

If $T_e < T_0$, where T_0 is the period corresponding to the peak of the acceleration response spectrum, a refined analysis (see Section 3104F.2.3.2.1 or 3104F.2.3.2.2) shall be used to calculate the displacement demand. In the refined analysis, the target node displacement demand may be computed from the Coefficient Method (Section 3104F.2.3.2.1) or the Substitute Structure Method (Section 3104F.2.3.2.2). Both of these methods utilize the pushover curve developed in Section 3104F.2.3.1.

3104F.2.3.2.1 Coefficient Method. *The Coefficient Method is based on the procedures presented in ASCE/SEI 41 [4.3] and FEMA 440 [4.4].*

The first step in the Coefficient Method requires idealization of the pushover curve to calculate the effective elastic lateral stiffness, k_e, and effective yield strength, F_y, of the structure as shown in Figure 31F-4-4.

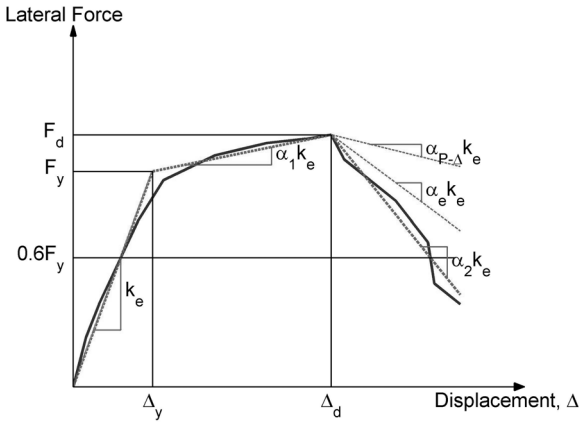


FIGURE 31F-4-4
IDEALIZATION OF PUSHOVER CURVE (ADAPTED FROM [4.3])

The first line segment of the idealized pushover curve shall begin at the origin and have a slope equal to the effective elastic lateral stiffness, k_e. The effective elastic lateral stiffness, k_e, shall be taken as the secant stiffness calculated at the lateral force equal to 60 percent of the effective yield strength, F_y, of the structure. The effective yield strength, F_y, shall not be taken as greater than the maximum lateral force at any point along the pushover curve.

The second line segment shall represent the positive post-yield slope ($\alpha_1 k_e$) determined by a point (F_d,Δ_d) and a point at the intersection with the first line segment such that the area above and below the actual curve area approximately balanced. (F_d,Δ_d) shall be a point on the actual pushover curve at the calculated target displacement, or at the displacement corresponding to the maximum lateral force, whichever is smaller.

The third line segment shall represent the negative post-yield slope ($\alpha_2 k_e$), determined by the point at the end of the positive post-yield slope (F_d,Δ_d) and the point at which the lateral force degrades to 60 percent of the effective yield strength.

The target displacement shall be calculated from:

$$\Delta_d = C_1 C_2 S_A \frac{T_e^2}{4\pi^2} \qquad (4\text{-}2)$$

where:

S_A = *spectral acceleration of the linear-elastic system at vibration period, which is computed from:*

$$T_e = 2\pi\sqrt{\frac{m}{k_e}} \qquad (4\text{-}3)$$

where:

m = *seismic mass as defined in Section 3104F.2.3*

k_e = *effective elastic lateral stiffness from idealized pushover*

C_1 = *modification factor to relate maximum inelastic displacement to displacement calculated for linear elastic response. For period less than 0.2 s, C_1 need not be taken greater than the value at T_e = 0.2 s. For period greater than 1.0 s, C_1 = 1.0. For all other periods:*

$$C_1 = 1 + \frac{\mu_{strength} - 1}{a T_e^2} \quad (4\text{-}4)$$

where:

a = *Site class factor*

= *130 for Site Class A or B,*

= *90 for Site Class C, and*

= *60 for Site Class D, E, or F.*

$\mu_{strength}$ = *ratio of elastic strength demand to yield strength coefficient calculated in accordance with Equation (4-6). The Coefficient Method is not applicable where $\mu_{strength}$ exceeds μ_{max} computed from Equation (4-7). $\mu_{strength}$ shall not be taken as less than 1.0.*

C_2 = *modification factor to represent the effects of pinched hysteresis shape, cyclic stiffness degradation, and strength deterioration on the maximum displacement response. For periods greater than 0.7s, C_2 = 1.0. For all other periods:*

$$C_2 = 1 + \frac{1}{800}\left(\frac{\mu_{strength} - 1}{T_e}\right)^2 \quad (4\text{-}5)$$

The strength ratio $\mu_{strength}$ shall be computed from:

$$\mu_{strength} = \frac{m S_A}{F_y} \quad (4\text{-}6)$$

where:

F_y = *effective yield strength of the structure in the direction under consideration from the idealized pushover curve.*

For structures with negative post-yield stiffness, the maximum strength ratio μ_{max} shall be computed from:

$$\mu_{max} = \frac{\Delta_d}{\Delta_y} + \frac{|\alpha_e|^{-h}}{4} \quad (4\text{-}7)$$

where:

Δ_d = *larger of target displacement or displacement corresponding to the maximum pushover force,*

Δ_y = *displacement at effective yield strength*

$$h = 1 + 0.15 \ln T_e \quad (4\text{-}8)$$

α_e = *effective negative post-yield slope ratio which shall be computed from:*

$$\alpha_e = \alpha_{P\text{-}\Delta} + \lambda(\alpha_2 - \alpha_{P\text{-}\Delta}) \quad (4\text{-}9)$$

where:

$\alpha_{P\text{-}\Delta}$, and the maximum negative post-elastic stiffness ratio, α_2, are estimated from the idealized force-deformation curve, and λ is a near-field effect factor equal to 0.8 for sites with 1 second spectral value, S_1 greater than or equal to 0.6g and equal to 0.2 for sites with 1 second spectral value, S_1 less than 0.6g.

3104F.2.3.2.2 Substitute Structure Method. *The Substitute Structure Method is based on the procedure presented in Priestley et al. [4.5] and ASCE/COPRI 61 [4.2]. This method is summarized below.*

1. *Idealize the pushover curve from nonlinear pushover analysis, as described in Section 3104F.2.3.2.1, and estimate the effective yield strength, F_y, and yield displacement, Δ_y.*
2. *Compute the effective elastic lateral stiffness, k_e, as the effective yield strength, F_y, divided by the yield displacement, Δ_y.*
3. *Compute the structural period in the direction under consideration from:*

$$T_e = 2\pi\sqrt{\frac{m}{k_e}} \quad (4\text{-}10)$$

where:

m = *seismic mass as defined in Section 3104F.2.3*

k_e = *effective elastic lateral stiffness in direction under consideration*

4. *Determine target displacement, Δ_d, of the effective linear elastic system from:*

$$\Delta_d = S_A \frac{T_e^2}{4\pi^2} \quad (4\text{-}11)$$

where:

S_A = *the 5 percent damped spectral displacement corresponding to the linear elastic structural period, T_e*

Select the initial estimate of the displacement demand as $\Delta_{d,i} = \Delta_d$.

5. *The ductility level, $\mu_{\Delta,i}$, is found from $\Delta_{d,i}/\Delta_y$. Use the appropriate relationship between ductility and damping, for the component undergoing inelastic deformation, to estimate the effective structural damping, $\xi_{eff,i}$. In lieu of more detailed analysis, Equation (4-12) may be used for concrete and steel piles connected to the deck through dowels embedded in the concrete. Note that the idealized pushover curves in Figure 31F-4-4 shall be utilized in Figure 31F-4-5, which illustrates the iterative procedure.*

R_p = *response modification factor for nonstructural component or nonbuilding structure (Table 31F-4-5)*

Alternatively, when dynamic properties of the MOT structure are available, the horizontal seismic force, F_p, may be computed from [4.10]:

$$F_p = \frac{a_p S_A I_p A_x W_p}{R_p} \qquad (4\text{-}24)$$

$$0.3 S_{xs} I_p W_p \le F_p \le 1.6 S_{xs} I_p W_p$$

where:

S_A = *spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5, at the period equal to the elastic fundamental period of the MOT structure, T, in direction under consideration*

A_x = *torsional amplification factor given by:*

$$A_x = \left(\frac{\Delta_m}{1.2\Delta_{avg}}\right)^2 \qquad (4\text{-}25)$$

$$1 \le A_x \le 3$$

where:

Δ_m = *maximum displacement at one end of the MOT structure transverse to an axis*

Δ_{avg} = *average of the displacements at the extreme points of the MOT structure (see Figure 31F-4-1)*

TABLE 31F-4-3
AMPLIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES

COMPONENT OR STRUCTURE	a_p[1, 2]
Rigid components or structures (period less than 0.06 seconds)	*1.0*
Rigidly attached components or structures	*1.0*
Flexible components or structures (period longer than 0.06 seconds)	*2.5*
Flexibly attached components or structures	*2.5*

1. *A lower value shall not be used unless justified by detailed dynamic analysis, and shall in no case be less than 1.0.*
2. *If the fundamental period of the MOT structure, T, and the period of the flexible nonstructural component or nonbuilding structure, T_p, is known, a_p may be estimated from Figure 31F-4-9.*

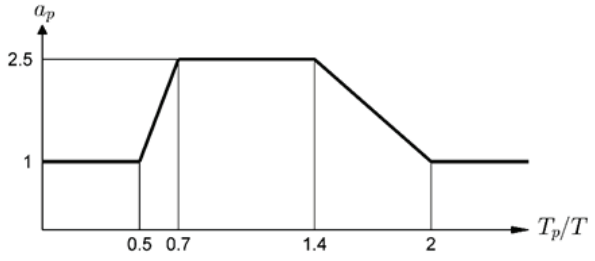


FIGURE 31F-4-9
AMPLIFICATION FACTOR, a_p [4.10]

TABLE 31F-4-4
IMPORTANCE FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES

COMPONENT OR STRUCTURE	I_p
Critical[1, 2]	*1.5*
Other	*1.0*

1. *See Section 3104F.5.1 for definition of critical system.*
2. *A lower value may be utilized, subject to Division approval.*

TABLE 31F-4-5
RESPONSE MODIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES

COMPONENT OR STRUCTURE	R_p[1]
Loading arms	*3.0*
Piping/pipelines (welded)	*12.0*
Pining/pipelines (threaded or flanged)	*6.0*
Pumps	*2.5*
Skids	*2.5*
Tanks and totes	*2.5*
Light fixtures (or luminaries)	*1.5*
Electrical conduits and cable trays	*6.0*
Mooring hardware	*2.5*
Velocity monitoring equipment	*2.5*
Instrumentation or storage cabinets	*6.0*
Cranes	*2.5*
Gangway (column systems)	*3.0*
Gangways (truss systems)	*Use R_p from frame systems*
Hose towers and racks	*Use R_p from frame systems*
Frame systems:	
Steel special concentrically braced frames	*6.0*
Steel ordinary concentrically braced frames	*3.5*
Steel special moment frames	*8.0*
Steel intermediate moment frames	*4.5*
Steel ordinary moment frames	*3.5*
Lightframe wood sheathed with wood structural panels	*6.5*
Lightframe cold-formed steel sheathed with wood structural panels	*6.5*
Lightframe walls with shear panels of other materials	*2.0*
Other	*Subject to Division approval*

1. *A higher value may be utilized, subject to Division approval.*

The horizontal seismic force, F_p, in the direction under consideration shall be applied at the center of gravity and distributed relative to the mass distribution of the nonstructural component or nonbuilding structure.

