

# REVISION RECORD FOR THE STATE OF CALIFORNIA

## SUPPLEMENT

July 1, 2021

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

#### General Information:

1. The date of this supplement is for identification purposes only. See the History Note Appendix on the backside or accompanying page.
2. This supplement is issued by the California Building Standards Commission in order to provide new and/or replacement pages containing recently adopted provisions for California Code of Regulations, Title 24, Part 2, Volume 2, 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. The new building standards provided with the enclosed blue supplement pages must not be enforced before the effective date.
4. Not all code text on the enclosed blue supplement pages is a new building standard. New, amended, or repealed building standards are identified by margin symbols. An explanation of margin symbols is provided in the code before the table of contents.
5. You may wish to retain the superseded material with this revision record so that the prior wording of any section can be easily ascertained.

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## PREFACE

This document is Part 2 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

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## ACKNOWLEDGEMENTS

The 2019 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections, and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

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For questions on California state agency amendments, please refer to the contact list on page iv.

# CALIFORNIA CODE OF REGULATIONS, TITLE 24

## California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

### **Board of State and Community Corrections**

www.bscc.ca.gov..... (916) 445-5073  
Local Adult and Juvenile  
Detention Facility Standards

### **California Building Standards Commission**

www.dgs.ca.gov/bsc..... (916) 263-0916  
State Buildings including UC and  
CSU Buildings, Parking Lot and Walkway Lighting,  
Green Building Standards for Non-residential Buildings

### **California Energy Commission**

www.energy.ca.gov..... **Energy Hotline** (800) 772-3300  
Building Efficiency Standards  
Appliance Efficiency Standards  
Compliance Manual/Forms

### **California State Lands Commission**

www.slc.ca.gov..... (562) 499-6312  
Marine Oil Terminal Standards

### **California State Library**

www.library.ca.gov..... (916) 323-9843

### **Department of Consumer Affairs:**

#### **Acupuncture Board**

www.acupuncture.ca.gov..... (916) 515-5200  
Office Standards

#### **Board of Pharmacy**

www.pharmacy.ca.gov..... (916) 518-3100  
Pharmacy Standards

#### **Bureau of Barbering and Cosmetology**

www.barbercosmo.ca.gov..... (800) 952-5210  
Barber and Beauty Shop,  
and College Standards

#### **Bureau of Household Goods and Services**

www.bhgs.dca.ca.gov..... (916) 999-2041  
Insulation Testing Standards

#### **Structural Pest Control Board**

www.pestboard.ca.gov..... (800) 737-8188  
Structural Standards

#### **Veterinary Medical Board**

www.vmb.ca.gov..... (916) 515-5220  
Veterinary Hospital Standards

### **Department of Food and Agriculture**

www.cdffa.ca.gov  
Meat & Poultry Packing Plant Standards  
Rendering & Collection Center Standards..... (916) 900-5004  
Dairy Standards..... (916) 900-5008

### **Department of Housing and Community Development**

www.hcd.ca.gov..... (800) 952-8356 |  
Residential—Hotels, Motels, Apartments,  
Single-Family Dwellings; and  
Permanent Structures in Mobilehome &  
Special Occupancy Parks  
(916) 445-3338  
Factory-Built Housing, Manufactured Housing &  
Commercial Modular  
Mobilehome—Permits & Inspections  
Northern Region—(916) 255-2501  
Southern Region—(951) 782-4420  
(800) 952-8356 |  
Employee Housing Standards

### **Department of Public Health**

www.dph.ca.gov..... (916) 449-5661  
Organized Camps Standards  
Public Swimming Pools Standards

### **Division of the State Architect**

www.dgs.ca.gov/dsa..... (916) 445-8100

#### **Access Compliance**

#### **Fire and Life Safety**

#### **Structural Safety**

Public Schools Standards  
Essential Services Building Standards  
Community College Standards

#### **State Historical Building Safety Board**

Historical Rehabilitation, Preservation,  
Restoration or Relocation Standards

### **Office of Statewide Health Planning and Development**

www.oshpd.ca.gov..... (916) 440-8300 |  
Hospital Standards  
Skilled Nursing Facility Standards &  
Clinic Standards

### **Office of the State Fire Marshal**

osfm.fire.ca.gov..... (916) 568-3800  
Code Development and Analysis  
Fire Safety Standards

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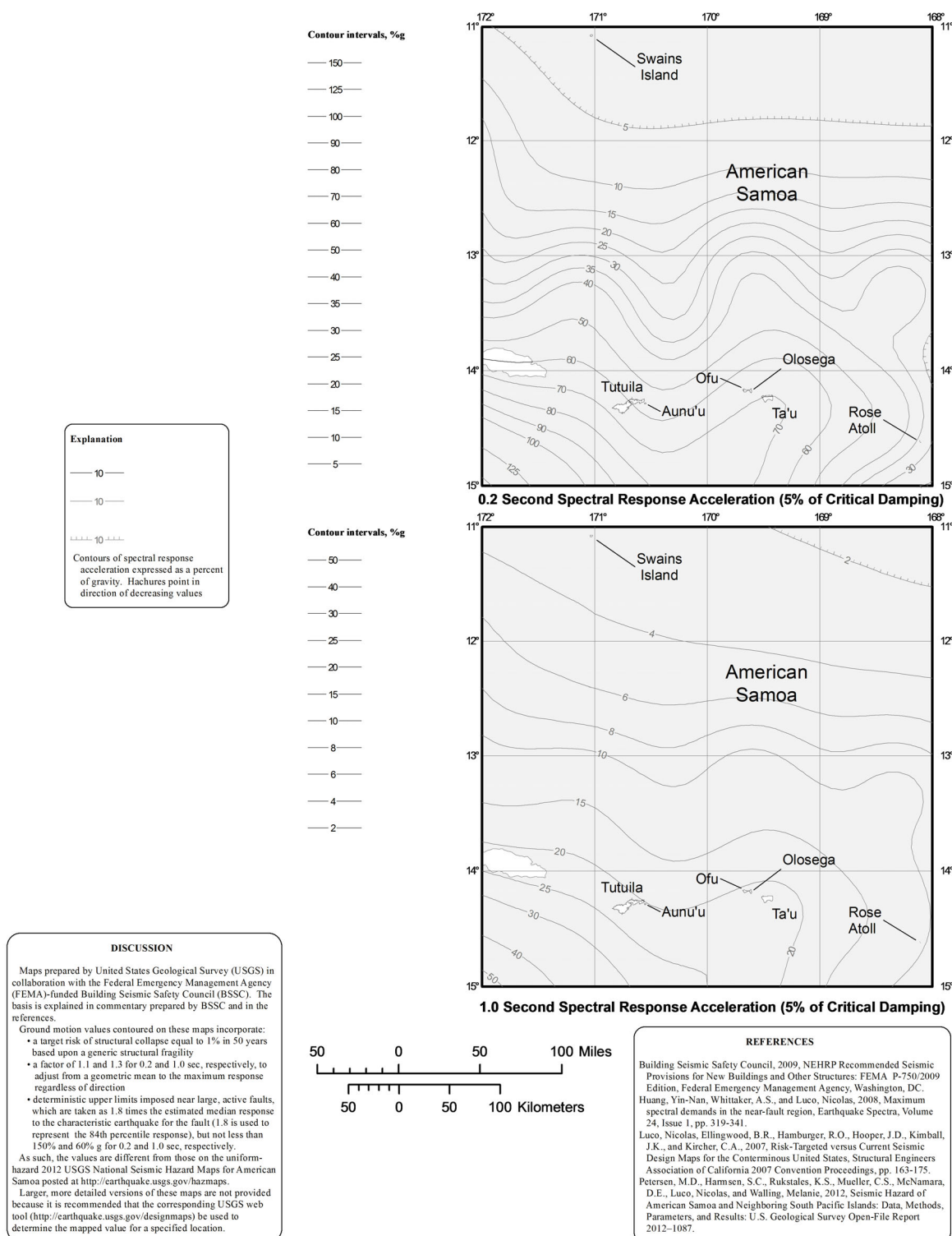
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**FIGURE 1613.2.1(8)**  
**RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE ( $MCE_R$ ) GROUND MOTION RESPONSE ACCELERATIONS**  
**FOR AMERICAN SAMOA OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)**

**1613.4 Component Importance Factors.** [OSHPD 1R, 2 & 5] Nonstructural components designated below shall have a component importance factor,  $I_p$ , equal to 1.5:

1. For components that are required for life-safety purposes after an earthquake, including emergency and standby power systems, mechanical smoke removal systems, fire protection sprinkler systems and fire alarm control panels.
2. For medical equipment required for patient life support.

## SECTION 1614 ATMOSPHERIC ICE LOADS

**1614.1 General.** Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

## SECTION 1615 TSUNAMI LOADS

**1615.1 General.** The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones defined in the Tsunami Design Geodatabase shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

## SECTION 1616 STRUCTURAL INTEGRITY

**1616.1 General.** High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of Section 1616.2 if they are frame structures, or Section 1616.3 if they are bearing wall structures.

**1616.2 Frame structures.** Frame structures shall comply with the requirements of this section.

**1616.2.1 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.

**1616.2.2 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.

**1616.2.2.1 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.

**1616.2.2.2 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.

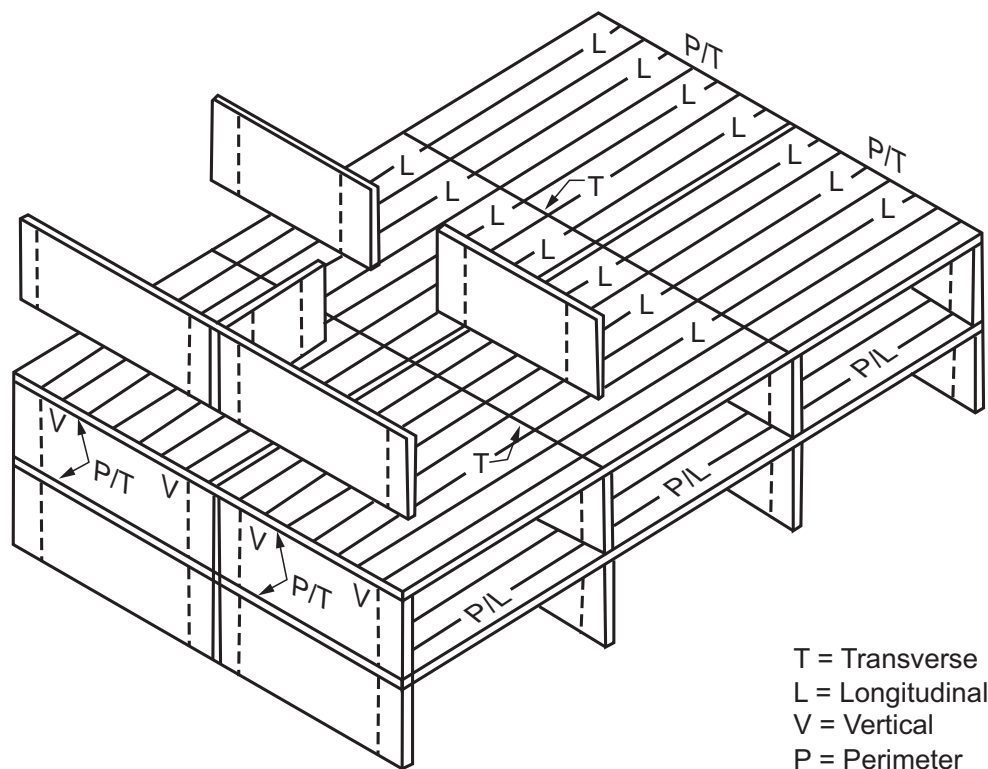
**Exception:** Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than  $\frac{3}{8}$ -inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

**1616.3 Bearing wall structures.** Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1616.3.

**1616.3.1 Concrete wall structures.** Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 16.2.4 and 16.2.5 of ACI 318.

**1616.3.2 Other bearing wall structures.** Ties in bearing wall structures other than those covered in Section 1616.3.1 shall conform to this section.