The horizontal seismic force, F_p, shall be applied independently in at least two orthogonal horizontal directions in combination with service or operating loads associated with the nonstructural component or nonbuilding structure, as appropriate. For vertically cantilevered systems, however, F_p shall be assumed to act in any horizontal direction.

The concurrent vertical seismic force, F_v, shall be applied at the center of gravity and distributed relative to the mass distribution of the nonstructural component or nonbuilding structure, as follows:

$$F_v = \pm 0.2 S_{xs} W_p \quad (4\text{-}26)$$

3104F.5.4.1.2 Linear modal demand procedure. *The linear modal demand procedure (Section 3104F.2.3.3) may always be used and shall be used to estimate seismic forces when the Simplified Procedure (Section 3104F.5.4.1.1) is not permitted. The MOT structure and nonstructural components and/or nonbuilding structures shall be modeled explicitly. The seismic forces obtained from the linear modal demand procedure shall be adjusted for appropriate importance factors and response modification factors as specified in Table 31F-4-4 and Table 31F-4-5.*

3104F.5.5 Nonstructural components and nonbuilding structures permanently attached to the ground. *The seismic load shall be computed using the procedures in ASCE/SEI 7 [4.1], except that Level 2 design earthquake motion parameters defined in Section 3103F.4 shall be used in lieu of those specified in ASCE/SEI 7 [4.1].*

3104F.5.6 Building structures. *For buildings permanently attached to MOT structure, Section 3104F.5.4.1 shall be used to compute seismic loads. Computation of seismic effects shall consider:*

1. *Amplification of acceleration from ground to location of attachment of the building to the deck due to flexibility of the MOT structure, and*
2. *Amplification of acceleration due to flexibility of the building.*

For buildings permanently attached to the ground, seismic loads shall be computed using the procedures in ASCE/SEI 7 [4.1], as amended by the local enforcing agency requirements, subject to Division approval.

3104F.6 Symbols.

a = *Site class factor*

a_p = *Amplification factor for nonstructural component or nonbuilding structure*

A_x = *Torsional amplification factor*

C_1 = *Modification factor to relate expected maximum inelastic displacement to displacement calculated for linear elastic response*

C_2 = *Modification factor to represent the effects of pinched hysteresis shape, cyclic stiffness degradation and strength deterioration on the maximum displacement response*

e = *Eccentricity between center of mass and center of rigidity*

$F_{d,\,i}$ = *Force at step i of iteration*

$F_{d,\,j}$ = *Force at step j of iteration*

F_p = *Horizontal seismic force on nonstructural component, nonbuilding structure or building structure supported on MOT*

F_v = *Vertical seismic force on nonstructural component, nonbuilding structure or building structure supported on MOT*

F_y = *Effective yield strength*

H = *Distance from maximum in-ground moment to center of gravity of the deck*

I_p = *Importance factor for nonstructural component or nonbuilding structure*

k_e = *Effective elastic lateral stiffness*

$k_{eff,\,i}$ = *Effective secant lateral stiffness at step i of iteration*

$k_{eff,\,j}$ = *Effective secant lateral stiffness at step j of iteration*

L_l = *Longitudinal length between wharf expansion joints*

m = *Seismic mass*

R_p = *Response modification factor for nonstructural component or nonbuilding structure*

S_A = *Spectral response acceleration at T*

S_{xs} = *Spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5*

S_1 = *1-second spectral response acceleration*

T = *Fundamental period of the elastic structure*

T_e = *Effective elastic structural period*

$T_{eff,\,i}$ = *Effective structural period at step i of iteration*

T_p = *Period of flexible nonstructural component or nonbuilding structure*

T_0 = *Period at peak of the acceleration response spectrum*

V = *Base shear strength of the structure obtained from a plastic analysis*

V_{sk} = *Shear force across shear keys*

$V_{\Delta T}$ = *Total segment lateral force*

W = *Dead load of the frame*

W_p = *Weight of the nonstructural component or nonbuilding structure*

Δ_d = *Target displacement demand*

$\Delta_{d,\,i}$ = *Target displacement demand at step i of iteration*

$\Delta_{d,\,j}$ = *Target displacement demand at step j of iteration*

α_1 = *Positive post-yield slope ratio equal to positive post-yield stiffness divided by the effective stiffness*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS

(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	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X												X										
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X								
Adopt only those sections that are listed below							X																X
Chapter/Section																							
AAMA 501.4-09										X	X	X		X	X								
AAMA 501.6-09								X	X	X	X	X		X	X								
AAMA TIR A8-16								X	X	X	X	X		X	X								
ACI 355.2-07								X	X	X	X	X		X	X								
ACI 355.4-11								X	X	X	X	X		X	X								
ACI 440.2R-08										X	X	X		X	X								
ACI 503.7-07										X	X	X		X	X								
ACI 506R-16								X	X	X	X	X		X	X								
ACI 506.2-13								X	X	†	†	†		†	†								
AISC 358-16								X	X	X				X									
ANSI/DASMA 103-2017				X	X																		
ANSI/AWC NDS-2018										X				X									
APA/ANSI 117-15								X	X	X	X	X		X	X								
ANSI/APA A190.1-17								X	X	X	X	X		X	X								
ANSI S3.41			X																				
ASCE/SEI 7-16								X	X	X	X	X		X	X								
ASCE/SEI 19-10										X	X	X		X	X								
ASCE/SEI 41-13								†	†	X	X	X		X	X								
ASCE/SEI 41-17								X	X	†	†	†		†	†								
ASCE/SEI 49-12								X	X	X				X									
ASME A17.1/CSA B44-16			X				X																
ASME A18.1-2014							X																
ASME BPE-2009			X																				
ASTM A153/A153M-16a								X	X	X	X	X		X	X								
ASTM A227/A227M-17				X	X																		
ASTM A229/A229M-17				X	X																		
ASTM A722/A722M-15										X	X	X		X	X								
ASTM A1064-17								X	X	X	X	X		X	X								
ASTM B695-04 *(2016)*								X	X	X	X	X		X	X								
ASTM C94/C94M-17								X	X	X	X	X		X	X								
ASTM C150/C150M-15								X	X	†	†	†		†	†								
ASTM C150/C150M-17								†	†	X	X	X		X	X								
ASTM C270-14a								X	X	X	X	X		X	X								
ASTM C595/C595M-17								X	X	X	X	X		X	X								
ASTM C618-15								†	†	X	X	X		X	X								
ASTM C618-17								X	X	†	†	†		†	†								

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X												X										
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X								
Adopt only those sections that are listed below							X																X
Chapter / Section																							
ASTM C635/C635M-13a								†	†	X	X	X		X	X								
ASTM C635/C635M-17								X	X	†	†	†		†	†								
ASTM C636/C636-13								†	†	X	X	X		X	X								
ASTM C636/C636M-*17*								X	X	†	†	†		†	†								
ASTM C989-16e1								†	†	X	X	X		X	X								
ASTM C989-17								X	X	†	†	†		†	†								
ASTM C1019-16								X	X	X	X	X		X	X								
ASTM C1157/C1157M-17								X	X	X	X	X		X	X								
ASTM C1249-06a								X	X	X	X	X		X	X								
ASTM C1392-00 (2014)								X	X	X	X	X		X	X								
ASTM C1394-03 (2012)										X	X	X		X	X								
ASTM C1401-14										X	X	X		X	X								
ASTM C1586-05 (2011)										X	X	X		X	X								
ASTM C1586-11										X	X	X		X	X								
ASTM D1586-11								X	X	X	X	X		X	X								
ASTM D3966-07 (2013)								X	X	X	X	X		X	X								
ASTM D5778-12								X	X	X	X	X		X	X								
ASTM E580/E580M-17								X	X	X	X	X		X	X								
ASTM E648-15e1			X					X	X														
ASTM E662-*17a*			X					X	X														
ASTM E2632/E2632M-13			X																				
ASTM E2707-15			X																				
ASTM E2726/E2726-12a			X																				
ASTM *E3121-17*								†	†	X	X	X		X	X								
ASTM F606/F606M-16								X	X	X	X	X		X	X								
ASTM F1292-99							X																
ASTM F1292-04							X																
ASTM F1487-01							X																
ASTM F1951-99							X																
AWPA U1-16								X	X														
AWPA U1-*17*										X	X	X		X	X								
AWS D1.1/D1.1M-15								X	X	X	X	X		X	X								
AWS *D1.2/D1.2M-15*								X	X	X	X	X		X	X								
AWS D1.3/D1.3M-08								X	X	X	X	X		X	X								
AWS D1.4/D1.4M-11								X	X	X	X	X		X	X								
AWS D1.8/D1.8M-16								X	X	X	X	X		X	X								
AWS QCI-16								X	X	X	X	X		X	X								
BHMA A156.10-2011							X																
BHMA A156.19-2013							X																
FM 1950-16								X	X	X	X	X		X	X								
FM 3011-99			X																				
FM 3260-00			X																				
FM 4430-80			X																				

(continued)

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X												X										
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X								
Adopt only those sections that are listed below							X																X
Chapter / Section																							
ICC-ES AC01-18								X	X	X	X	X		X	X								
ICC-ES AC58-18								X	X	X	X	X		X	X								
ICC-ES AC70-18								X	X	X	X	X		X	X								
ICC ES AC77			X																				
ICC-ES AC106-18								X	X	X	X	X		X	X								
ICC-ES AC125-18								X	X	X	X	X		X	X								
ICC-ES AC156-18								X	X	X	X	X		X	X								
ICC-ES AC178-18								X	X	X	X	X		X	X								
ICC-ES AC193-18								X	X	X	X	X		X	X								
ICC-ES AC232-18								X	X	X	X	X		X	X								
ICC-ES AC308-18								X	X	X	X	X		X	X								
ICC ES AC331			X																				
ICC-ES AC358-18								X	X	X	X	X		X	X								
ICC-ES AC446-18								X	X	X	X	X		X	X								
ISO 9001-15										X	X	X		X	X								
NFPA 11-16			X																				X
NFPA 13-*16*			X																				
NFPA 13D-*16*			X																				
NFPA 13R-*16*			X																				
NFPA 14-*16*			X																				
NFPA 22-*13*			X																				
NFPA 24-*16*			X																				X
NFPA 25-*13CA*			X																				X
NFPA 32-16			X																				
NFPA 37-*15*			X																				
NFPA 54-*15*			X																				
NFPA 72-16			X				X																X
NFPA 110-16			X																				X
NFPA 111-13			X																				X
NFPA 130-14			X																				
NFPA 502-14			X																				
NFPA 1124-17			X																				
NFPA 2001-*15*			X																				
PCI MNL 120-17								X	X	X	X	X		X	X								
PTI DC35.1-14								X	X	X	X	X		X	X								
SFM 12-3			X																				
SFM 12-7-3			X																				
SFM 12-7A-1			X																				
SFM 12-7A-2			X																				
SFM 12-7A-3			X																				

(continued)

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X												X										
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X								
Adopt only those sections that are listed below							X																X
Chapter / Section																							
SFM 12-7A-4			X																				
SFM 12-7A-4A			X																				
SFM 12-7A-5			X																				
SFM 12-8-100			X																				
SFM 12-10-1			X																				
SFM 12-10-2			X																				
SFM 12-10-3			X																				
TMS 402-2016								X	X	X	X	X		X	X								
TMS 602-2016								X	X	X	X	X		X	X								
UBC 15-2			X																				
UBC 15-3			X																				
UBC 15-4			X																				
UL 13-96			X																				
UL 38-99			X																				
UL 193-04			X																				
UL 199-95			X																				
UL 228-97			X																				
UL 260-04			X																				
UL 262-04			X																				
UL 268A-09			X																				
UL 312-04			X																				
UL 346-05			X																				
UL 464-03			X																				
UL 497B-04			X																				
UL 521-99			X																				
UL 539-00			X																				
UL 632-00			X																				
UL 753-04			X																				
UL 813-96			X																				
UL 857-13										X	X	X		X	X								
UL 864-03			X																				

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 35

REFERENCED STANDARDS

User note:

About this chapter: *The* International Building Code® *contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Chapter 1, Scope and Administration, Division 1, Sections 1.1.5 and 1.1.7, and in Chapter 1, Scope and Administration, Division II, Section 102.4, *as applicable.*

[DSA-SS, DSA-SS/CC & OSHPD 1 & 4] Reference to other chapters. *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A.*

AA

Aluminum Association
1400 Crystal Drive, Suite 430
Arlington, VA 22202

ADM—2015: Aluminum Design Manual: Part 1—A Specification for Aluminum Structures
1604.3.5, 2002.1

ASM 35—00: Aluminum Sheet Metal Work in Building Construction (Fourth Edition)
2002.1

AAMA

American Architectural Manufacturers Association
1827 Waldon Office Square, Suite 550
Schaumburg, IL 60173

711—16: Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
1404.4

714—15: Voluntary Specification for Liquid Applied Flashing Used to Create a Water-resistive Seal around Exterior Wall Openings in Buildings
1404.4

1402—09: Standard Specifications for Aluminum Siding, Soffit and Fascia
1403.5.1

AAMA/WDMA/CSA 101/I.S.2/A440—17: North American Fenestration Standard/Specifications for Windows, Doors and Skylights
1709.5.1, 2405.5

501.4-09: Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts
2410.1

501.6-09: Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System
2410.1

TIR A8-16: Structural Performance of Composite Thermal Barrier Framing Systems
2411.1

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

216.1—14: Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Table 721.1(2), 722.1

318—14: Building Code Requirements for Structural Concrete
722.2.4.3, 1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, *Table 1705A.2.1, Table 1705A.3,* 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11.1, 1810.3.12, *1810A.3.10.4,* 1901.2, 1901.3, *1901.3.4.4,* 1902.1, 1903.1, 1904.1, 1904.2, 1905.1, 1905.1.1, 1905.1.2, 1905.1.3, 1905.1.4, 1905.1.5, 1905.1.6, 1905.1.7, 1905.1.8, 1906.1, *1909.2, 1909.3, 1903A, 1904A, 1905A*, *1910A.5.4,* 2108.3, 2206.1

ACI—continued

355.2—07: Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
1617A.1.19

355.4—11: Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
1617A.1.19

440.2R-08: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
1911.3, 1911A.3

503.7—07: Specification for Crack Repair by Epoxy Injection
1911.2, 1911A.2

506R—16: Guide to Shotcrete
1908.1, 1908A.1, 1908.3, 1908A.3, 1908.12, 1908A.12

506.2—13: [DSA-SS, DSA-SS/CC] Guide to Shotcrete
1908A.1, 1908A.9

AISC

American Institute of Steel
130 East Randolph Street, Suite 2000
Chicago, IL 60601-6219

ANSI/AISC 341—16: Seismic Provisions for Structural Steel Buildings
1705.12.1.1, 1705.12.1.2, 1705.13.1.1, 1705.13.1.2, 2205.2.1.1, 2205.2.1.2, 2205.2.2, 2206.2.1, *1705A.2.1, 1705A.2.5, 2212.2, 2205A*, *2206A*, *2205.3*

358—16: Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications
1705A.2.1, 2205A, 2205.4, 2206A.2, 2206.2.1, 2212.3, 3413A

ANSI/AISC 360—16: Specification for Structural Steel Buildings
722.5.2.2.1, 1604.3.3, 1705.2.1, 2202.1, 2203.1, 2205.1, 2205.2.1.1, 2206.1, *1705A.2.1, Table 1705A.2.1, 1705A.2.5, 2212.1.1, 2204A.4, 2212A.1.2. 2212A.2.1, 2204.4*

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001

AISI S100—16: North American Specification for the Design of Cold-formed Steel Structural Members, 2016
1604.3.3, 1905.1.8, 2202.1, 2203.1, 2210.1, 2210.2, *2211A.2*

AISI S202—15: Code of Standard Practice for Cold-formed Steel Framing, 2015
2211.1.3.1

AISI S220—15: North American Standard for Cold-formed Steel Framing—Nonstructural Members, 2015
2202.1, 2203.1, 2211.2, Table 2506.2, Table 2507.2

AISI S230—15: Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, 2015
1609.1.1, 1609.1.1.1, 2211.1.2

AISI S240—15: North American Standard for Cold-Formed Steel Structuring Framing, 2015
1705.2.2.2, 2202.1, 2203.1, 2211.1, 2211.1.1.1, 2211.1.3.3, Table 2306.12.2, Table 2506.2, Table 2507.2, Table 2603.12.1

AISI S400—15/S1—16: North American Standard for Seismic Design of Cold-formed Steel Structural Systems, 2015, with Supplement 1, dated 2016.
2210.2, 2211.1.1.1, 2211.1.1.2

ALI

Automotive Lift Institute, Inc.
P.O. Box 85
Cortland, NY 13045

ALI ALCTV—2016: Standard for Automotive Lifts—Safety Requirements for Construction, Testing and Validation (ANSI)
Table 3001.3

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

7—16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures *with Supplement No. 1*
104.11, 202, Table 1504.1.1, *Table 1504.8, 1510.7.1,* 1602.1, *1603A.2,* 1604.3, *1604A.4,* Table 1604.3, 1604.5, Table 1604.5, 1604.8.2, 1604.9, 1605.1, 1605.2.1, 1605.3.1, 1605.3.1.2, 1605.3.2, 1605.3.2.1, 1607.8.1, 1607.8.1.1, 1607.8.1.2, 1607.9, 1607.13.1, 1607.13.3.1, 1608.1, 1608.2, 1608.3, 1609.1.1, 1609.2, 1609.3, 1609.5.1, 1609.5.3, 1611.2, 1612.2, 1613.1, 1613.2.2, 1613.2.3, 1613.2.5, Table 1613.2.3(1), Table 1613.2.3(2), 1613.2.5.1, 1613.2.5.2, 1613.3, 1614.1, 1615.1, *1613A, 1617A, 1617.9, 1617.10, 1617.2,* 1705.12, 1705.12.1.1, 1705.12.1.2, 1705.12.4, 1705.13.1.1, 1705.13.1.2, 1705.13.2, 1705.13.3, 1705.13.4, 1709.5, *1803A.6,* 1803.5.12, 1808.3.1, 1809.13, 1810.3.6.1, 1810.3.8.3.2, 1810.3.8.3.3, 1810.3.9.4, 1810.3.11.2, 1810.3.12, 1901.2, 1905.1.1, 1905.1.2, 1905.1.7, 1905.1.8, 2205.2.1.1, 2205.2.1.2, 2205.2.2, 2206.2.1, 2209.1, 2209.2, 2210.2, 2211.1.1.1, *2212A.1.1, 2212A.2.4,* Table 2304.6.1, Table 2306.3(3), Table 2308.7.5, 2404.1, *2410.1.1, 2410.1.2,* 2505.1, 2505.2, 2506.2.1