**1616.3.2.1 Longitudinal ties.** Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and



**FIGURE 1616.3**  
**LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES**

shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength,  $T_T$ , given by Equation 16-40. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_T = wLS \leq \alpha_T S \quad \text{(Equation 16-40)}$$

where:

$L$  = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

$w$  = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m<sup>2</sup>).

$S$  = The spacing between ties, feet (m).

$\alpha_T$  = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

**1616.3.2.2 Transverse ties.** Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed not farther apart than the spacing of

load-bearing walls. Transverse ties shall have minimum nominal tensile strength  $T_T$ , given by Equation 16-24. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

**1616.3.2.3 Perimeter ties.** Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than  $T_p$ , given by Equation 16-41. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_p = 200w \leq \beta_T \quad \text{(Equation 16-41)}$$

For SI:  $T_p = 90.7w \leq \beta_T$

where:

$w$  = As defined in Section 1616.3.2.1.

$\beta_T$  = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame construction.

**1616.3.2.4 Vertical ties.** Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. Not fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

## SECTION 1617 ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

### 1617.1 Construction documents.

**1617.1.1 Additional requirements for construction documents** are included in Sections 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R).

**1617.1.2 Connections.** Connections that resist design seismic forces shall be designed and detailed on the design drawings.

**1617.1.3 Construction procedures.** Where unusual erection or construction procedures are considered essential by the project structural engineer or architect in order to accomplish the intent of the design or influence the construction, such procedure shall be indicated on the plans or in the specifications.

### 1617.2 General design requirements.

#### 1617.2.1 Lateral load deflections.

**1617.2.1.1 Horizontal diaphragms.** The maximum span-depth ratio for any roof or floor diaphragm consisting of steel and composite steel slab decking or concrete shall be based on test data and design calculations acceptable to the enforcement agency.

**1617.2.1.2 Veneers.** The deflection shall not exceed  $l/600$  for veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing.

**1617.2.1.3 Risk Category of buildings and other structures.** Risk Category IV includes structures as defined in the California Administrative Code, Section 4-207 and all structures required for their continuous operation or access/egress.

**1617.2.1.4 Analysis.** Structural analysis shall explicitly include consideration of stiffness of diaphragm in accordance with ASCE 7 Section 12.3.1. A diaphragm

is rigid for the purpose of distribution of story shear and torsional moment where so indicated in Section 12.3.1 of ASCE 7.

**1617.2.2 Structural walls.** For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.

### 1617.3 Load combinations.

**1617.3.1 Stability.** When checking stability under the provisions of Section 1605.1.1 using allowable stress design, the factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported. Strength design for foundation geotechnical capacity shall be in accordance with ASCE 7 Section 12.13.5 for all strength design load combinations, except that Resistance Factor ( $\phi$ ) shall be permitted to be 1.0 for load combinations with overstrength factor. Allowable stress design for foundation geotechnical capacity shall be in accordance with ASCE 7 Section 12.13.6 for all allowable stress design load combinations, and shall be established to be consistent with strength design requirements in ASCE 7 Section 12.13.5.

**1617.3.2 Modifications to load combinations in ICC 300.** Modify the text of ICC 300, Section 303.5.2 by adding Equation 3-5a as follows:

$$D + 0.4L + Z$$

(Equation 3-5a)

**1617.3.2.3 ICC 300, Section 303.5.3.** Modify Section 303.5.3 as follows:

The uniform live load,  $L$ , used in Equation 3-2 and 3-4 may be taken as zero when evaluating elements supporting the handrail/guardrail provided those elements do not also support  $L$ .

**1617.4 Roof dead loads.** The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1511.

### 1617.5 Live loads.

#### 1617.5.1 Modifications to Table 1607.1.

**1617.5.1.1 Item 4. Assembly areas.** The following minimum loads for stage accessories apply:

1. Gridirons and fly galleries: 75 pounds per square foot uniform live load.
2. Loft block wells: 250 pounds per lineal foot vertical load and lateral load.
3. Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads.

the following equations shall be taken as 1.3. For other wind loads, ( $\omega$ ) shall be taken as 1. Where allowable stresses have not been increased or load combinations have not been reduced as permitted by the material chapter of this code or the referenced standards, ( $\omega$ ) shall be taken as 1. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect,  $E_v$ , in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero.

$$D + L + (L_r \text{ or } S \text{ or } R) \quad (\text{Equation 16A-17})$$

$$D + L + 0.6 \omega W \quad (\text{Equation 16A-18})$$

$$D + L + 0.6 \omega W + S/2 \quad (\text{Equation 16A-19})$$

$$D + L + S + 0.6 \omega W/2 \quad (\text{Equation 16A-20})$$

$$D + L + S + E/1.4 \quad (\text{Equation 16A-21})$$

$$0.9D + E/1.4 \quad (\text{Equation 16A-22})$$

#### Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 psf (1.44 kN/m<sup>2</sup>) or less and roof live loads of 30 psf (1.44 kN/m<sup>2</sup>) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 psf (1.44 kN/m<sup>2</sup>), 20 percent shall be combined with seismic loads.

**1605A.3.2.1 Other loads.** Where  $F$ ,  $H$  or  $T$  are to be considered in the design, each applicable load shall be added to the combinations specified in Section 1605.3.2. Where self-straining loads,  $T$ , are considered in the design, their structural effects in combination with other loads shall be determined in accordance with Section 2.4.4 of ASCE 7.

**1605A.4 Modifications to load combinations in ICC 300.** Modify the text of ICC 300, Section 303.5.2 by adding Equation 3-5a as follows:

$$D + 0.4L + Z \quad (\text{Equation 3-5a})$$

**1605A.4.3 ICC 300, Section 303.5.3.** Modify Section 303.5.3 as follows:

*The uniform live load  $L$  used in Equation 3-2 and 3-4 may be taken as zero when evaluating elements supporting the handrail/guard provided those elements do not also support  $L$ .*

## SECTION 1606A DEAD LOADS

**1606A.1 General.** Dead loads are those loads defined in Chapter 2 of this code. Dead loads shall be considered to be permanent loads.

**1606A.2 Design dead load.** For purposes of design, the actual weights of materials of construction and fixed service equipment shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

**1606A.3 Roof dead loads.** *The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1511.*

## SECTION 1607A LIVE LOADS

**1607A.1 General.** Live loads are those loads defined in Chapter 2 and Section 1602A.1 of this code.

**1607A.2 Loads not specified.** For occupancies or uses not designated in Table 1607A.1, the live load shall be determined in accordance with a method approved by the building official.

**1607A.3 Uniform live loads.** The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607A.1.

**1607A.4 Concentrated live loads.** Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607A.3 or the concentrated live loads, given in Table 1607A.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of 2½ feet by 2½ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

**1607A.5 Partition loads.** In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load is 80 psf (3.83 kN/m<sup>2</sup>) or greater. The partition load shall be not less than a uniformly distributed live load of 15 psf (0.72 kN/m<sup>2</sup>).

**TABLE 1607A.1**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ ,**  
**AND MINIMUM CONCENTRATED LIVE LOADS<sup>g</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
1. Apartments (see residential)	—	—
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150 <sup>n</sup>	—
4. Assembly areas <sup>o, q</sup>		
Fixed seats (fastened to floor)	60 <sup>m</sup>	—
Follow spot, projections and control rooms	50	
Lobbies	100 <sup>m</sup>	
Movable seats	100 <sup>m</sup>	
Stage floors	150 <sup>n</sup>	
Platforms (assembly)	100 <sup>m</sup>	
Other assembly areas	100 <sup>m</sup>	
5. Balconies and decks <sup>h</sup>	1.5 times the live load for the area served, not required to exceed 100	—
6. Catwalks	40	300
7. Cornices	60	—
8. Corridors		
First floor	100	—
Other floors	Same as occupancy served except as indicated	
9. Dining rooms and restaurants	100 <sup>m</sup>	—
10. Dwellings (see residential)	—	—
11. Elevator machine room and controlroom grating (on area of 2 inches by 2 inches)	—	300
12. Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200
13. Fire escapes	100	—
On single-family dwellings only	40	
14. Garages (passenger vehicles only)	40 <sup>o</sup>	Note a
Trucks and buses	See Section 1607.7	
15. Handrails, guards and grab bars	See Section 1607.8	
16. Helipads	See Section 1607.6	
17. Hospitals [OSHPD 1 & 4]		
Corridors above first floor	80	1,000
Operating rooms, laboratories	60 <sup>m</sup>	1,000
Patient rooms	40	1,000
18. Hotels (see residential)	—	—
19. Libraries <sup>r</sup>		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150 <sup>b, n</sup>	1,000
20. Manufacturing		
Heavy	250 <sup>n</sup>	3,000
Light	125 <sup>n</sup>	2,000
21. Marquees, except one- and two-family dwellings	75	—

(continued)

**TABLE 1607A.1—continued**  
**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS,  $L_o$ ,**  
**AND MINIMUM CONCENTRATED LIVE LOADS<sup>g</sup>**

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
22. Office buildings <sup>r</sup>		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000
23. Penal institutions		
Cell blocks	40	—
Corridors	100	
24. Recreational uses:		
Bowling alleys, poolrooms and similar uses	75 <sup>m</sup>	—
Dance halls and ballrooms	100 <sup>m</sup>	
Gymnasiums	100 <sup>m</sup>	
Ice skating rink	250 <sup>n</sup>	
Reviewing stands, grandstands and bleachers <sup>s</sup>	100 <sup>c, m</sup>	
Roller skating rink	100 <sup>m</sup>	
Stadiums and arenas with fixed seats (fastened to floor)	60 <sup>c, m</sup>	
25. Residential		
One- and two-family dwellings		—
Uninhabitable attics without storage <sup>i</sup>	10	
Uninhabitable attics with storage <sup>i, j, k</sup>	20	
Habitable attics and sleeping areas <sup>k</sup>	30	
Canopies, including marquees	20	
All other areas	40	
Hotels and multifamily dwellings		
Private rooms and corridors serving them	40	
Public rooms <sup>m</sup> and corridors serving them	100	
26. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5 <sup>m</sup>	
All other construction, except one- and two-family dwellings	20	
Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	
Primary roof members exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages		
All other primary roof members		
Occupiable roofs:		
Roof gardens	100	2,000
Assembly areas	100 <sup>m</sup>	300
All other similar areas	Note 1	Note 1
27. Schools <sup>p</sup>		
Classrooms	40 <sup>r</sup>	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000

(continued)



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,  $\Omega_0$ , 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 differ-

ence 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:

$$\delta_M = C_d \delta_{max} \quad \text{(Equation 12.12-1)}$$

**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 over-strength 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: **[DSA-SS] [for OSHPD see Section 13.1.4.a]**

**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.
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.

**13.1.4.a [OSHPD 1, 1R, 2, 4 & 5].** The following non-structural components and equipment shall be anchored in accordance with this section. Design and detailing shall be in accordance with Chapter 13 except as modified by this section.