8—17: Standard Specification for the Design of Cold-formed Stainless Steel Structural Members
1604.3.3, 2210.1, 2210.2

19—16: Structural Applications of Steel Cables for Buildings
2208.1

24—14: Flood Resistant Design and Construction
1202.4.2, 1202.4.4, 1612.4, 1612.5, 2702.1.8, 3001.3

29—17: Standard Calculation Methods for Structural Fire Protection
722.1

32—17: Design and Construction of Frost Protected Shallow Foundations
1809.5

41—13: Seismic Evaluation and Retrofit of Existing Buildings
1603A.2

41—17: [DSA-SS, DSA-SS/CC] Seismic Evaluation and Retrofit of Existing Buildings
1603A.2, 1617A.1.30, 1617A.1.34

49—*12*: Wind Tunnel Testing for Buildings and Other Structures
1609.1.1

55—16: Tensile Membrane Structures
3102.2

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

ASME/A17.1—2016/CSA B44—16: Safety Code for Elevators and Escalators
907.3.3, 911.1.6, 1009.4.1, *11B-407.1, 11B-407.1.1, 11B-407.4.9, 11B-408.1, 11B-409.1, 11B-411.1, 11B-810.9,*1607.10.1, 3001.2, Table 3001.3, 3001.4, 3001.5, 3002.5, 3003.2, 3007.1, 3008.1.4, 3008.7.1

A17.7—2007/CSA B44—07(R2012): Performance-based Safety Code for Elevators and Escalators
Table 3001.3, 3001.5, 3002.5

A18.1—2014: Safety Standard for Platform Lifts and Stairway Chairlifts
1109.8, Table 3001.3

A90.1—2015: Safety Standard for Belt Manlifts
Table 3001.3

B16.18—2012: Cast Copper Alloy Solder Joint Pressure Fittings
909.13.1

B16.22—2013: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
909.13.1

B20.1—2015: Safety Standard for Conveyors and Related Equipment
Table 3001.3, 3004.3

BPE—2009: Bio-processing Equipment Standard

B31.3—2014: [SLC] Process Piping
415.11.6

B31.3—2016: Process Piping
415.11.6

ASSE

American Society of Safety Engineers
520 N. Northwest Highway
Park Ridge, IL 60068

ANSI/ASSE Z359.1—2016: Requirements for the ANSI/ASSE Z359 Fall Protection Code
1015.6, 1015.7

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

A6/A6M—14: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling
1810.3.2.3, 1810.3.5.3.1, 1810.3.5.3.3

A36/A36M—14: Specification for Carbon Structural Steel
1810.3.2.3

A153/A153M—*16a*: Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware
2304.10.1.1, 2304.10.5

A227/A227M—17: Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs
1210.1.1

A229/A229M—17: Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs
1210.1.1

A240/A240M—15a: Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications
Table 1507.4.3(1)

A252—10: Specification for Welded and Seamless Steel Pipe Piles
1810.3.2.3

A283/A283M—13: Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
1810.3.2.3

A416/A416M—15: Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete
1810.3.2.2

A463/A463M—15: Standard Specification for Steel Sheet, Aluminum-coated, by the Hot-dip Process
Table 1507.4.3(2)

A572/A572M—15: Specification for High-strength Low-alloy Columbium-Vanadium Structural Steel
1810.3.2.3

A588/A588M—15: Specification for High-strength Low-alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point with Atmospheric Corrosion Resistance
1810.3.2.3

A615/A615M—15ae1: Specification for Deformed and Plain Carbon-steel Bars for Concrete Reinforcement
1704.5, 1810.3.10.2

A653/A653M—15: Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process
Table 1507.4.3(1), Table 1507.4.3(2), 2304.10.5.1

A690/A690M—13a: Standard Specification for High-strength Low-alloy Nickel, Copper, Phosphorus Steel H-piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
1810.3.2.3

A706/A706M—15: Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement
1704.5, Table 1705.3, 2107.3, 2108.3

A722/A722M—15: Specification for High-strength Steel Bars for Prestressed Concrete
1810.3.10.2, *1811.4, 1811A.4, 1812.4.2, 1812A.4.2*

A755/A755M—15: Specification for Steel Sheet, Metallic-coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products
Table 1507.4.3(1), Table 1507.4.3(2)

A792/A792M—10(2015): Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process
Table 1507.4.3(1), Table 1507.4.3(2)

ASTM—continued

A875/A875M—13: Standard Specification for Steel Sheet, Zinc-5%, Aluminum Alloy-coated by the Hot-dip Process
Table 1507.4.3(2)

A924/A924M—14: Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process
Table 1507.4.3(1)

A1064—17: Standard Specification for Carbon-steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
1903A.8

B42—2015A: Specification for Seamless Copper Pipe, Standard Sizes
909.13.1

B43—15: Specification for Seamless Red Brass Pipe, Standard Sizes
909.13.1

B68/B68M—11: Specification for Seamless Copper Tube, Bright Annealed (Metric)
909.13.1

B88—14: Specification for Seamless Copper Water Tube
909.13.1

B101—12: Specification for Lead-coated Copper Sheet and Strip for Building Construction
1403.5.3, Table 1507.2.8.2, Table 1507.4.3(1)

B209—14: Specification for Aluminum and Aluminum Alloy Steel and Plate
Table 1507.4.3(1)

B251—10: Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube
909.13.1

B280—13: Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
909.13.1

B370—12: Specification for Copper Sheet and Strip for Building Construction
1403.5.2, Table 1507.2.8.2, Table 1507.4.3(1)

B695—04(*2016*): Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel Strip for Building Construction
2304.10.1.1, 2304.10.5.1, 2304.10.5.3

C5—10: Specification for Quicklime for Structural Purposes
Table 2507.2

C22/C22M—00(2015): Specification for Gypsum
Table 2506.2

C27—98(2013): Specification for Classification of Fireclay and High-alumina Refractory Brick
2111.6

C28/C28M—10(2015): Specification for Gypsum Plasters
Table 2507.2

C31/C31M—15: Practice for Making and Curing Concrete Test Specimens in the Field
Table 1705.3

C33/C33M—13: Specification for Concrete Aggregates
722.3.1.4, 722.4.1.1.3

C35/C35—01(2014): Specification for Inorganic Aggregates for Use in Gypsum Plaster
Table 2507.2

C55—2014a: Specification for Concrete Building Brick
Table 722.3.2

C59/C59M—00(2015): Specification for Gypsum Casting Plaster and Molding Plaster
Table 2507.2

C61/C61M—00(2015): Specification for Gypsum Keene's Cement
Table 2507.2

C62—13a: Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
1807.1.6.3

C67—14: Test Methods of Sampling and Testing Brick and Structural Clay Tile
722.4.1.1.1, 2109.2.1.1

C73—14: Specification for Calcium Silicate Brick (Sand-lime Brick)
Table 722.3.2

ASTM—continued

C90—14: Specification for Loadbearing Concrete Masonry Units
Table 722.3.2, 1807.1.6.3, 2114.3

C91/C91M—12: Specification for Masonry Cement
Table 2507.2

C94/C94M—*17*: Specification for Ready-mixed Concrete
110.3.1, *1705A.3.3.1*

C140/C140M—15: Test Method Sampling and Testing Concrete Masonry Units and Related Units
722.3.1.2

C150/C150M—15: Specification for Portland Cement
*1909.2.3, 1910A.1,*1903.1, Table 2507.2

C150/C150M—17: [OSHPD] Specification for Portland Cement
1910.2.1, *1910A.1*

C172/C172M—14a: Practice for Sampling Freshly Mixed Concrete
Table 1705.3

C199—84(2011): Test Method for Pier Test for Refractory Mortars
2111.6, 2111.9, 2113.12

C206—14: Specification for Finishing Hydrated Lime
Table 2507.2

C208—12: Specification for Cellulosic Fiber Insulating Board
Table 1508.2, 2303.1.6

C216—15: Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
Table 721.1(2), 1807.1.6.3

C270—14a: Specification for Mortar for Unit Masonry
2103.2.4, *2105.3, 2105A.3, 2115.6.1*

C315—07(2011): Specification for Clay Flue Liners and Chimney Pots
2111.9, 2113.11.1, Table 2113.16(1)

C317/C317M—00(2015): Specification for Gypsum Concrete
2514.1

C330/C330M—14: Specification for Lightweight Aggregates for Structural Concrete
202

C331/C331M—14: Specification for Lightweight Aggregates for Concrete Masonry Units
722.3.1.4, 722.4.1.1.3

C406/C406M—15: Specification for Roofing Slate
1507.7.5

C472—99(2014): Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete
Table 2506.2

C473—15: Test Methods for Physical Testing of Gypsum Panel Products
Table 2506.2

C474—15: Test Methods for Joint Treatment Materials for Gypsum Board Construction
Table 2506.2

C475/C475M—15: Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
Table 2506.2

C514—04(2014): Specification for Nails for the Application of Gypsum Board
Table 721.1(2), Table 721.1(3), Table 2506.2

C516—08(2014)e1: Specifications for Vermiculite Loose Fill Thermal Insulation
722.3.1.4, 722.4.1.1.3

C547—15: Specification for Mineral Fiber Pipe Insulation
Table 721.1(2), Table 721.1(3)

C549—06(2012): Specification for Perlite Loose Fill Insulation
722.3.1.4, 722.4.1.1.3

C552—15: Standard Specification for Cellular Glass Thermal Insulation
Table 1508.2

C557—03(2009)e01: Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing
Table 2506.2, 2508.4

ASTM—continued

C578—15: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
Table 1508.2, 2603.10, Table 2603.12.1, Table 2603.12.2, Table 2603.13.1, Table 2603.13.2

C587—04(2014): Specification for Gypsum Veneer Plaster
Table 2507.2

C595/C595M—*17*: Specification for Blended Hydraulic Cements
1903.1, *1909.2.3, 1909A.1,* Table 2507.2

C618—15: [OSHPD] Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
1910.2.1, *1910A.1*