1. **Fixed Equipment:** Equipment shall be anchored if it is directly attached to the building utility services such as electricity, gas, or water. For the purposes of this requirement, "directly attached" shall include all electrical connections except plugs for 110/220-volt receptacles having a flexible cable/cord. Equipment that is connected to the building plumbing system with a shut-off valve in proximity to the equipment shall not be considered as directly attached provided the inside diameter of the pipe/tubing is less than  $1/2$  inches (12.7 mm).
2. **Movable Equipment:** Equipment is subject to the same requirement as fixed equipment, but is permitted to be anchored by re-attachable anchors or restraints in a manner approved by the enforcement agency. Utilities and services at the equipment shall have flexible connections to allow for necessary movement.
3. **Mobile Equipment:** Equipment heavier than 400 lb (18.44 kg) that has a center of mass located 4 feet (1219 mm) 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 stored and not in use, unless the equipment is stored in an equipment storage room.
4. **Countertop Equipment:** Countertop Equipment shall be subject to the same anchorage or restraint requirements for fixed, movable, mobile or other equipment as applicable.
5. **Temporary Equipment:** Equipment for uses greater than 30 days but less than or equal to 180 days and where this section requires supports and attachments, the following shall apply:
  - a. Seismic design for supports and attachments for temporary equipment shall meet the requirements of Chapter 13; however, the calculated  $F_p$  may be reduced by 50 percent. It is acceptable to use ballasts for seismic bracing supports and attachments and to limit the design criteria to overturning unless directly or indirectly supported by the building structure.
  - b. Wind design speeds may be reduced as prescribed in ASCE 37-14 or other standard approved by OSHPD.
  - c. Temporary piping, conductors and ductwork shall be supported. Seismic design for supports and attachments of temporary piping, conductors and ductwork is not required.
6. **Interim Equipment:**
  - a. Seismic design for supports and attachments for interim equipment shall meet the require-

- ments of Chapter 13. It is acceptable to use ballasts for seismic or wind bracing supports and attachments.
- b. Wind design speeds may be reduced as prescribed in ASCE 37-14 or other standard approved by OSHPD.
  - c. Piping, conductors and ductwork shall be supported. Seismic design for supports and attachments of piping, conductors and ductwork is not required.
7. **Other Equipment:** Equipment shall be anchored where any of the following apply:
- a. Essential to hospital operations and weight of equipment is greater than 100 lb (45 kg).
  - b. Could fall within the patient care vicinity as defined in Article 517.2 of the California Electrical Code.
  - c. Could fall and block a required means of egress. Weight of equipment is greater than 400 lb (18.44 kg).
  - d. Weight of equipment is greater than 200 lb (90 kg) and center of mass located greater than 4 feet (1219 mm) measured from the finished floor.
8. Equipment with hazardous contents.
9. Other architectural, mechanical and electrical components stated in Chapter 13.

**Exemptions:**

1. Furniture except storage cabinets as noted in Table 13.5-1.
2. Nonstructural components and equipment, that are attached to the building, provided that the component weighs 20 lb (9 kg) or less or, in the case of a distributed system, 5 lb/ft (73 N/m) or less. Seismic design and seismic details need not be provided.
3. Seismic design need not be provided for discrete architectural, mechanical and electrical components and equipment that are attached to the building and anchorage is detailed on the plans, provided that the component weighs 400 lb (18.44 kg) or less, and the center of mass is located 4 feet (1219 mm) or less above the adjacent floor or roof level that directly support the component and flexible connections are provided between the component and associated ductwork, piping and conduit where required.

**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<sup>2</sup>) 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 ( $\Omega_o$ ) 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,  $D_{pt}$ , 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 associ-

ated 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  $\frac{3}{8}$  inch (10 mm) or  $\frac{1}{2}$  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<sup>2</sup>) 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  $\frac{3}{8}$ -inch (10 mm) or  $\frac{1}{2}$ -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, 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  $\frac{3}{8}$  inch (10 mm) or  $\frac{1}{2}$  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  $\frac{3}{4}$  inches (80 mm) or less.

3. Pneumatic tube systems supported with trapeze assemblies using  $\frac{3}{8}$  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  $\frac{3}{8}$  inch (10 mm) or  $\frac{1}{2}$  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<sup>2</sup>) 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 Elevation (DFE) or Base Flood Elevation (BFE) plus two feet (BFE + 2 ft.) or 500 year flood elevation, whichever is higher, and shall be located at an elevation close to grade for easy accessibility from outside for maintenance.

**1617A.1.41 Peer Review Requirements. [OSHPD 1, 1R, 2, 4, & 5]**

1. **General.** Independent peer review is an objective technical review by knowledgeable reviewer(s) experienced in structural design, analysis and performance issues involved. The reviewer(s) shall examine the available information on the condition of the building, basic engineering concept employed and recommendations for action.
2. **Timing of Independent Review.** The independent reviewer (s) shall be selected prior to initiation of substantial portion of the design and analysis work that is to be reviewed, and review shall start as soon as practical and sufficient information defining the project is available.
3. **Qualifications and Terms of Employment.** The reviewer shall be independent from the design and construction team.
  - 3.1. The reviewer(s) shall have no other involvement in the project before, during or after the review, except in a review capacity.
  - 3.2. The reviewer shall be selected and paid by owner and shall have technical expertise similar to the project being reviewed, as determined by enforcement agent.
  - 3.3. The reviewer (in case of review team, the chair) shall be a California-licensed structural engineer who is familiar with technical issues and regulations governing the work to be reviewed.
  - 3.4. The reviewer shall serve through completion of the project and shall not be terminated except for failure to perform the duties specified herein. Such termination shall be in writing with copies to enforcement agent, owner, and the engineer of record. When a reviewer is terminated or resigns, a qualified replacement shall be appointed within 10 working days or a timeframe mutually agreed to by the Owner, Registered Design Professional (RDP) and the Office.

4. **Scope of Review.** *Review activities shall include, where appropriate, available construction documents, design criteria, observation of the condition of structure, all new and original inspection reports, including methods of sampling, analyses prepared by the engineer of record and consultants, and the new, retrofit or repair design. Review shall include consideration of the proposed design approach, method, materials and details.*
5. **Reports.** *The reviewer(s) shall prepare a written report to the owner and responsible enforcement agent that covers all aspect of the review performed including conclusions reached by the reviewer. Report shall be issued after the schematic phase, during design development, and at the completion of construction documents, but prior to their issuance of permit. Such report shall include, at the minimum, statement of the following:*
  - a. *Scope of engineering design peer review with limitations defined.*
  - b. *The status of the project documents at each review stage.*
  - c. *Ability of selected materials and framing systems to meet the performance criteria with given loads and configuration.*
  - d. *Degree of structural system redundancy and the deformation compatibility among structural and nonstructural elements.*
  - e. *Basic constructability of the new, retrofit or repair system.*
  - f. *Other recommendation that will be appropriate for the specific project.*
  - g. *Presentation of the conclusions of the reviewer identifying any areas that need further review, investigation and/or clarification.*
  - h. *Recommendations.*



# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS

(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			OSHDP						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																							
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																							
1701.1.1											X	X			X								
1701.1.2											X	X			X								
1701.1.3											X	X			X								
1703.4											X	X			X								
1704.2, Exception 5				X	X																		
1704.2, Exceptions 3 & 4											X	X			X								
1704.2.3	X																						
1704.2.3 Exception											X	X			X								
1704.2.4											X	X			X								
1704.2.5.1											X	X			X								
1704.3.2											X	X			X								
1705.2.1											X	X			X								
1705.2.3.1											X	X			X								
1705.2.4.1											X	X			X								
1705.2.5											X	X			X								
1705.2.6											X	X			X								
1705.3 Exception											X	X			X								
1705.3.3											X	X			X								
1705.3.3.1											X	X			X								
Table 1705.3											X	X			X								
1705.3.4											X	X			X								
1705.3.5											X	X			X								
1705.3.6											X	X			X								
1705.3.7											X	X			X								
1705.3.8											X	X			X								
1705.4											X	X			X								
1705.4.1											X	X			X								
1705.5.3											X	X			X								
1705.5.4											X	X			X								
1705.5.5											X	X			X								
1705.5.6											X	X			X								
1705.5.7	X		X	X	X																		
Table 1705.5.7	X		X	X	X																		

(continued)

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS—continued

(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			OSHDPD						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																							
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																							
1705.6.1											X	X			X								
1705.7.1											X	X			X								
1705.11.1 Exception	X		X	X	X																		
1705.11.2 Exception 2	X		X	X	X																		
1705.12.2 Exception	X		X	X	X																		
1705.12.3 Exception 2	X		X	X	X																		
1705.13.1.1 Exception											X	X			X								
1705.13.1.2 Exception											X	X			X								
1705.13.3.1											X	X			X								
1705.13.2											X	X			X								
1705.14			X																				
1705.15			X																				
1705.17											X	X			X								
1705.19											X	X			X								
1705.19.1											X	X			X								
1705.20	X		X	X	X																		
1707.1	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.

tural 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.

**1705.5.2 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.

**1705.5.3 [OSHPD 1R, 2 & 5] Manufactured trusses and assemblies.** The fabrication of trusses and other assemblies constructed using wood and metal members, or using light metal plate connectors, shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report that the lumber species, grades and moisture content; type of glue, temperature and gluing procedure; type of metal members and metal plate connectors; and the workmanship conform in every material respect with the duly approved construction documents. Each inspected truss shall be stamped by the approved agency with an identifying mark.

**1705.5.4 Structural glued laminated timber. [OSHPD 1R, 2 & 5]** 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 non-custom members of 5<sup>1</sup>/<sub>8</sub>-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 A190.1 Section 13.1 for noncustom members.

**1705.5.5 Manufactured open web trusses. [OSHPD 1R, 2 & 5]** 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.

**1705.5.6 Timber connectors. [OSHPD 1R, 2 & 5]** 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.

**1705.5.7 Mass timber construction. [BSC, HCD-1, HCD-2, SFM]** Special inspections of Mass Timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.7.

**1705.6 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 1705.6. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance. During fill

**TABLE 1705.5.7  
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION  
[BSC, HCD-1, HCD-2, SFM]**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	—	X
2. Inspect erection of mass timber construction.	—	X
3. Inspection of connections where installation methods are required to meet design loads.	—	—
3.1. Threaded fasteners.	—	—
3.1.1. Verify use of proper installation equipment.	—	X
3.1.2. Verify use of pre-drilled holes where required.	—	X
3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.	—	X
3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	X	—
3.3. Adhesive anchors not defined in 3.2.	—	X
3.4. Bolted connections.	—	X
3.5. Concealed connections.	—	X

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 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.

**1705.6.1 Soil fill. [OSHPD 1R, 2 & 5]** 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 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; and 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 inspections required by the approved construction documents were completed and whether the tested materials and/or inspected work meet the requirements of the approved construction documents.*

**1705.7 Driven deep foundations.** Special inspections and tests shall be performed during installation of driven deep foundation elements as specified in Table 1705.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

**1705.7.1 Driven deep foundations observation. [OSHPD 1R, 2 & 5]** 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, 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.*

**1705.8 Cast-in-place deep foundations.** Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in Table 1705.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

**1705.9 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 installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

**1705.10 Fabricated items.** Special inspections of fabricated items shall be performed in accordance with Section 1704.2.5.

**1705.11 Special inspections for wind resistance.** Special inspections for wind resistance specified in Sections 1705.11.1 through 1705.11.3, unless exempted by the exceptions to Section 1704.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where  $V_{asd}$  as determined in accordance with Section 1609.3.1 is 120 miles per hour (52.8 m/sec) or greater.
2. In wind Exposure Category C or D, where  $V_{asd}$  as determined in accordance with Section 1609.3.1 is 110 mph (49 m/sec) or greater.

**TABLE 1705.6  
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

**TABLE 1705.7  
REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	—	—
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3.	—	—
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	—	—

**TABLE 1705.8  
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3.	—	—

**1705.11.1 Structural wood.** Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

**Exception:** Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the main windforce-resisting system, where the *[BSC, HCD-1, HCD-2, SFM] lateral resistance is provided by the structural sheathing and the specified fastener spacing at panel edges is more than 4 inches (102 mm) on center.*

**1705.11.2 Cold-formed steel light-frame construction.** Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**Exception:** Special inspections are not required for cold-formed steel light-frame shear walls and diaphragms, including screwing, bolting, anchoring and

other fastening to components of the windforce-resisting system, where either of the following applies:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the *specified* fastener spacing *at the panel or sheet edges* is more than 4 inches (102 mm) on center (o.c.).

**1705.11.3 Wind-resisting components.** Periodic special inspection is required for fastening of the following systems and components:

1. Roof covering, roof deck and roof framing connections.
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.

**1705.12 Special inspections for seismic resistance.** Special inspections for seismic resistance shall be required as specified in Sections 1705.12.1 through 1705.12.9, unless exempted by the exceptions of Section 1704.2.