C618—17: [DSA-SS, DSA-SS/CC] Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
1909.3.4, 1910A.1, *1909.2.3*

C631—09(2014): Specification for Bonding Compounds for Interior Gypsum Plastering
Table 2507.2

C635/C635M—*13a*: *[OSHPD]* Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
1617A.1.21

C635/C635M—*17*: *[DSA-SS, DSA-SS/CC]* Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
801.1.1.1, 2506.2.1, *1617.10.16, 1617A.1.21*

C636/C636M—13: Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
808.1.1.1, *1617A.1.21*

C636/C636M—*17*: *[DSA-SS, DSA-SS/CC]* Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
808.1.1.1, *1617.10.16, 1617A.1.21*

C652—15: Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
1807.1.6.3

C726—12: Standard Specification for Mineral Wool Roof Insulation Board
Table 1508.2

C728—15: Standard Specification for Perlite Thermal Insulation Board
Table 1508.2

C744—14: Specification for Prefaced Concrete and Calcium Silicate Masonry Units
Table 722.3.2

C754—15: Specification for Installation of Steel Framing Members to Receive Screw-attached Gypsum Panel Products
Table 2508.1, Table 2511.1.1

C836/C836M—15: Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
1507.15.2

C840—13: Specification for Application and Finishing of Gypsum Board
Table 2508.1, 2509.2

C841—03(2013): Specification for Installation of Interior Lathing and Furring
Table 2508.1, Table 2511.1.1

C842—05(2015): Specification for Application of Interior Gypsum Plaster
Table 2511.1.1, 2511.3, 2511.4

C843—99(2012): Specification for Application of Gypsum Veneer Plaster
Table 2511.1.1

C844—2015: Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster
Table 2508.1

C847—14a: Specification for Metal Lath
Table 2507.2

C887—13: Specification for Packaged, Dry Combined Materials for Surface Bonding Mortar
1805.2.2, 2103.2.2

C897—15: Specification for Aggregate for Job-mixed Portland Cement-based Plaster
Table 2507.2

C920—14a: Standard for Specification for Elastomeric Joint Sealants
Table 2506.2

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C926—15b: Specification for Application of Portland Cement-based Plaster
2109.2.4.8, 2510.3, Table 2511.1.1, 2511.3, 2511.4, 2512.1, 2512.1.2, 2512.2, 2512.6, 2512.8.2, 2512.9, 2513.7

C932—06(2013): Specification for Surface-applied Bonding Compounds for Exterior Plastering
Table 2507.2

C933—14: Specification for Welded Wire Lath
Table 2507.2

C946—10: Specification for Construction of Dry-stacked, Surface-bonded Walls
2103.2.2, 2114.5

C954—15: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch (0.84 mm) to 0.112 inch (2.84 mm) in Thickness
Table 2506.2, Table 2507.2

C956—04(2015): Specification for Installation of Cast-in-place Reinforced Gypsum Concrete
2514.1

C957/C957M—15: Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane with Integral Wearing Surface
1507.15.2

C989—16e1: [OSHPD] Standard Specification for Slag Cement for Use in Concrete and Mortars
1910.2.1, 1910A.1

C989—17: [DSA-SS, DSA-SS/CC] Standard Specification for Slag Cement for Use in Concrete and Mortars
1909.2.3, 1910A.1

C1002—14: Specification for Steel Self-piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
Table 2506.2, Table 2507.2

C1007—11a(2015): Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
Table 2508.1, Table 2511.1.1

C1019—16: Test Method for Sampling and Testing Grout
2115.6.1, 2105A.3, 2105.3

C1029—15: Specification for Spray-applied Rigid Cellular Polyurethane Thermal Insulation
1507.14.2

C1032—14: Specification for Woven Wire Plaster Base
Table 2507.2

C1047—14a: Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
Table 2506.2, Table 2507.2

C1063—15a: Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-based Plaster
2109.2.4.8, 2510.3, Table 2511.1.1, 2512.1.1

C1088—14: Specification for Thin Veneer Brick Units Made from Clay or Shale
Table 721.1(2)

C1157/C1157M—*17*: Standard Performance Specification for Hydraulic Cement
1903.1, *1909.2.3,* 1910.2.1, *1910A.1,* Table 2507.2

C1167—11: Specification for Clay Roof Tiles
1507.3.4

C1177/C1177M—13: Specification for Glass Mat Gypsum Substrate for Use as Sheathing
Table 1508.2, Table 2506.2

C1178/C1178M—13: Specification for Coated Mat Water-resistant Gypsum Backing Panel
Table 2506.2, Table 2509.2

ASTM—continued

E2273—03(2011): Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
1407.4.1

E2307—15b: Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using the Intermediate-scale, Multistory Test Apparatus
715.4

E2353—14: Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards and Balustrades
2407.1.2

E2393—10a(2015): Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
1705.17.2

E2404—15a: Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facing and Veneers to Assess Surface Burning Characteristics
803.5.2, 803.12

E2556/E2556M—10: Standard Specification for Vapor Permeable Flexible Sheet Water-resistive Barriers Intended for Mechanical Attachment
2510.6

E2568—09e1: Standard Specification for PB Exterior Insulation and Finish Systems
1407.2

E2570/E2570M—07(2014)e1: Standard Test Method for Evaluating Water-resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) for EIFS with Drainage
1407.4.1.1, 1705.16.1

E2573—12: Standard Practice for Specimen Preparation and Mounting of Site-fabricated Stretch Systems to Assess Surface Burning Characteristics
803.10

E2579—13: Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics
803.11

E2599—15: Standard Practice for Specimen Preparation and Mounting of Reflective Insulation, Radiant Barrier and Vinyl Stretch Ceiling Materials for Building Applications to Assess Surface Burning Characteristics
2614.3

E2632/E2632M—13: Standard Test Method for Evaluating the Under-Deck Fire Test Response of Deck Materials
709A.3, 709A.4, 709A.4.1, 709A.5

E2634—11(2015): Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems
1903.4

E2707—15: Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure
707A.3, 707A.3.1, 708A.3

E2726/E2726—12a: Standard Test Method for Evaluating the Fire-Test-Response of Deck Structures to Burning Brands
709A.3, 709A.4, 709A.4.2

E2751/E2751M—13: Practice for Design and Performance of Supported Laminated Glass Walkways
2409.1

E3121—17: [OSHPD] Standard Test Methods for Field Testing of Anchors in Concrete or Masonry
1901.3.4.2, 1910A.5.2

F547—06(2012): Terminology of Nails for Use with Wood and Wood-base Materials
Table 2506.2

F606/F606M—16: Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets
2213.1, *2213A.1*

F1292—99: Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment
11B-1008.2.6.2

F1292—04: Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment
11B-1008.2.6.2

ASTM—continued

F1487—01: Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
202-USE ZONE

F1667—15: Specification for Driven Fasteners: Nails, Spikes and Staples
Table 721.1(2), Table 721.1(3), 1507.2.5, 1507.17.5, 2303.6, Table 2304.10.1, 2304.10.5, Table 2506.2, Table 2603.13.1, Table 2603.13.2

F1951—99: Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment
11B-1008.2.6.1

F2006—17: Standard/Safety Specification for Window Fall Prevention Devices for Nonemergency Escape (Egress) and Rescue (Ingress) Windows
1015.8

F2090—17: Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms
1015.8, 1015.8.1

F2200—14: Standard Specification for Automated Vehicular Gate Construction
3110.2

G152—13: Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
1504.6

G154—12a: Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
1504.6

G155—13: Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
1504.6

AWC

American Wood Council
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

AWC WCD No. 4—2003: Wood Construction Data—Plank and Beam Framing for Residential Buildings
2306.1.2

ANSI/AWC WFCM—2018: Wood Frame Construction Manual for One- and Two-Family Dwellings
1609.1.1, 1609.1.1.1, 2302.1, 2308.2.4, 2308.6.7.2, 2309.1

ANSI/AWC NDS—2018: National Design Specification (NDS) for Wood Construction—with 2018 NDS Supplement
202, 722.1, Table 1604.3, 1809.12, 1810.3.2.4, Table 1810.3.2.6, 1905.1.8, 2304.13, 2306.1, Table 2306.2(1), Table 2306.2(2), Table 2306.3(1), Table 2306.3(2), 2307.1, Table 2603.1.3.1, Table 2603.13.2

AWC STJR—2015: Span Tables for Joists and Rafters
2306.1.1, 2308.4.2.1, 2308.7.1, 2308.7.2

ANSI/AWC PWF—2015: Permanent Wood Foundation Design Specification
1805.2, 1807.1.4, 2304.10.5.2

ANSI/AWC SDPWS—2015: Special Design Provisions for Wind and Seismic
202, 2305.1, 2305.2, 2305.3, 2306.1, 2306.2, 2306.3, Table 2306.3(1), Table 2306.3(3), 2307.1

AWCI

Association of the Wall and Ceiling Industry
513 West Broad Street, Suite 210
Falls Church, VA 22046

12-B—14: Technical Manual 12B, Third Edition; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-resistive Materials; an Annotated Guide:
1705.15

AWPA

American Wood Protection Association
P.O. Box 361784
Birmingham, AL 35236-1784

C1—03: All Timber Products—Preservative Treatment by Pressure Processes
1505.6

M4—16: Standard for the Care of Preservative-treated Wood Products
1810.3.2.4.1, 2303.1.9

U1—*17*: USE CATEGORY SYSTEM: User Specification for Treated Wood Except Commodity Specification H
Table 1507.9.6, 1807.1.4, 1807.3.1, 1809.12, 1810.3.2.4.1, *1812.2, 1812A.2,* 2303.1.9, 2304.12.1, 2304.12.2, 2304.12.3, 2304.12.4, 2304.12.5

AWS

American Welding Society
8669 NW 36 Street, #130
Miami, FL 33166

D1.1/D1.1M—15: Structural Welding Code—Steel
Table 1705A.2.1, 1705A.2.5, 2204.1.1, 2204A.1.1, 2212.6.2, 2213.2, 2213A.2