**Exception:** The special inspections specified in Sections 1705.12.1 through 1705.12.9 are not required for structures designed and constructed in accordance with one of the following:

1. The structure consists of light-frame construction; the design spectral response acceleration at short periods,  $S_{DS}$ , as determined in Section 1613.2.4, does

not exceed 0.5; and the building height of the structure does not exceed 35 feet (10 668 mm).

2. The seismic force-resisting system of the structure consists of reinforced masonry or reinforced concrete; the design spectral response acceleration at short periods,  $S_{DS}$ , as determined in Section 1613.2.4, does not exceed 0.5; and the building height of the structure does not exceed 25 feet (7620 mm).
3. The structure is a detached one- or two-family dwelling not exceeding two stories above grade plane and does not have any of the following horizontal or vertical irregularities in accordance with Section 12.3 of ASCE 7:
  - 3.1. Torsional or extreme torsional irregularity.
  - 3.2. Nonparallel systems irregularity.
  - 3.3. Stiffness-soft story or stiffness-extreme soft story irregularity.
  - 3.4. Discontinuity in lateral strength-weak story irregularity.

**1705.12.1 Structural steel.** Special inspections for seismic resistance shall be in accordance with Section 1705.12.1.1 or 1705.12.1.2, as applicable.

**1705.12.1.1 Seismic force-resisting systems.** Special inspections of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

**Exceptions:**

1. In buildings and structures assigned to Seismic Design Category B or C, special inspections are not required for structural steel seismic force-resisting systems where 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, has been used for design and detailing.
2. In structures assigned to Seismic Design Category D, E, or F, special inspections are not required for structural steel seismic force-resisting systems where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

**1705.12.1.2 Structural steel elements.** Special inspections of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.12.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341.

**Exceptions:**

1. In buildings and structures assigned to Seismic Design Category B or C, special inspections

of structural steel elements are not required for seismic force-resisting systems with a response modification coefficient,  $R$ , of 3 or less.

2. In structures assigned to Seismic Design Category D, E, or F, special inspections of structural steel elements are not required for seismic force-resisting systems where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. Special inspection shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

**1705.12.2 Structural wood.** For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F:

1. Continuous special inspection shall be required during field gluing operations of elements of the seismic force-resisting system.
2. Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

**Exception:** Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the seismic force-resisting system, where the *lateral resistance is provided by structural sheathing, and the specified fastener spacing at the panel edges* is more than 4 inches (102 mm) on center.

**1705.12.3 Cold-formed steel light-frame construction.** For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F, periodic special inspection shall be required for both:

1. Welding operations of elements of the seismic force-resisting system.
2. Screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**Exception:** Special inspections are not required for cold-formed steel light-frame shear walls and diaphragms, including screw installation, bolting, anchoring and other fastening to components of the seismic force-resisting system, where either of the following applies:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the *specified fastener spacing at the panel or sheet edge* is more than 4 inches (102 mm) on center.

**1705.12.4 Designated seismic systems.** For structures assigned to Seismic Design Category C, D, E or F, the special inspector shall examine designated seismic systems requiring seismic qualification in accordance with

Section 13.2.2 of ASCE 7 and verify that the label, anchorage and mounting conform to the certificate of compliance.

**1705.12.5 Architectural components.** Periodic special inspection is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

**Exception:** Periodic special inspection is not required for the following:

1. Exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer 30 feet (9144 mm) or less in height above grade or walking surface.
2. Exterior cladding and interior and exterior veneer weighing 5 psf (24.5 N/m<sup>2</sup>) or less.
3. Interior nonbearing walls weighing 15 psf (73.5 N/m<sup>2</sup>) or less.

**1705.12.5.1 Access floors.** Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

**1705.12.6 Plumbing, mechanical and electrical components.** Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to Seismic Design Category C, D, E or F.
2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category C, D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the approved construction documents require a nominal clearance of  $\frac{1}{4}$  inch (6.4 mm) or less between the equipment support frame and restraint.
6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to Seismic Design Category C, D, E or F to verify one of the following:
  - 6.1. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7.
  - 6.2. A nominal clearance of not less than 3 inches (76 mm) has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers;

equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.

**1705.12.7 Storage racks.** Periodic special inspection is required for the anchorage of storage racks that are 8 feet (2438 mm) or greater in height in structures assigned to Seismic Design Category D, E or F.

**1705.12.8 Seismic isolation systems.** Periodic special inspection shall be provided for seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F during the fabrication and installation of isolator units and energy dissipation devices.

**1705.12.9 Cold-formed steel special bolted moment frames.** Periodic special inspection shall be provided for the installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F.

**1705.13 Testing for seismic resistance.** Testing for seismic resistance shall be required as specified in Sections 1705.13.1 through 1705.13.4, unless exempted from special inspections by the exceptions of Section 1704.2.

**1705.13.1 Structural steel.** Nondestructive testing for seismic resistance shall be in accordance with Section 1705.13.1.1 or 1705.13.1.2, as applicable.

**1705.13.1.1 Seismic force-resisting systems.** Nondestructive testing of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

**Exceptions:** *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, nondestructive testing is not required for structural steel seismic force-resisting systems where 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, has been used for design and detailing.
2. In structures assigned to Seismic Design Category D, E, or F, nondestructive testing is not required for structural steel seismic force-resisting systems where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

**1705.13.1.2 Structural steel elements.** Nondestructive testing of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.13.1.1, including struts, collectors, chords and foundation elements, shall be

performed in accordance with the quality assurance requirements of AISC 341.

**Exceptions:** *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, nondestructive testing of structural steel elements is not required for seismic force-resisting systems with a response modification coefficient,  $R$ , of 3 or less.
2. In structures assigned to Seismic Design Category D, E or F, nondestructive testing of structural steel elements is not required for seismic force-resisting systems where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. Nondestructive testing of structural steel elements shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

**1705.13.2 Nonstructural components.** For structures assigned to Seismic Design Category B, C, D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by seismic qualification as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic qualification by analysis, testing or experience data. Certificates of compliance for the seismic qualification shall be submitted to the building official as specified in Section 1704.5.

*[OSHPD 1R, 2 & 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.*

**1705.13.3 Designated seismic systems.** For structures assigned to Seismic Design Category C, D, E or F and with designated seismic systems that are subject to the requirements of Section 13.2.2 of ASCE 7 for certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis, testing or experience data 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.

**1705.13.3.1 Special seismic certification.** *[OSHPD 1R, 2 & 5]*

1. *Special seismic certification shall be required for life-safety components, such as emergency and standby power systems, mechanical smoke removal systems, and fire sprinkler/fire protection systems.*
2. *Medical, mechanical and electrical equipment and components required for life support for patients shall have special seismic certification in accordance with Section 1705A.13.3.*

**1705.13.4 Seismic isolation systems.** Seismic isolation systems in seismically isolated structures assigned to Seis-

mic Design Category B, C, D, E or F shall be tested in accordance with Section 17.8 of ASCE 7.

**[BF] 1705.14 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 1705.14.1 through 1705.14.6. 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 *during construction with an additional visual inspection* after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings *and before concealed*, where applicable. *The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705.14.4.1 through 1705.14.4.9.*

**[BF] 1705.14.1 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 ( $\text{kg/m}^3$ ).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

**[BF] 1705.14.2 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] 1705.14.3 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] 1705.14.4 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 1705.14.4.1.

**[BF] 1705.14.4.1 Minimum allowable thickness.** For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus  $\frac{1}{4}$  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 1705.14.4.2 and 1705.14.4.3.



**[BF] 1705.14.4.2 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<sup>2</sup>) of the sprayed area, or portion thereof, in each story.

**[BF] 1705.14.4.3 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] 1705.14.4.4 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 symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

**[BF] 1705.14.4.5 Structural members.** The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

**[BF] 1705.14.4.6 Beams and girders.** At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

**[BF] 1705.14.4.7 Joists and trusses.** At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

**[BF] 1705.14.4.8 Wide-flanged columns.** At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

**[BF] 1705.14.4.9 Hollow structural section and pipe columns.** At hollow structural section and pipe columns, thickness measurements shall be made at not fewer than four locations around the column at each end of a 12-inch (305 mm) length.

**[BF] 1705.14.5 Density.** The density of the sprayed fire-resistant material shall be not less than the density specified in the approved fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of struc-

tural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**[BF] 1705.14.6 Bond strength.** The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) (7.18 kN/m<sup>2</sup>). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705.14.6.1 through 1705.14.6.3.

**[BF] 1705.14.6.1 Floor, roof and wall assemblies.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) of the sprayed area, or portion thereof, in each story.

**[BF] 1705.14.6.2 Structural members.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**[BF] 1705.14.6.3 Primer, paint and encapsulant bond tests.** Bond tests to qualify a primer, paint or encapsulant shall be conducted where the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

**[BF] 1705.15 Mastic and intumescent fire-resistant coatings.** Special inspections and tests for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be performed in accordance with AWCI 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents. *Special inspections and tests shall be performed after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, and before concealed, where applicable.*

**1705.16 Exterior insulation and finish systems (EIFS).** Special inspections shall be required for all EIFS applications.

**Exceptions:**

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.

2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

**1705.16.1 Water-resistive barrier coating.** A water-resistive barrier coating complying with ASTM E2570 requires special inspection of the water-resistive barrier coating where installed over a sheathing substrate.

**[BF] 1705.17 Fire-resistant penetrations and joints.** In high-rise buildings or in buildings assigned to Risk Category III or IV, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire barrier systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3 and 715.4 shall be in accordance with Section 1705.17.1 or 1705.17.2.

**[OSHPD 1R, 2 & 5]** Buildings assigned to all Risk Categories shall be subject to special inspections for fire-resistant penetrations and joints.

**[BF] 1705.17.1 Penetration firestops.** Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.4.1.2 and 714.5.1.2 shall be conducted by an approved agency in accordance with ASTM E2174.

**[BF] 1705.17.2 Fire-resistant joint systems.** Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3 and 715.4 shall be conducted by an approved agency in accordance with ASTM E2393.

**[F] 1705.18 Testing for smoke control.** Smoke control systems shall be tested by a special inspector.

**[F] 1705.18.1 Testing scope.** The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

**[F] 1705.18.2 Qualifications.** Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

**1705.19 Shotcrete.** **[OSHPD 1R, 2 & 5]** All shotcrete work shall be continuously inspected during placing by an approved agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The approved agency shall furnish a verified report that of his or her own personal knowledge the work covered by the report has been performed and materials have been used and installed in every material respect in compliance with the duly approved plans and specifications. Preconstruction and strength tests of shotcrete shall be in accordance with Sections 1908.5 and 1908.10, respectively.

**1705.19.1 Visual examination for structural soundness of in-place shotcrete.** Completed shotcrete work shall be

checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.

**Exception:** Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.

**1705.20 Sealing of mass timber.** **[BSC, HCD-1, HCD-2, SFM]** Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.9 is applied to mass timber building elements as designated in the approved construction documents.

## SECTION 1706 DESIGN STRENGTHS OF MATERIALS

**1706.1 Conformance to standards.** The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

**1706.2 New materials.** For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707.

## SECTION 1707 ALTERNATIVE TEST PROCEDURE

**1707.1 General.** In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Sections 104.11 or 1.8.7, as applicable. The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

**[BSC]** In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 1.2.1, Chapter 1, Division I. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.

## SECTION 1708 IN-SITU LOAD TESTS

**1708.1 General.** Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

**1708.2 In-situ load tests.** In-situ load tests shall be conducted in accordance with Section 1708.2.1 or 1708.2.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

**1708.2.1 Load test procedure specified.** Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1708.2.2 shall apply.

**1708.2.2 Load test procedure not specified.** In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to an approved test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic force-resisting system, at a minimum the test load shall be equal to the specified factored design loads. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design loads being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic loads (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.

3. During and immediately after the test, the structure shall not show evidence of failure.

## SECTION 1709 PRECONSTRUCTION LOAD TESTS

**1709.1 General.** Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

**1709.2 Load test procedures specified.** Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1709.3 shall apply.

**1709.3 Load test procedures not specified.** Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1709.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

**1709.3.1 Test procedure.** The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in Section 1709.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

**1709.3.2 Deflection.** The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3.

**1709.4 Wall and partition assemblies.** Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

**1709.5 Exterior window and door assemblies.** The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709.5.1 or 1709.5.2. For exterior windows and doors tested in accordance with Sections 1709.5.1 or 1709.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

**Exception:** Structural wind load design pressures for window units smaller than the size tested in accordance with Section 1709.5.1 or 1709.5.2 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. Components of the small unit shall be the same as the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window unit having the highest allowable design pressure.

**1709.5.1 Exterior windows and doors.** Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

**1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1.** Exterior window and door assemblies shall be tested in accordance with ASTM E330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

**1709.6 Skylights and sloped glazing.** Skylights and sloped glazing shall comply with the requirements of Chapter 24.

**1709.7 Test specimens.** Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

## CHAPTER 17A

# SPECIAL INSPECTIONS AND TESTS

### SECTION 1701A GENERAL

**1701A.1 Scope.** The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

**1701A.1.1 Application.** *The scope of application of Chapter 17A is as follows:*

1. Structures regulated by the Division of the State Architect-Structural Safety, which include those applications listed in Sections 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.
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.

**1701A.1.2 Amendments in this chapter.** *DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.*

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

**1701A.1.3 Reference to other chapters.**

**1701A.1.3.1 [DSA-SS/CC]** *Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A, 22A and 23, the provisions in Chapters 16, 19, 21, 22 and 23, respectively, shall apply instead as defined in Section 1.9.2.2. Referenced sections may not directly correlate, but the corresponding DSA-SS/CC sections to such references still apply.*

**1701A.3 Special inspections and tests. [OSHPD 1 and 4]** *In addition to the inspector(s) of record required by the California Administrative Code (CCR, Title 24, Part 1), Section 7-144, the owner shall employ one or more approved agencies to provide special inspections and tests during construction*

*on the types of work listed under Chapters 17A, 18A, 19A, 20, 21A, 22A, 23 and 25, and noted in the Test, Inspection, and Observation (TIO) program required by Sections 7-141, 7-145 and 7-149, of the California Administrative Code. Test, Inspection and Observation (TIO) program shall satisfy requirements of Section 1704A.*

**1701A.4 Special inspections and tests. [DSA-SS & DSA-SS/CC]** *In addition to the project inspector required by the California Administrative Code (CCR, Title 24, Part 1), Section 4-333, the owner shall employ one or more approved agencies to provide special inspections and tests as required by the enforcement agency during construction on the types of work listed under Chapters 17A, 18A, 19A, 20, 21A, 22A, 23, and 25 and the California Existing Building Code and noted in the special test, inspection and observation plan required by Section 4-335 of the California Administrative Code.*

### SECTION 1702A NEW MATERIALS

**1702A.1 General.** New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

### SECTION 1703A APPROVALS

**1703A.1 Approved agency.** An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements specified in Sections 1703A.1.1 through 1703A.1.3.

**1703A.1.1 Independence.** An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall disclose to the building official and the registered design professional in responsible charge possible conflicts of interest so that objectivity can be confirmed.

**1703A.1.2 Equipment.** An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

**1703A.1.3 Personnel.** An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and special inspections.

**1703A.2 Written approval.** Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

**1703A.3 Record of approval.** For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be available for public review at appropriate times.

**1703A.4 Performance.** Specific information consisting of test reports conducted by an approved agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the product, material or assembly meets the applicable code requirements.

*[OSHPD 1 & 4] Tests performed by an independent approved testing agency/laboratory or under the responsible charge of a competent approved independent Registered Design Professional shall be deemed to comply with requirements of this section. Test reports for structural tests shall be reviewed and accepted by an independent California licensed structural engineer.*

**1703A.4.1 Research and investigation.** Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the product, material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the owner or the owner's authorized agent.

**1703A.4.2 Research reports.** Supporting data, where necessary to assist in the approval of products, materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**1703A.5 Labeling.** Products, materials or assemblies required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703A.5.1 through 1703A.5.4.

**1703A.5.1 Testing.** An approved agency shall test a representative sample of the product, material or assembly being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

**1703A.5.2 Inspection and identification.** The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product, material or assembly is representative of the product, material or assembly tested.

**1703A.5.3 Label information.** The label shall contain the manufacturer's identification, model number, serial number or definitive information describing the performance characteristics of the product, material or assembly and the approved agency's identification.

**1703A.5.4 Method of labeling.** Information required to be permanently identified on the product, material or assembly shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

**1703A.6 Evaluation and follow-up inspection services.** Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the owner or the owner's authorized agent shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

**1703A.6.1 Follow-up inspection.** The owner or the owner's authorized agent shall provide for special inspections of fabricated items in accordance with Section 1704A.2.5.

**1703A.6.2 Test and inspection records.** Copies of necessary test and special inspection records shall be filed with the building official.

## SECTION 1704A SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION

**1704A.1 General.** Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the building official and structural observations shall meet the applicable requirements of this section.

**1704A.2 Special inspections and tests.** Where application is made to the building official for construction as specified in Section 105, the owner shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705A and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are identified in Section 110.

*[OSHPD 1 & 4] The inspectors shall act under the direction of the architect or structural engineer or both, and be responsible to the Owner. Where the California Administrative Code (CAC) Section 7-115 (a) 2 permits construction documents to be prepared under the responsible charge of a mechanical, electrical or civil engineer, inspectors shall be permitted to work under the direction of engineer in appropriate branch as permitted therein.*

### Exceptions:

1. Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.

*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).*

**1705A.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.*

**1705A.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 2110A 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.*

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

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

**1705A.5.1 High-load diaphragms.** *High-load diaphragms designed in accordance with Section 2306A.2 shall be installed with special inspections as indicated in Section 1704A.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 con-*

*struction 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.*

**1705A.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 and cross-laminated timber.** *Manufacture of all structural glued laminated and cross-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 non-custom glued laminated members of 5<sup>1</sup>/<sub>2</sub>-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.

**1705A.5.7 Mass timber construction.** Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705A.5.7.

**1705A.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 1705A.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 1803A 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.

**1705A.7 Driven deep foundations.** Special inspections and tests shall be performed during installation of driven deep foundation elements as specified in 1810A.3.3.1.2 and Table 1705A.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.

**TABLE 1705A.5.7  
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	—	X
2. Inspect erection of mass timber construction.	—	X
3. Inspection of connections where installation methods are required to meet design loads.	—	—
3.1. Threaded fasteners.	—	—
3.1.1. Verify use of proper installation equipment.	—	X
3.1.2. Verify use of pre-drilled holes where required.	—	X
3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.	—	X
3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	X	—
3.3. Adhesive anchors not defined in 3.2.	—	X
3.4. Bolted connections.	—	X
3.5. Concealed connections.	—	X



**TABLE 1705A.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

**TABLE 1705A.7  
REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	—	—
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3.	—	—
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	—	—

**1705A.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 1705A.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

**1705A.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 installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

**1705A.10 Fabricated items.** Special inspections of fabricated items shall be performed in accordance with Section 1704A.2.5.

**1705A.11 Special inspections for wind resistance.** Special inspections for wind resistance specified in Sections 1705A.11.1 through 1705A.11.3, unless exempted by the exceptions to Section 1704A.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where  $V_{asd}$  as determined in accordance with Section 1609A.3.1 is 120 miles per hour (52.8 m/sec) or greater.

2. In wind Exposure Category C or D, where  $V_{asd}$  as determined in accordance with Section 1609A.3.1 is 110 mph (49 m/sec) or greater.

**1705A.11.1 Structural wood.** Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

**1705A.11.2 Cold-formed steel light-frame construction.** Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**1705A.11.3 Wind-resisting components.** Periodic special inspection is required for fastening of the following systems and components:

1. Roof covering, roof deck and roof framing connections.
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.

**TABLE 1705A.8**  
**REQUIRED SPECIAL INSPECTIONS AND TESTS OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3.	—	—

**1705A.12 Special inspections for seismic resistance.** Special inspections for seismic resistance shall be required as specified in Sections 1705A.12.1 through 1705A.12.9, unless exempted by the exceptions of Section 1704A.2.

**1705A.12.1 Structural steel.** Special inspections for seismic resistance shall be in accordance with Section 1705A.12.1.1 or 1705A.12.1.2, as applicable.

**1705A.12.1.1 Seismic force-resisting systems.** Special inspections of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341 *as modified by Section 1705A.2.1 of this code.*

**1705A.12.1.2 Structural steel elements.** Special inspections 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 1705A.12.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341 *as modified by Section 1705A.2.1 of this code.*

**1705A.12.2 Structural wood.** For the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F:

1. Continuous special inspection shall be required during field gluing operations of elements of the seismic force-resisting system.
2. Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

**1705A.12.3 Cold-formed steel light-frame construction.** For the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F, periodic special inspection shall be required for both:

1. Welding operations of elements of the seismic force-resisting system.
2. Screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

**1705A.12.4 Special inspection for special seismic certification.** For structures assigned to Seismic Design Category D, E or F, the special inspector shall examine *equipment and components* requiring *special seismic certification* in accordance with *Section 1705A.13.3 or ASCE 7, Section 13.2.2* and verify that the label, anchorage and mounting conform to the certificate of compliance.

**1705A.12.5 Architectural components.** Periodic special inspection is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls, *ceilings* and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

**[OSHPD 1] Exception:** *Periodic special inspection is not required where continuous inspection of the work is performed in accordance with Section 7-145 of the CAC.*

**1705A.12.5.1 Access floors.** Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

**1705A.12.6 Plumbing, mechanical and electrical components.** Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to Seismic Design Category D, E or F.
2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category D, E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category D, E or F where the approved construction documents require a nominal clearance of  $\frac{1}{4}$  inch (6.4 mm) or less between the equipment support frame and restraint.

6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to Seismic Design Category D, E or F to verify one of the following:

- 6.1. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7.
- 6.2. A nominal clearance of not less than 3 inches (76 mm) has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.

**1705A.12.7 Storage racks.** Periodic special inspection is required for the anchorage of storage racks that are 8 feet (2438 mm) or greater in height in structures assigned to Seismic Design Category D, E or F.

**1705A.12.8 Seismic isolation and damping systems.** Periodic special inspection shall be provided for seismic isolation and damping systems in structures assigned to Seismic Design Category D, E or F during the fabrication and installation of isolator units and energy dissipation devices. *Continuous special inspection is required for prototype and production testing of isolator units and damping devices.*

**1705A.13 Testing for seismic resistance.** Testing for seismic resistance shall be required as specified in Sections 1705A.13.1 through 1705A.13.4, unless exempted from special inspections by the exception of Section 1704A.2.

**1705A.13.1 Structural steel.** Nondestructive testing for seismic resistance shall be in accordance with Section 1705A.13.1.1 or 1705A.13.1.2, as applicable.

**1705A.13.1.1 Seismic force-resisting systems.** Nondestructive testing of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

**1705A.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 1705A.13.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341.

**1705A.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.*

**1705A.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. Imaging equipment needed for diagnostic services of emergency/trauma patients, a minimum of one such equipment.
8. Air conditioning units excluding Variable/Constant Air Volume (VAV/CAV) boxes up to 75 lbs.
9. Air handling units.

10. Chillers, including associated evaporators, and condensers.
11. Cooling towers.
12. Transformers.
13. Electrical substations.
14. UPS and batteries.
15. Panelboards as defined in the California Electrical Code (CEC) Article 100.
16. Industrial control panels as defined in the California Electrical Code (CEC) Article 100.
17. Power isolation and correction systems.
18. Motorized surgical lighting systems.
19. Motorized operating table systems.
20. Internal communication servers, routers, and switches failure of which could impair the continued operation of the facility.
21. Medical gas and vacuum systems.
22. Electrical busways as defined in UL 857.
23. 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. Base-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.
12. Temporary and Interim equipment.

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.