D1.2/D1.2M—15: Structural Welding Code—Aluminum
2003.1

D1.3/D1.3M—08: Structural Welding Code—Sheet Steel
Table 1705A.2.1, 1705A.2.5

D1.4/D1.4M—2011: Structural Welding Code—Reinforcing Steel Including Metal Inserts and Connections In Reinforced Concrete Construction
1704.5, 1704A.5, *Table 1705A.2.1, 1705.2.5, 1705A.2.5,* Table 1705.3, 1705.3.1, *1705A.3.1, 1903.8, 1903A.8,* 2107.3

D1.8/D1.8M—2016: Structural Welding Code – Seismic Supplement
Table 1705A.2.1, 1705A.2.5, 1705.2.5

QC1—2016: Specification for AWS Certification of Welding Inspectors
1705.2.5, 1705A.2.5

BHMA

Builders Hardware Manufacturers' Association
355 Lexington Avenue, 15th Floor
New York, NY 10017-6603

A 156.10—2011: Power Operated Pedestrian Doors
1010.1.4.2, *11B-404.2.9, 11B-404.3*

A 156.19—2013: Standard for Power Assist and Low Energy Power Operated Doors
1010.1.4.2, *11B-404.2.9, 11B-404.3, 11B-408.3.2.1, 11B-409.3.1*

A 156.27—2011: Power and Manual Operated Revolving Pedestrian Doors
1010.1.4.1.1

A 156.38—2014: Low Energy Power Operated Sliding and Folding Doors
1010.1.4.2

CEN

European Committee for Standardization (CEN)
Central Secretariat
Rue de Stassart 36
B-10 50 Brussels

EN 1081—98: Resilient Floor Coverings—Determination of the Electrical Resistance
406.7.1

BS EN 15250—2007: Slow Heat Release Appliances Fired by Solid Fuel Requirements and Test Methods
2112.2, 2112.5

CPA

Composite Panel Association
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176

ANSI A135.4—2012: Basic Hardboard
1403.3.1, 2303.1.7

ANSI A135.5—2012: Prefinished Hardboard Paneling
2303.1.7, 2304.7

ANSI A135.6—2012: Engineered Wood Siding
1403.3.2, 2303.1.7

A208.1—2016: Particleboard
2303.1.8, 2303.1.8.1

CPSC

Consumer Product Safety Commission
4330 East/West Highway
Bethesda, MD 20814

16 CFR Part 1201 (2002): Safety Standard for Architectural Glazing Material
2406.2, Table 2406.2(1), 2406.3.1, 2407.1, 2407.1.4.1, 2408.2.1, 2408.3, 2409.2, 2409.3.1, 2409.4.1

16 CFR Part 1209 (2002): Interim Safety Standard for Cellulose Insulation
720.6

16 CFR Part 1404 (2002): Cellulose Insulation
720.6

16 CFR Part 1500 (2009): Hazardous Substances and Articles; Administration and Enforcement Regulations
202

16 CFR Part 1500.44 (2009): Method for Determining Extremely Flammable and Flammable Solids
202

16 CFR Part 1507 (2002): Fireworks Devices
202

16 CFR Part 1630 (2007): Standard for the Surface Flammability of Carpets and Rugs
804.4.1

CSA

Canadian Standards Association
8501 East Pleasant Valley Road
Cleveland, OH 44131-5516

AAMA/WDMA/CSA 101/I.S.2/A440—17: North American Fenestration Standard/Specifications for Windows, Doors and Unit Skylights
1709.5.1, 2405.5

ASME A17.1—2016/CSA B44-—16: Safety Code for Elevators and Escalators
907.3.3, 911.1.6, 1009.4.1, 1607.10.1, 3001.2, Table 3001.3, 3001.5, 3002.5, 3003.2, 3007.1, 3008.1.4, 3008.7.1

ASME A17.7—2007/CSA B44.7—07: Performance-based Safety Code for Elevators and Escalators
Table 3001.3, 3001.5, 3002.5

CSSB

Cedar Shake & Shingle Bureau
P. O. Box 1178
Sumas, WA 98295-1178

CSSB—97: Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau
Table 1507.8.5, Table 1507.9.6

ICC—continued

ICC 500—14: ICC/NSSA Standard on the Design and Construction of Storm Shelters
202, 423.1, 423.2, 423.3, 423.4, 1604.5.1, 1604.10

ICC 600—14: Standard for Residential Construction in High-wind Regions
1609.1.1, 1609.1.1.1, 2308.2.4

ICC 900/SRCC 300—2015: Solar Thermal System Standard
3111.2.1

ICC 901/SRCC 100—2015: Solar Thermal Collector Standard
3111.2.1

ICC-ES AC 01—18*: Acceptance Criteria for Expansion Anchors in Masonry Elements
1617A.1.19

ICC-ES AC 58—18*: Acceptance Criteria for Adhesive Anchors in Masonry Elements
1617A.1.19

ICC-ES AC 70—18*: Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements
1617A.1.20

ICC-ES AC 77: Acceptance Criteria for Smoke Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames
707.14.1

ICC-ES AC 106—18*: Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry
1617A.1.19

ICC-ES AC 125—18*: Acceptance Criteria for Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems
1911A.3, 1911.3

ICC-ES AC 156—18*: Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components
1705A.13.3

ICC-ES AC 178—18*: Acceptance Criteria for Inspection and Verification of Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems
1911A.3, 1911.3

ICC-ES AC 193—18*: Acceptance Criteria for Mechanical Anchors in Concrete Elements
1617A.1.19, 1901.3.2

ICC-ES AC 232—18*: Acceptance Criteria for Anchor Channels in Concrete Elements
1617A.1.19, 1901.3.2

ICC-ES AC 308—18*: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
1617A.1.19, 1901.3.3

ICC-ES AC 331: Acceptance Criteria for Smoke and Heat Vents
910.3.1

ICC-ES AC 358—18*: Acceptance Criteria for Helical Foundation Systems and Devices
1810A.3.1.5.1, 1810.3.1.5.1

ICC-ES AC 446—18*: Acceptance Criteria for Headed Cast-in Specialty Inserts in Concrete
1617A.1.19, 1901.3.2

SBCCI SSTD 11—97: Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles
1504.2.1.1, 1504.2.1.2

** Refers to International Building Code, 2018 as a reference standard.*

ISO

International Organization for Standardization
Chemin de Blandonnet 8
CP 401
1214 Vernier
Geneva, Switzerland

ISO 8115—86: Cotton Bales—Dimensions and Density
Table 307.1(1), Table 415.11.1.1.1

ISO 8336—09: Fiber-cement Flat Sheets—Product Specification and Test Methods
1403.10, 1404.16.1, 1404.16.2, Table 2509.2

ISO 9001—15: Quality Management Systems - Requirements
1705A.13.3

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte, NC 28217

ANSI MH29.1—08: Safety Requirements for Industrial Scissors Lifts
Table 3001.3

NAAMM

National Association of Architectural Metal Manufacturers
800 Roosevelt Road, Bldg. C, Suite 312
Glen Ellyn, IL 60137

FP 1001—17: Guide Specifications for Design of Metal Flag Poles
1609.1.1

NCMA

National Concrete Masonry Association
13750 Sunrise Valley
Herndon, VA 22071-4662

TEK 5—84(1996): Details for Concrete Masonry Fire Walls
Table 721.1(2)

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

10—18: Standard for Portable Fire Extinguishers
906.2, 906.3.2, 906.3.4, Table 906.3(1), Table 906.3(2)

11—16: Standard for Low Expansion Foam
904.7, *3109F*

12—15: Standard on Carbon Dioxide Extinguishing Systems
904.8, 904.12

12A—15: Standard on Halon 1301 Fire Extinguishing Systems
904.9

13—16: Standard for Installation of Sprinkler Systems
712.1.3.1, 903.3.1.1, 903.3.2, 903.3.8.2, 903.3.8.5, 904.12, 905.3.4, 907.6.4, 1019.3

NFPA 13, Amended Sections as follows:

Revise Section 2.2 and add publications as follows:
2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.*

Revise Section 8.15.1.2.15 as follows:

8.15.1.2.15 Exterior columns under 10 ft^2 (0.93m^2) in total area, formed by studs or wood joist, *with no sources of ignition within the column,* supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.

Revise Section 8.15.5.3 as follows:

8.15.5.3 Automatic sprinkler system. *Automatic sprinklers shall not be required to be installed in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room where all the following are met:*

1. Approved smoke detectors shall be installed and connected to the building fire alarm system in accordance with Section 907 in the area where the fire sprinkler was removed per this section.

2. Activation of any smoke detector located in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room shall cause the actuation of the building fire alarm notification appliances in accordance with Section 907.

3. Activation of any smoke detector located in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room shall cause all elevators having any equipment located in that elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room to recall nonstop to the appropriate designated floor in accordance with CCR Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

NFPA—continued

(f) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.

(g) Any disconnecting means for the pump shall be approved.

(h) A method for refilling the tank shall be piped to the tank.

(i) A method of seeing the water level in the tank shall be provided without having to open the tank.

(j) The pump shall not be permitted to sit directly on the floor.

Add new Section 6.2.2.1 as follows:

6.2.2.1 *Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.*

Add new Section 6.2.4 as follows:

6.2.4 *Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multipurpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.*

Revise Section 8.3.4 as follows:

8.3.4* Sprinklers shall not be required in *detached* garages, open attached porches, carports *with no habitable space above,* and similar structures.

Add *new* Sections *8.3.10 and 8.3.10.1* as follows:

8.3.10 Solar photovoltaic panel structures

8.3.10.1 *Sprinklers shall be permitted to be omitted from the following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

13R—16: Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies

903.3.1.2, 903.3.5.2, 903.4

****NFPA 13R, Amended Sections as follows:***

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.

Add new Sections 6.6.10 and 6.10.1 as follows:

6.6.10 Solar photovoltaic panel structures

6.6.10.1 *Sprinklers shall be permitted to be omitted from the following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

Revise Section 11.4 as follows:

11.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

(1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

(2) NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 2013 California Edition and Title 19, California Code of Regulations, Chapter 5.

(3) Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, California Code of Regulations, Chapter 5, shall be affixed to each system riser.