**1705A.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] 1705A.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 1705A.14.1 through 1705A.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] 1705A.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 ( $\text{kg}/\text{m}^3$ ).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

**[BF] 1705A.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] 1705A.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] 1705A.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 1705A.14.4.1.

**[BF] 1705A.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  $\frac{1}{4}$  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 1705A.14.4.2 and 1705A.14.4.3.

**[BF] 1705A.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<sup>2</sup>) of the sprayed area, or portion thereof, in each story.

**[BF] 1705A.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] 1705A.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 symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

**[BF] 1705A.14.4.5 Structural members.** The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

**[BF] 1705A.14.4.6 Beams and girders.** At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

**[BF] 1705A.14.4.7 Joists and trusses.** At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

**[BF] 1705A.14.4.8 Wide-flanged columns.** At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

**[BF] 1705A.14.4.9 Hollow structural section and pipe columns.** At hollow structural section and pipe columns, thickness measurements shall be made at not fewer than four locations around the column at each end of a 12-inch (305 mm) length.

**[BF] 1705A.14.5 Density.** The density of the sprayed fire-resistant material shall be not less than the density specified in the approved fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**[BF] 1705A.14.6 Bond strength.** The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) (7.18 kN/m<sup>2</sup>). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705A.14.6.1 through 1705A.14.6.3.

**[BF] 1705A.14.6.1 Floor, roof and wall assemblies.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m<sup>2</sup>) of the sprayed area, or portion thereof, in each story.

**[BF] 1705A.14.6.2 Structural members.** The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m<sup>2</sup>) of floor area or portion thereof in each story.

**[BF] 1705A.14.6.3 Primer, paint and encapsulant bond tests.** Bond tests to qualify a primer, paint or encapsulant shall be conducted where the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be

applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

**[BF] 1705A.15 Mastic and intumescent fire-resistant coatings.** Special inspections and tests for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be performed in accordance with AWC 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents.

**1705A.16 Exterior insulation and finish systems (EIFS).** Special inspections shall be required for all EIFS applications.

**Exceptions:**

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

**1705A.16.1 Water-resistive barrier coating.** A water-resistive barrier coating complying with ASTM E2570 requires special inspection of the water-resistive barrier coating where installed over a sheathing substrate.

**[BF] 1705A.17 Fire-resistant penetrations and joints.** In high-rise buildings or in buildings assigned to Risk Category III or IV, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire barrier systems that are tested and listed in accordance with Sections 714A.4.1.2, 714A.5.1.2, 715A.3 and 715A.4 shall be in accordance with Section 1705A.17.1 or 1705A.17.2.

**[DSA SS, DSA-SS/CC]** Buildings assigned to Risk Category II, III or IV shall be subject to special inspections for fire-resistant penetrations and joints.

**[BF] 1705A.17.1 Penetration firestops.** Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714A.4.1.2 and 714A.5.1.2 shall be conducted by an approved agency in accordance with ASTM E2174.

**[BF] 1705A.17.2 Fire-resistant joint systems.** Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715A.3 and 715A.4 shall be conducted by an approved agency in accordance with ASTM E2393.

**[F] 1705A.18 Testing for smoke control.** Smoke control systems shall be tested by a special inspector.

**[F] 1705A.18.1 Testing scope.** The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

**[F] 1705A.18.2 Qualifications.** Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

**1705A.19 Shotcrete.** All shotcrete work shall be continuously inspected during placing by an approved agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The approved agency shall furnish a verified report that of his or her 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.

**[DSA-SS, DSA-SS/CC]** Testing requirements per ACI 506.2 shall also apply.

**1705A.19.1 Visual examination for structural soundness of in-place shotcrete.** Completed shotcrete work shall be checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.

**Exception:** Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.

**1705A.20 Sealing of mass timber.** Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.9 is applied to mass timber building elements as designated in the approved construction documents.

## SECTION 1706A DESIGN STRENGTHS OF MATERIALS

**1706A.1 Conformance to standards.** The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

**1706A.2 New materials.** For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707A.

## SECTION 1707A ALTERNATIVE TEST PROCEDURE

**1707A.1 General.** In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the

building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 1044.11. The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

## SECTION 1708A IN-SITU LOAD TESTS

**1708A.1 General.** Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708A.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

**1708A.2 In-situ load tests.** In-situ load tests shall be conducted in accordance with Section 1708A.2.1 or 1708A.2.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

**1708A.2.1 Load test procedure specified.** Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1708A.2.2 shall apply.

**1708A.2.2 Load test procedure not specified.** In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to an approved test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic force-resisting system, at a minimum the test load shall be equal to the specified factored design loads. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design loads being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic loads (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have

successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604A.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

## SECTION 1709A PRECONSTRUCTION LOAD TESTS

**1709A.1 General.** Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709A. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

**1709A.2 Load test procedures specified.** Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1709A.3 shall apply.

**1709A.3 Load test procedures not specified.** Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1709A.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

**1709A.3.1 Test procedure.** The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709A.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709A.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure

occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in Section 1709A.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

**1709A.3.2 Deflection.** The deflection of structural members under the design load shall not exceed the limitations in Section 1604A.3.

**1709A.4 Wall and partition assemblies.** Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

**1709A.5 Exterior window and door assemblies.** The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709A.5.1 or 1709A.5.2. For exterior windows and doors tested in accordance with Sections 1709A.5.1 or 1709A.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

**Exception:** Structural wind load design pressures for window units smaller than the size tested in accordance with Section 1709A.5.1 or 1709A.5.2 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. Components of the small unit shall be the same as the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window unit having the highest allowable design pressure.

**1709A.5.1 Exterior windows and doors.** Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403A.2 and 2403A.3.

**1709A.5.2 Exterior windows and door assemblies not provided for in Section 1709A.5.1.** Exterior window and door assemblies shall be tested in accordance with ASTM E330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108. Exterior window and door assemblies containing glass shall comply with Section 2403A. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assem-

bly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

**1709A.6 Skylights and sloped glazing.** Skylights and sloped glazing shall comply with the requirements of Chapter 24.

**1709A.7 Test specimens.** Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

#### Notation for [DSA-SS]

**Authority:** Education Code §17310 and 81142, and H&S Code §16022.

**Reference:** Education Code §§17280 through 17317, and 81130 through 81147, and Health and Safety Code §§16000 through 16023.

#### Notation for [DSA-SS/CC]

**Authority:** Education Code §81053.

**Reference:** Education Code §81052, 81053, and 81130 through 81147.



## CHAPTER 18A

# SOILS AND FOUNDATIONS

### SECTION 1801A GENERAL

**1801A.1 Scope.** The provisions of this chapter shall apply to building and foundation systems.

**1801A.1.1 Application.** *The scope of application of Chapter 18A is as follows:*

1. *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*
2. *Applications listed in Section 1.10.1 and 1.10.4 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.*

**1801A.1.2 Amendments in this chapter.** *DSA-SS, DSA-SS/CC 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.*  
**[DSA-SS/CC]** *For applications listed in Section 1.9.2.2.*
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.*

**1801A.1.3 Reference to other chapters.**

**1801A.1.3.1 [DSA-SS/CC]** *Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A, and 22A, the provisions in Chapters 16, 19, 21, and 22, respectively shall apply instead as defined in Section 1.9.2.2. Referenced sections may not directly correlate, but the corresponding DSA-SS/CC sections to such references still apply.*

### SECTION 1802A DESIGN BASIS

**1802A.1 General.** Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in Section 1605A.3. The quality and design of materials used structurally in excavations and foundations shall comply

with the requirements specified in Chapters 16A, 19A, 21A, 22A and 23. Excavations and fills shall comply with Chapter 33.

### SECTION 1803A GEOTECHNICAL INVESTIGATIONS

**1803A.1 General.** Geotechnical investigations shall be conducted in accordance with Section 1803A.2 and reported in accordance with Section 1803A.7. *The classification and investigation of the soil shall be made under the responsible charge of a California registered geotechnical engineer. All recommendations contained in geotechnical and geohazard reports shall be subject to the approval of the enforcement agency. All reports shall be prepared and signed by a registered geotechnical engineer, a certified engineering geologist, and a registered geophysicist, where applicable.*

**1803A.2 Investigations required.** Geotechnical investigations shall be conducted in accordance with Sections 1803A.3 through 1803A.6.

#### Exceptions:

1. *Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m<sup>2</sup>) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan. Allowable foundation and lateral soil pressure values may be determined from Table 1806A.2.*
2. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

**1803A.3 Basis of investigation.** Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

**1803A.3.1 Scope of investigation.** The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

*There shall not be less than one boring or exploration shaft for each 5,000 square feet (465 m<sup>2</sup>) of building area at the foundation level with a minimum of two provided for any one building. A boring may be considered to reflect*

*subsurface conditions relevant to more than one building, subject to the approval of the enforcement agency.*

*Borings shall be of sufficient size to permit visual examination of the soil in place or, in lieu thereof, cores shall be taken.*

*Borings shall be of sufficient depth and size to adequately characterize sub-surface conditions.*

**1803.4.4 Qualified representative.** The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

**1803.4.5 Investigated conditions.** Geotechnical investigations shall be conducted as indicated in Sections 1803.4.5.1 through 1803.4.5.12.

**1803.4.5.1 Classification.** Soil materials shall be classified in accordance with ASTM D2487.

**1803.4.5.2 Questionable soil.** Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

**1803.4.5.3 Expansive soil.** In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75  $\mu$ m), determined in accordance with ASTM D422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D422.
4. Expansion index greater than 20, determined in accordance with ASTM D4829.

**1803.4.5.4 Ground-water table.** A subsurface soil investigation shall be performed to determine whether the existing ground water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

**1803.4.5.5 Deep foundations.** Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.
2. Recommended center-to-center spacing of deep foundation elements.

3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

**1803.4.5.6 Rock strata.** Where subsurface explorations at the project site indicate variations in the structure of rock on which foundations are to be constructed, a sufficient number of borings shall be drilled to sufficient depths to assess the competency of the rock and its load-bearing capacity.

**1803.4.5.7 Excavation near foundations.** Where excavation will reduce support from any foundation, a registered design professional shall prepare an assessment of the structure as determined from examination of the structure, the review of available design documents and, if necessary, excavation of test pits. The registered design professional shall determine the requirements for underpinning and protection and prepare site-specific plans, details and sequence of work for submission. Such support shall be provided by underpinning, sheeting and bracing, or by other means acceptable to the building official.

**1803.4.5.8 Compacted fill material.** Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

**1803.4.5.9 Controlled low-strength material (CLSM).** Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.

**1808.4.8 Concrete foundations.** The design, materials and construction of concrete foundations shall comply with Sections 1808.4.8.1 through 1808.4.8.6 and the provisions of Chapter 19.4.

**1808.4.8.1 Concrete or grout strength and mix proportioning.** Concrete or grout in foundations shall have a specified compressive strength ( $f'_c$ ) not less than the largest applicable value indicated in Table 1808.4.8.1.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

**1808.4.8.2 Concrete cover.** The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808.4.8.2. Longitudinal bars spaced less than  $1\frac{1}{2}$  inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.6.1.3.4 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where con-

crete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.

**1808.4.8.3 Placement of concrete.** Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

**1808.4.8.4 Protection of concrete.** Concrete foundations shall be protected from freezing during depositing and for a period of not less than 5 days thereafter. Water shall not be allowed to flow through the deposited concrete.

**1808.4.8.5 Forming of concrete.** Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Section 26.11 of ACI 318.

**TABLE 1808.4.8.1  
MINIMUM SPECIFIED COMPRESSIVE STRENGTH  $f'_c$  OF CONCRETE OR GROUT**

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, $f'_c$
1. Foundations for structures assigned to Seismic Design Category D, E or F	3,000 psi
2. Precast nonprestressed driven piles	4,000 psi
3. Socketed drilled shafts	4,000 psi
4. Micropiles	4,000 psi
5. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

**TABLE 1808.4.8.2  
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.6 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	3 inches 2 inches In accordance with Section 20.6.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	2.5 inches In accordance with Section 20.6.1.3.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

**1808.4.8.6 Seismic requirements.** See Section 1905.4 for additional requirements for foundations of structures assigned to Seismic Design Category D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of Section 18.13 of ACI 318 shall apply where not in conflict with the provisions of Sections 1808.4 through 1810.4.