NFPA—continued

14—16: Standard for the Installation of Standpipe and Hose System, *as amended**
905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

NFPA 14, Amended Sections as follows:

Replace Section 6.3.7.1

6.3.7.1 *System water supply valves, isolation control valves, and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:*

(1) Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) a central station, proprietary, or remote supervising station, or

(b) a local signaling service that initiates an audible signal at a constantly attended location.

(2) Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) Locking the valves in the open position, or

(b) Sealing of valves and an approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

16—15: Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems
904.7, 904.12

17—17: Standard for Dry Chemical Extinguishing Systems
904.6, 904.12

17A—17: Standard for Wet Chemical Extinguishing Systems
904.5, 904.12

20—16: Standard for the Installation of Stationary Pumps for Fire Protection
412.2.4.1, 913.1, 913.2, 913.2.1, 913.5

24—16: *Installation of Private Fire Service Mains and Their Appurtenances, as amended**
3109F

NFPA 24, Amended Sections as follows:

Amend Section 4.2.1 as follows:

Section 4.2.1. Installation work shall be done by fully experienced and responsible *contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.*

Revise Section 4.2.2 as follows:

4.2.2 *Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from* the authority having jurisdiction.

Add Section 4.2.2.1 as follows:

4.2.2.1 *As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.*

Revise Section 5.9.5.1 as follows:

5.9.5.1 Fire department connections shall be on the street side of buildings and *as approved by the authority having jurisdiction.*

Add Sections 6.6.1.1, 6.6.1.2, 6.6.1.3 and 6.6.1.4 as follows:

6.6.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

6.6.1.2 *Sectional control valves shall be indicating valves in accordance with NFPA 13, Section 6.7.1.3.*

6.6.1.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser, and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

6.6.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

Revise Section 10.4.3.1.1 as follows:

10.4.3.1.1 Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

1. Where allowed in accordance with 10.4.3.2.
2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

NFPA—continued

Revise Section 10.9.1 as follows:

10.9.1 *Backfill shall be well tamped in layers or puddle under and around pipes to prevent settlement or lateral movement.* Backfill shall consist of clean fill sand or pea gravel to a minimum 6″ below and to a minimum of 12″ above the pipe *and shall contain no ashes, cinders, refuse, organic matter, or other corrosive materials. Other backfill materials and methods are permitted where designed by a registered professional engineer and approved by the enforcing agency.*

25—13CA: California NFPA 25 Edition (Based on the 2011 Edition) Inspection, Testing and Maintenance of Water-based Fire Protection Systems
Chapter 31F, 3108F

30—18: Flammable and Combustible Liquids Code
415.6, 507.8.1.1.1, 507.8.1.1.2

30A—18: Code for Motor Fuel Dispensing Facilities and Repair Garages
406.2.9.2

31—16: Standard for the Installation of Oil-burning Equipment
2113.15

32—16: Standard for Dry Cleaning Plants, *as amended**
415.9.3, *2101.1.1*

****NFPA 32, Amended Sections as follows:***

Delete the following publications from Section 2.2:

2.2 NFPA Publications.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2010 edition.
NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2011 edition.
NFPA 70, *National Electrical Code®,* 2011 edition.
NFPA *101®*, *Life Safety Code®,* 2009 edition.
NFPA 5000®, *Building Construction and Safety Code®*, 2009 edition.

Revise Section 4.4.1.1 as follows:

4.4.1.1 General building and structure design and construction shall be in accordance with *California Building Code.*

Delete language to Sections 4.4.1.2 and 4.4.1.3 and reserve section numbers.

4.4.1.2 Reserved

4.4.1.3 Reserved

Revise Section 4.4.4 as follows:

4.4.4 Means of Egress. Means of egress shall conform with the provisions of *the California Building Code.*

Revise Section 4.6.2 as follows:

4.6.2 Automatic Sprinkler Systems. Where required by this standard, automatic sprinkler systems shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems,* and periodically inspected, tested, and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5.*

Revise Section 4.6.4 as follows:

4.6.4 Portable Fire Extinguishers. Suitable numbers and types of portable fire extinguishers shall be installed and maintained throughout the drycleaning plant in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3.*

Revise Section 7.3.2 as follows:

7.3.2 Electrical Installations. Electrical equipment and wiring in a Type II drycleaning room shall comply with the provisions of *California Electrical Code*, for use in Class I, Division 2 hazardous locations.

37—15: Installation and Use of Stationary Combustion Engines and Gas Turbines

40—16: Standard for the Storage and Handling of Cellulose Nitrate Film
409.1

45—15: Standard on Fire Protection Laboratories Using Chemicals (2015 Edition)
428.3.7

54—15: National Fuel Gas Code

58—17: Liquefied Petroleum Gas Code
415.9.2

61—17: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities

NFPA—continued

426.1

70—17: National Electrical Code

108.3, 406.2.7, 406.2.9, 412.5.7, 415.11.1.8, Table 509, 904.3.1, 907.6.1, 909.12.2, 909.16.3, 910.4.6, 1204.4.1, 2701.1, 2702.1.3, 3111.3

72—16: National Fire Alarm and Signaling Code, *as amended**

407.4.4.3, 407.4.4.5, 407.4.4.5.1, 901.6, 903.4.1, 904.3.5, 907.1.2, 907.2, 907.2.6, 907.2.9.3, 907.2.10, 907.2.12.2, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.2, 907.5.2.2.5, 907.6, 907.6.1, 907.6.2, 907.6.6, 907.7, 907.7.1, 907.7.2, 911.1.6, 917.1, 2702.2.4, 3005.5, 3007.7, *3108F*

NFPA 72, Amended Sections as follows:

Revise Section 10.3.1 as follows:

10.3.1 Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used. *Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

Revise Section 10.3.3 as follows:

10.3.3 All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be *California State Fire Marshal* listed for use with the control unit.

Revise Section 10.7.1 as follows:

10.7.1 *Where approved by the authority having jurisdiction,* ECS priority signals when evaluated by stakeholders through risk analysis in accordance with 24.3.11 shall be permitted to take precedence over all other signals.

Revise Section 12.3.8.1 as follows:

12.3.8.1 The outgoing and return (redundant) circuit conductors shall be permitted in the same cable assembly (i.e., multiconductor cable), enclosure, or raceway only under the following conditions:

(1) For a distance not to exceed 10 ft (3.0 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance, or control unit enclosures.

(2) Single drops installed in the raceway to individual devices or appliances.

(3)*In a single room not exceeding 1000 ft^2 (93 m^2) in area, a drop installed in the raceway to multiple devices or appliances that does not include any emergency control function devices.

(4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire-resistive rating.

Revise Section 14.4.6.1 as follows:

14.4.6.1 Testing. Household fire alarm systems shall be tested in *accordance with the manufacturer's published instructions* according to the methods of Table 14.4.3.2.

Revise Section 17.15 as follows:

17.15 Fire Extinguisher Electronic Monitoring Device. A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by *California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2 (c) and California Fire Code to a fire alarm control unit.*

Revise Section 21.3.6 as follows:

21.3.6 Smoke detectors shall not be installed in unsprinklered elevator hoistways unless they are installed to activate the elevator hoistway smoke relief equipment *or where required by Chapter 30 of the California Building Code.*

Revise Section 12.3.7 as follows:

12.3.7 (4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

Revise Section 23.8.5.1.2 as follows:

23.8.5.1.2 Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

Exception: Fire alarm systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring *as permitted in section 21.3 of NFPA 72.*

Revise Section 23.8.5.4.1 as follows:

NFPA—continued

23.8.5.4.1 Systems equipped with alarm verification features shall be permitted under the following conditions:

(1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.

(2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.7 through 10.16, 23.8.1.1, or 21.2.1 by more than 30 seconds.

(3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of Sections 10.7 through 10.16, 23.8.1.1, or 21.2.1 without additional delay.

(4) The current status of the alarm verification feature is shown on the record of completion *(see Figure 7.8.2(a), Item 4.3).*

(5) Operation of a patient room smoke detector in I-2 and R-2.1 occupancies shall not include an alarm verification feature.

Revise Section 29.3.1 as follows:

29.3.1 All devices, combinations of devices, and equipment to be installed in conformity with this chapter shall be approved *and* listed *by the California State Fire Marshal* for the purposes for which they are intended.

Revise Section 29.5.2.1.1 as follows:

29.5.2.1.1* Smoke and Heat Alarms. Unless exempted by applicable laws, codes, or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms, or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.

Note: Exception to 29.5.2.1.1 not adopted by the SFM.

Add Section 29.7.2.1 as follows:

29.7.2.1 *The alarm verification feature shall not be used for household fire warning equipment.*

Add Section 29.7.6.7.1 as follows:

29.7.6.7.1 *The alarm verification feature shall not be used for household fire warning equipment.*

Revise Section 23.8.3.4 as follows:

29.8.3.4 Specific location requirements. *The installation of smoke alarms and smoke detectors shall comply with the following requirements:*

(1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.

(2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other spaces where temperatures can fall below 40ºF (4ºC) or exceed 100ºF (38ºC).

(3) Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.

(4) Smoke alarms or smoke detectors shall be installed a minimum of 20 feet horizontal distance from a permanently installed cooking appliance.

Exceptions: *Ionization smoke alarms with an alarm silencing switch or photoelectric smoke alarms shall be permitted to be installed 10 feet (3 m) or greater from a permanently installed cooking appliance.*

Photoelectric smoke alarms shall be permitted to be installed greater than 6 feet (1.8 m) from a permanently installed cooking appliance where the kitchen or cooking area and adjacent spaces have no clear interior partitions and the 10 ft distances would prohibit the placement of a smoke alarm or smoke detector required by other sections of the code.

Smoke alarms listed for use in close proximity to a permanently installed cooking appliance.

(5) Effective January 1, 2016, smoke alarms and smoke detectors used in household fire alarm systems installed between 6 ft (1.8 m) and 20 ft (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be listed for resistance to common nuisance sources from cooking.

(6) Installation near bathrooms. Smoke alarms shall be installed not less than a 3-foot (0.91 m) horizontal distance from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by other sections of the code.

(7) Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers.

(8) Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan.

(9) Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.

NFPA—continued

(10) For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.