**1808.4.9 Vertical masonry foundation elements.** Vertical masonry foundation elements that are not foundation piers as defined in Section 202 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402.

## SECTION 1809A SHALLOW FOUNDATIONS

**1809A.1 General.** Shallow foundations shall be designed and constructed in accordance with Sections 1809A.2 through 1809A.13.

**1809A.2 Supporting soils.** Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804A.5. CLSM shall be placed in accordance with Section 1804A.6.

**1809A.3 Stepped footings.** The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than one unit vertical in 10 units horizontal (10-percent slope).

*Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50 percent slope) unless otherwise recommended by a geotechnical report. The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.*

**1809A.4 Depth and width of footings.** The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809A.5 shall be satisfied. The minimum width of footings shall be 12 inches (305 mm).

**1809A.5 Frost protection.** Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality.
2. Constructing in accordance with ASCE 32.
3. Erecting on solid rock.

**Exception:** Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I.
2. Area of 600 square feet (56 m<sup>2</sup>) or less for light-frame construction or 400 square feet (37 m<sup>2</sup>) or less for other than light-frame construction.
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

**1809A.6 Location of footings.** Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

**1809A.7 Prescriptive footings for light-frame construction.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1809A.8 Plain concrete footings.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1809A.9 Masonry-unit footings.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1809A.10 Pier and curtain wall foundations.** *Not permitted by DSA-SS, DSA-SS/CC, or OSHPD.*

**1809A.11 Steel grillage footings.** Grillage footings of structural steel elements shall be separated with approved steel spacers and be entirely encased in concrete with not less than 6 inches (152 mm) on the bottom and not less than 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

**1809A.12 Timber footings.** *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

**1809A.13 Footing seismic ties.** Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Chapter 20 of ASCE 7 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient,  $S_{DS}$ , divided by 10 and 25 percent of the smaller footing design gravity load.

**1809A.14 Pipes and trenches.** *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50 percent slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

*Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.*

**Exception:** *Alternate trench locations and pipe clearances shall be permitted when approved by registered design professional in responsible charge and the enforcement agent.*

**1809A.15 Grade beams.** *[DSA-SS, DSA-SS/CC] For structures assigned to Seismic Design Category D, E or F, grade beams in shallow foundations shall comply with Section 1810A.3.12.*

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  $6d_b$  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  $\phi$  FOR MOMENT,**  
**AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE**

NET TENSILE STRAIN $\epsilon_t$	CLASSIFICATION	$\phi$			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\epsilon_t \leq \epsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\epsilon_{ty} < \epsilon_t < 0.005$	Transition <sup>1,2</sup>	$0.75 + 0.15 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(c)	$0.65 + 0.25 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(d)
$\epsilon_t \geq 0.005$	Tension-controlled <sup>3</sup>	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use  $\phi$  corresponding to compression-controlled sections.

2.  $\epsilon_t^*$  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  $P_n \geq 0.1A_g f'_c$ ,  $\phi$  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<sup>3</sup>) of concrete, or not less than once for each 2,000 square feet (186 m<sup>2</sup>) of surface area for slabs or walls. Additional samples for seven-day com-

pressive 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<sup>2</sup>/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 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 brought to a saturated surface-dry (SSD) before shotcrete is deposited.

**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 a mechanical method acceptable to the enforcement agency. 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 rodged 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<sup>2</sup>) 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  $\frac{3}{4}$  inch (19 mm).

**SECTION 1910**  
**ADDITIONAL REQUIREMENTS FOR SKILLED**  
**NURSING FACILITIES, INTERMEDIATE CARE**  
**FACILITIES, ACUTE PSYCHIATRIC AND NON-GAC**  
**BUILDINGS [OSHPD 1R, 2 & 3]**

**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  $2\frac{1}{2}$  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<sup>2</sup>) 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  $\phi$  FOR MOMENT,**  
**AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE**

NET TENSILE STRAIN $\epsilon_t$	CLASSIFICATION	$\phi$			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\epsilon_t \leq \epsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\epsilon_{ty} < \epsilon_t < 0.005$	Transition <sup>1,2</sup>	$0.75 + 0.15 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(c)	$0.65 + 0.25 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(d)
$\epsilon_t \geq 0.005$	Tension-controlled <sup>3</sup>	0.9	(e)	0.9	(f)

- For sections classified as transition, it shall be permitted to use  $\phi$  corresponding to compression-controlled sections.
- $\epsilon_t^*$  is the greater of net tensile strain calculated for  $P_u = 0.1A_g f'_c$  and 0.005.
- For sections with factored axial compression force  $P_u \geq 0.1A_g f'_c$ ,  $\phi$  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<sup>3</sup>) of concrete, or not less than once for each 2,000 square feet (186 m<sup>2</sup>) 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 1906A STRUCTURAL PLAIN CONCRETE

*Not permitted by OSHPD and DSA-SS*

## SECTION 1907A MINIMUM SLAB PROVISIONS

**1907A.1 General.** The thickness of concrete floor slabs supported directly on the ground shall not be less than 3½ 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:

- For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
- For unheated storage rooms having an area of less than 70 square feet (6.5 m<sup>2</sup>) and carports attached to occupancies in Group R-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.
- For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
- Where approved based on local site conditions.

## SECTION 1908A SHOTCRETE

**1908A.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 brought to a saturated surface-dry (SSD) condition before shotcrete is deposited.

**1908A.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.

**1908.4.3 Aggregate.** Coarse aggregate, if used, shall not exceed  $\frac{3}{4}$  inch (19.1 mm). *For structural walls, when total rebar in any direction is more than 0.31 in<sup>2</sup>/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.*

**1908.4.4 Reinforcement.** Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1908.4.4.1 through 1908.4.4.4.

**1908.4.4.1 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.

**1908.4.4.2 Clearance.** Where No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of  $2\frac{1}{2}$  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.

**1908.4.4.3 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.

**1908.4.4.4 Spirally tied columns.** Shotcrete shall not be applied to spirally tied columns.

**1908.4.5 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 nozzle 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 1704.4.5.

**1908.4.6 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.

**1908.4.7 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 a mechanical method acceptable to the enforcement agency. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.*

**1908.4.8 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.

**1908.4.9 Curing.** During the curing periods specified herein, shotcrete shall be maintained above 50°F (10°C) and in moist condition.

**1908.4.9.1 Initial curing.** Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

**1908.4.9.2 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.

**1908.4.9.3 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.

**1908.4.10 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  $\frac{3}{8}$  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  $\frac{3}{8}$  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.

**1908.4.10.1 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<sup>3</sup>) of shotcrete.



**1908A.10.2 Panel criteria.** Where the maximum-size aggregate is larger than  $\frac{3}{8}$  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  $\frac{3}{8}$  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 nozzle men doing the work. The conditions under which the panels are cured shall be the same as the work. *Approval from the enforcement agency shall be obtained prior to performing the test panel method.*

**1908A.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.

**1908A.11 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.*

**1908A.12 Placing.** Shotcrete shall be placed in accordance with ACI 506R. In addition to testing requirements in Section 1908A, special inspection and testing shall be in accordance with Section 1705A.19.

**[DSA-SS] Exception:** The reference to ACI 506R shall be to ACI 506.2 and ACI 506R.

## SECTION 1909A RESERVED

## SECTION 1910A CONCRETE, REINFORCEMENT AND ANCHOR TESTING

**1910A.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.

**1910A.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  $2\frac{1}{2}$  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 non-building structures provided 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.*

**1910A.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 jobsite. 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 jobsite 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 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 pre-stressing 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 fur-

nished 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.

**1910A.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 (465m<sup>2</sup>) of area of composite concrete construction and not less 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.

**1910A.5 Tests for post-installed anchors in concrete.** When post-installed anchors are used in lieu of cast-in place bolts, the installation verification test loads, frequency, and acceptance criteria shall be in accordance with this section.

**1910A.5.1 General.** Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

**1910A.5.2 Testing procedure.** The test procedure shall be as permitted by an approved evaluation report using criteria adopted in this code. All post-installed anchors shall be tension tested. [OSHPD 1 & 4] Tension testing to verify proper installation shall be performed in accordance with ASTM E3121.

**Exception:** [OSHPD 1 & 4] Torque-controlled post-installed anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.

**Exception:** [DSA-SS] Torque-controlled post-installed anchors and screw type anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.

Alternatively, manufacturer's recommendation for testing may be approved by the enforcement agency, based on an approved test report using criteria adopted in this code.

**1910A.5.3 Test frequency.** When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural components, such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

**Exceptions:**

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the design tension on anchors is less than 100 lbs and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all of the following conditions are met:
  - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
  - b. The number of dowels in any one member equals or exceeds 12.
  - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).
4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.

**1910A.5.4 Test loads.** Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter (1<sup>1</sup>/<sub>4</sub>) times the maximum design strength of anchors as provided in an approved evaluation report using criteria adopted in this code or determined in accordance with Chapter 17 of ACI 318.
 

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ( $= 0.8 A_{se} f_{ya}$ ).
2. The manufacturer's recommended installation torque based on an approved evaluation report using criteria adopted in this code.

**2103.3 Grout.** Grout shall comply with Article 2.2 of TMS 602.

**2103.4 Metal reinforcement and accessories.** Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where unidentified reinforcement is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work. *[OSHPD 1R, 2 & 5] Alternatively, the frequency of sampling for unidentifiable reinforcing bars specified in Section 1910.2 can be used.*

**2103.5 Air entrainment.** *[OSHPD 1R, 2 & 5] Air-entraining materials or air-entraining admixtures shall not be used in grout unless tests are conducted to determine compliance with the requirements of this code.*

## SECTION 2104 CONSTRUCTION

**2104.1 Masonry construction.** Masonry construction shall comply with the requirements of Sections 2104.1.1 through 2104.1.3 and with the requirements of either TMS 602 or TMS 604. *[OSHPD 1R, 2 & 5] Architectural cast stone construction shall be considered as an alternative system.*

**2104.1.1 Support on wood.** Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.12.

**2104.1.2 Molded cornices.** Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

**2104.2 Grouted masonry.** *[OSHPD 1R, 2 & 5]*

**2104.2.1 General conditions.** Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than  $\frac{1}{4}$  inch (6.4 mm), mortar droppings and other foreign material.

*All cells shall be solidly filled with grout.*

**Exception:** Reinforced hollow-unit masonry laid in running bond used for freestanding site walls or interior nonbearing nonshear wall partitions may be grouted only in cells containing vertical and horizontal reinforcement.

Reinforcement and embedded items shall be clean, properly positioned and securely anchored against movement prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting. Reinforcement, embedded items and bolts shall be solidly embedded in grout. Anchor bolts in the face shells of hollow masonry units shall be positioned to maintain a minimum of  $\frac{1}{2}$  inch of grout between the bolt and the face shell.

The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour. At

*the time of laying, all masonry units shall be free of dust and dirt.*

*Grout pours shall be consolidated in accordance with the requirements of TMS 602, Article 3.5E.*

*Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of  $1\frac{1}{2}$  inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of  $\frac{1}{2}$  inch (12.7 mm) below the top of the masonry.*

**2104.3 Aluminum equipment.** *[OSHPD 1R, 2 & 5] Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.*

## SECTION 2105 QUALITY ASSURANCE

**2105.1 General.** A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the approved construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17 and TMS 602.

**2105.2 Compressive strength,  $f'_m$ .** *[OSHPD 1R, 2 & 5] The minimum specified compressive strength,  $f'_m$ , in the design shall be 2,000 psi (13.79 MPa) for all masonry construction using materials and details of construction required herein. Testing of the constructed masonry shall be provided in accordance with Section 2105.5 or 2105.6.*

**Exception:** Higher values of  $f'_m$  may be used in the design of reinforced grouted masonry and reinforced hollow-unit masonry based on prism test results submitted by the architect or engineer to the enforcement agency which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength. In no case shall the  $f'_m$  used in design exceed 3,000 psi (20.7 MPa).