(11) For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 in. (300 mm) vertically down from the highest point.

(12) Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4 of NFPA 72.

(13) Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3 of NFPA 72.

80—16: Standard for Fire Doors and Other Opening Protectives
410.2.5, 509.4.2, 716.1, 716.2.5.1, 716.2.6.4, 716.2.9, 716.3.4.1, 716.3.5, 1010.1.4.3

82—14: Standard on Incinerators and Waste and Linen Handling Systems and Equipment
713.13

85—15: Boiler and Combustion System Hazards Code
426.1

92—15: Standard for Smoke Control Systems
909.7, 909.8

99—18: Health Care Facilities Code
407.11, 422.6, 425.1

101—18: Life Safety Code
1029.6.2

105—16: Standard for Smoke Door Assemblies and Other Opening Protectives
405.4.2, 710.5.2.2, 716.2.10, 909.20.4.1

110—16: Standard for Emergency and Standby Power Systems
2702.1.3, *3111F*

111—13: Standard on Stored Electrical Energy Emergency and Standby Power Systems
2702.1.3, *3111F*

120—15: Standard for Fire Prevention and Control in Coal Mines
426.1

130—14: Standard for Fixed Guideway Transit and Passenger Rail Systems
443

****NFPA 130, Amended Sections as follows:***

Amend Section 2.2 and amend publications to read as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, *2013 California edition.*

Amend Section 3.3.44.2 and amend publications to read as follows:

3.3.44.2* Open Station. A station that is constructed such that it is directly open to the atmosphere and smoke and heat are allowed to disperse directly into the atmosphere.

The following enclosed areas in open stations are permitted:

1. Ticket/pass booths not exceeding 150 square feet (13.9 m^2) in area.

2. Mechanical and electrical spaces typically not used for human occupancy and necessary for the operation of a fixed guideway transit system. Such spaces shall be limited to two per level.

3. Restrooms not exceeding 150 square feet (13.9 m^2) in area. A maximum of four restrooms are permitted per level.

Add a new definition as 3.3.44.3 to read as follows:

3.3.44.1.1 Underground Station. *A station or portion thereof that is located beneath the surface of the earth or of the water.*

Amend Section 5.2.2.1 to read as follows:

5.2.2.1 Building construction for all new enclosed stations shall be not less than *Type IA, Type IB or Type IIA construction and shall not exceed in area or height the limits specified in the California Building Code Table 503,* for the station configuration or as determined by fire hazard analysis of potential fire exposure hazards to the structure.

Add Section 5.2.2.1.1 –5.2.2.1.3 to read as follows:

5.2.2.1.1 *Underground stations shall be a minimum Type IA or Type IB constructions.*

5.2.2.1.2 *Open stations may be of Type IIB construction and shall not exceed in area or height as required by Table 503 for Type IIA.*

5.2.2.1.3 *Open at grade stations may be of any construction type allowed by the California Building Code.*

SFM—continued

12-7A-4: Decking
703A.7, 709A.3

12-7A-4A: Decking Alternate Method A
703A.7, 709A.3

12-7A-5: Ignition Resistant Building Material
703A.7, 709A.3

12-8-100: Room Fire Tests for Wall and Ceiling Materials
NA

12-10-1: Power Operated Exit Doors
NA

12-10-2: Single Point Latching or Locking Devices
NA

12-10-3: Emergency Exit and Panic Hardware
NA

(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.)

SJI

Steel Joist Institute
234 W. Cheves Street
Florence, SC 29501

SJI 100—15: 44th Edition Standard Specification Load Tables and Weight Tables for Steel Joists and Joist Girders K-Series, LH-Series, DHL-Series, Joist Girders
1604.3.3, 2203.2, 2207.1

SJI 200—15: Standard Specification for Composite Steel Joists, CJ-Series
1604.3.3, 2203.2, 2207.1

SPRI

Single-Ply Roofing Institute
465 Waverly Oaks Road, Suite 421
Waltham, MA 02452

ANSI/SPRI/FM 4435-ES-1—11: Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems
1504.5

ANSI/SPRI RP-4—13: Wind Design Guide for Ballasted Single-ply Roofing Systems
1504.4

ANSI/SPRI VF1—10: External Fire Design Standard for Vegetative Roofs
1505.10

SRCC

Solar Rating & Certification Corporation
3060 Saturn Street, Suite 100
Brea, CA 92821

ICC 900/SRCC 300—2015; Solar Thermal System Standard
3111.2.1

ICC 901/SRCC 100—2015: Solar Thermal Collector Standard
3111.2.1

TIA

Telecommunications Industry Association
1320 N. Courthouse Road #200
Arlington, VA 22201-3834

222-H—2016: Structural Standards for Antenna Supporting Structures and Antennas
1609.1.1, 3108.1, 3108.2

TMS

The Masonry Society
105 South Sunset Street, Suite Q
Longmont, CO 80501

216—2013: Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Table 721.1(2), 722.1

302—2012: Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls
1207.2.1

402—2016: Building Code for Masonry Structures
1404.6, 1404.6.2, 1404.10, 1604.3.4, 1705.4, 1705.4.1, 1807.1.6.3.2, 1808.9, 2101.2, 2106.1, 2107.1, 2107.2, 2107.3, 2108.1, 2108.2, 2108.3, 2109.1, 2109.1.1, 2109.2, 2110.1, 2114.1, 2114.4, *1411.2.1, 2106A.1.1, 2107A.5, 2107A.6, 2115.7, 2115.8, 2107.4, 2107.5, 2107.6, 2105A.3, 2106A.1.1, 2115.9, 2115.10*

403—2017: Direct Design Handbook for Masonry Structures
2101.2

404—2016: Standard for the Design of Architectural Cast Stone
2102.2

504—2016: Standard for the Fabrication of Architectural Cast Stone
2103.1

602—2016: Specification for Masonry Structures
1404.6.1, 1705.4, *1705A.4,* 1807.1.6.3, 2103.1, 2103.2.1, 2103.3, *2103A.3.1,* 2103.4, 2104.1, 2104A.1.3.1.1, *2105A.1.3.1.2, 2104A.1.3.1.1, 2104A.1.3.1.2.1,* 2105.1, *2105.3, 2105A.3, 2105.5, 2105A.5, 2105A.6, 2105.6, 2106.6*

604—2016: Standard for the Installation of Architectural Cast Stone
2104.1

TPI

Truss Plate Institute
218 N. Lee Street, Suite 312
Alexandria, VA 22314

TPI 1—2014: National Design Standard for Metal-plate-connected Wood Truss Construction
2303.4.6, 2306.1

UBC

International Code Council, Inc.
500 New Jersey Avenue, NW 6th Floor
Washington, DC 20001

UBC Standard 15-2: Test Standard for Determining the Fire Retardancy of Roof-Covering Materials
1505.6

UBC Standard 15-3: Wood Shakes
1505.6

UBC Standard 15-4: Wood Shingles
1505.6

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062-2096

9—2009: Fire Tests of Window Assemblies—with Revisions through February 2015
Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.2.1.3, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4, 1013.5

10A—2009: Tin Clad Fire Doors—with Revisions through December 2013
716.2.1

10B—2008: Fire Tests of Door Assemblies—with Revisions through February 2015
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.2, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

10C—2009: Positive Pressure Fire Tests of Door Assemblies—with Revisions through February 2015
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1, 1010.1.10.1

13—96: Power-limited Circuit Cables

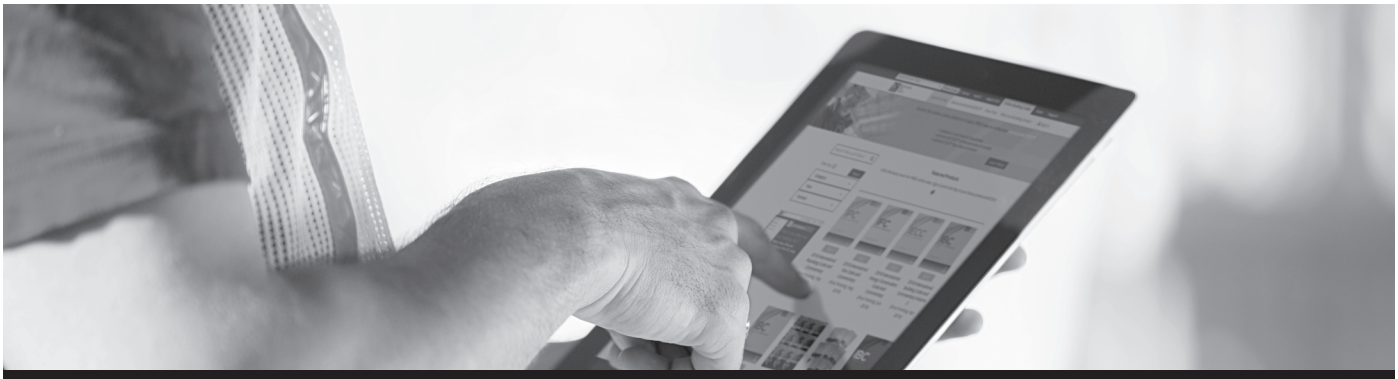
HISTORY NOTE APPENDIX

2019 California Building Code
California Code of Regulations, Title 24, Part 2

HISTORY:

For prior code history, see the History Note Appendix to the *California Building Code* 2016 Triennial Edition, effective January 1, 2017.

1. BSC 02/18, HCD 03/18, DSA-SS/CC 02/18, DSA/AC 01/18, SFM 01/18, OSHPD 02/18 and OSHPD 03/18, CDPH 01/18, SLC 01/18, BSCC 01/18 -- Adoption of the 2018 edition of the *International Building Code* published by the International Code Council, for incorporation into the 2019 *California Building Code,* CCR Title 24, Part 2 with amendments for state-regulated occupancies effective on January 1, 2020.
2. Erratum to correct editorial errors in Matrix Adoption Tables and miscellaneous corrections throughout Chapters 2, 3, 4, 5, 9, 10, 12, 14, 15, 16, 16A, 17, 17A, 18, 18A, 19, 19A, 20, 21A, 22, 22A, 23, 25, 27, 31, 31F, 35, effective January 1, 2020.



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