Where an  $f'_m$  greater than 2,000 psi (13.79 MPa) is approved, the architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract specifications. Compliance with the requirements for the specified strength of constructed masonry shall be provided using the prism test method and core shear testing in accordance with Sections 2105.5 and 2105.4. Substantiation for the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in Section 2105.5.

**2105.3 Mortar and grout tests.** *[OSHPD 1R, 2 & 5] These tests are to establish whether the masonry components meet the specified component strengths.*

At the beginning of all masonry work, at least one test sample of the mortar shall be taken on three successive work-

ing days and at one-week intervals thereafter. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. They shall meet the minimum strength requirement given in ASTM C270 Table 1 for mortar and ASTM C476/TMS 602 Section 2.2 for grout. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official. When the prism test method in accordance with Section 2105.5 is used during construction, the tests in this section are not required.

Test specimens for mortar and grout shall be made as set forth in ASTM C1586 and ASTM C1019.

**Exception:** For nonbearing nonshear masonry walls not exceeding total wall height of 12 feet above top of foundation, mortar test shall be permitted to be limited to those at the beginning of masonry work for each mix design.

**2105.4 Masonry core testing. [OSHPD 1R, 2 & 5]** Not less than two cores shall be taken from each building for each 5,000 square feet (465 m<sup>2</sup>) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.

Core samples shall comply with the following:

1. Cored no sooner than 7 days after grouting of the selected area;
2. Be a minimum of 3<sup>3</sup>/<sub>4</sub> inch nominal diameter; and
3. Sampled in such a manner as to exclude any masonry unit webs, mortar joint, or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect voids or delamination shall be selected by the registered design professional and approved by the building official.

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear tests of both joints between the grout core and the outside wythes or face shell of the masonry shall be made 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or nonabsorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of core shall not be less than  $2.5 \sqrt{f'_m}$  psi.

All cores shall be submitted to an approved agency for examination, even where the core specimens failed during the cutting operation. The approved agency shall report the location where each core was taken, report the findings of their visual examination of each core, identify which cores were selected for shear testing, and report the results of the shear tests.

**Exceptions:**

1. Core sampling and testing is not required for nonbearing nonshear masonry walls, not exceeding total wall height of 12 feet above the top of the foundation, built with single-wythe hollow unit concrete

masonry that attaches opposite face shells using webs cast as single unit, when designed using an  $f'_m$  not exceeding 2,000 psi (13.79MPa).

2. An infrared thermographic survey or other nondestructive test procedures shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in conjunction with reduced core sampling and testing. A minimum of two cores shall be taken from each building for each 10,000 square feet (930 m<sup>2</sup>) of the wall.

**2105.5 Masonry prism method testing. [OSHPD 1R, 2 & 5]** The prism test method performed prior to the start or during construction shall be in accordance with TMS 602 Section 1.4 B.3. The prism test method performed on constructed walls shall be in accordance with TMS 602 Section 1.4 B.4.

**2105.6 Unit strength method testing. [OSHPD 1R, 2 & 5]** Unit strength method testing shall be performed in accordance with TMS 602 Section 1.4 B.2.

## SECTION 2106 SEISMIC DESIGN

**2106.1 Seismic design requirements for masonry.** Masonry structures and components shall comply with the requirements in Chapter 7 of TMS 402 depending on the structure's seismic design category.

**2106.1.1 Modifications to TMS 402. [OSHPD 1R, 2 & 5]** Modify TMS 402 Section 7.4.4 as follows:

1. **Minimum reinforcement requirements for masonry walls.** The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center.

**Exception:** Reinforced hollow-unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4'-0" on center, except as required by TMS 402 Section 7.4.5 when applicable.

The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.

Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement

shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.

When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.

Joint reinforcement shall not be used as principal reinforcement in masonry.

## 2. Minimum reinforcement for masonry columns.

The spacing of column ties shall be as follows: not greater than eight bar diameters, one half the least dimension of the column for the full column height, or 8 inches (203 mm). Ties shall be at least  $\frac{3}{8}$  inch in 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  $\frac{1}{2}$ -inch (13 mm) diameter for 6-inch (152 mm) nominal masonry,  $\frac{3}{4}$ -inch (19 mm) diameter for 8-inch (203 mm) nominal masonry,  $\frac{7}{8}$ -inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.

## SECTION 2107 ALLOWABLE STRESS DESIGN

**2107.1 General.** [OSHPD 1R, 2 & 5] The design of masonry structures using allowable stress design shall comply with Section 2106 and the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2107.2 through 2107.6.

**2107.2 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 2107.2.1.

**2107.2.1 Lap splices.** The minimum length of lap splices for reinforcing bars in tension or compression,  $l_d$ , shall be:

$$l_d = 0.002d_b f_s \quad (\text{Equation 21-1})$$

$$\text{For SI: } l_d = 0.29d_b f_s$$

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.

## 2107.3 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.

## 2107.4 [OSHPD 1R, 2 & 5] TMS 402, Section 8.3.7, maximum bar size. [OSHPD 1R, 2 & 5] Add the following to Chapter 8:

8.3.7 – Maximum bar size. The maximum bar diameter shall conform to the requirements of TMS 402, Section 9.3.3.1.

## 2107.5 [OSHPD 1R, 2 & 5] Modify TMS 402 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 2107.5.

**Piers.** Every pier or wall section with a width 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 with a width 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 hair-pins.

**TABLE 2107.5**  
**MINIMUM THICKNESS OF MASONRY WALLS<sup>1, 2</sup>**

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS <sup>2,3</sup>	NOMINAL MINIMUM THICKNESS (inches)
<b>BEARING OR SHEAR WALLS:</b>		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow-unit masonry	25	6
<b>NONBEARING WALLS:</b>		
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.

**2107.6 [OSHPD 1R, 2 & 5] Modify TMS 402, Section 8.3.4.4 by the following:**

- > | Reinforced masonry walls, columns, pilasters, beams and  
| | lintels that are subjected to in-plane forces shall have a  
| | maximum flexural tensile reinforcement ratio,  $\rho_{max}$ , not  
| | greater than that computed by Equation 8-20.

**SECTION 2108**  
**STRENGTH DESIGN OF MASONRY**

**2108.1 General.** The design of masonry structures using strength design shall comply with Section 2106 and the requirements of Chapters 1 through 7 and Chapter 9 of TMS 402, except as modified by Sections 2108.2 through 2108.3.

**Exception:** AAC masonry shall comply with the requirements of Chapters 1 through 7 and Chapter 11 of TMS 402.

**2108.2 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  $72 d_b$ .

**2108.3 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**  
**EMPIRICAL DESIGN OF ADOBE MASONRY**

**[OSHPD 1R, 2 & 5] Not permitted by OSHPD.**

**2109.1 General.** Empirically designed adobe masonry shall conform to the requirements of Appendix A of TMS 402, except where otherwise noted in this section.

**2109.1.1 Limitations.** The use of empirical design of adobe masonry shall be limited as noted in Section A.1.2 of TMS 402. In buildings that exceed one or more of the limitations of Section A.1.2 of TMS 402, masonry shall be designed in accordance with the engineered design provisions of Section 2101.2 or the foundation wall provisions of Section 1807.1.5.

Section A.1.2.2 of TMS 402 shall be modified as follows:

**A.1.2.2 – Wind.** Empirical requirements shall not apply to the design or construction of masonry for buildings, parts of buildings, or other structures to be located in areas where  $V_{asd}$  as determined in accordance with Section 1609.3.1 of the *California Building Code* exceeds 110 mph.

**2109.2 Adobe construction.** Adobe construction shall comply with this section and shall be subject to the requirements of this code for Type V construction, Appendix A of TMS 402, and this section.

**2109.2.1 Unstabilized adobe.** Unstabilized adobe shall comply with Sections 2109.2.1.1 through 2109.2.1.4.

**2109.2.1.1 Compressive strength.** Adobe units shall have an average compressive strength of 300 psi (2068 kPa) when tested in accordance with ASTM C67. Five samples shall be tested and individual units are not permitted to have a compressive strength of less than 250 psi (1724 kPa).

**2109.2.1.2 Modulus of rupture.** Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and individual units shall not have a modulus of rupture of less than 35 psi (241 kPa).

**2109.2.1.2.1 Support conditions.** A cured unit shall be simply supported by 2-inch-diameter (51 mm) cylindrical supports located 2 inches (51 mm) in from each end and extending the full width of the unit.

**2109.2.1.2.2 Loading conditions.** A 2-inch-diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

**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. [OSHDP 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 bolted moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206.2 and AISC 358-16 Supplement No. 1, Chapter 11.
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.

**2205.4.3 Bolted Moment Connection - Chapter 11, Supplement No. 1.** The bolted sideplate steel moment connection in accordance with AISC 358-16 Supplement No. 1 shall be permitted provided:

1. A linear analysis procedure shall be used for design of the SMF and IMF systems using the bolted side-

plate connection when permitted in accordance with ASCE 7. Nonlinear procedures will be considered as an alternative system.

2. The beams shall consist of either rolled or built-up wide flange sections. Columns shall consist of rolled or built-up wide flange sections or noncomposite built-up box or HSS with a minimum wall thickness of  $\frac{3}{4}$  inch (19 mm), or satisfy the requirements of width-to-thickness ratios of highly ductile members in AISC 341-16.
3. The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.
4. For SMF and IMF systems, on the sideplate standard or configuration A the U-shaped cover plates shall be used with the k dimension extension. The k dimension extension length is defined as beam depth  $d_b/6$ , rounded to the nearest  $\frac{1}{2}$  inch (12.7 mm).
5. The hinge-to-hinge span to beam depth,  $L_h/d$ , shall be greater than or equal to 4.5.
6. The width-to-thickness ratios for beam flanges shall not be less than 3.5.

**Exception:** For width-to-thickness ratios less than 3.5 the  $C_{pr}$  shall be calculated in accordance with that for welded sideplate connections but in no case shall the width-to-thickness ratio be less than 3.0.

7. The minimum bolt-to-bolt spacing shall not be less than 3 bolt diameters.
8. The extension of the side plates beyond the face of the column shall be within the range of 0.65d to 1.5d.
9. The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.
10. Demand Critical fillet welds {2}, {5}, {5a} and {8} 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 (152 mm) length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches (152 mm) on either side of the start/stop location.
11. The connection specific factor to account for peak connection strength,  $C_{pr}$ , shall be between 1.15 and 1.35. Calculations shall be submitted to OSHPD for review and approval.
12. For in-plane collectors transferring axial loads into the sideplate connection, coordination between sideplate and the registered design professional in responsible charge will be required to confirm the collector connection is sufficient to transfer the load into the moment frame system. This requirement shall be satisfied by designing the sideplate connections in the first bay of a multi-bay sideplate moment frame or an end bay to have a minimum connection capacity, including combined shear ( $V_u + V_g$ ) and moment ( $M_{pr}$ ) demands, of at least 1.2 times the  $M_{pr}$  at the plastic hinge location when the axial load, as

determined by ASCE 7 Section 12.10.2.1 without  $\Omega_p$ , exceeds  $0.1 F_y A_g$  of the sideplate beam.

13. A complete frame analysis for gravity and design wind loading using LRFD load combinations in Section 1605.2 shall be performed including Demand/Capacity Ratios. Frame beam member nominal moment strengths ( $M_n$ ) used for gravity and design wind loading for the bolted sideplate connection using Class A or Class B faying surfaces shall be taken as  $0.80F_y Z$  for frame beams up to 300 plf and  $0.60F_y Z$  for frame beams greater than 300 plf.
14. For moment frame beams with maximum beam shear greater than 90 percent of the vertical bolt shear capacity, a secondary check is to be provided to confirm the vertical bolt shear capacities are sufficient.
15. Bolted sideplate connections used on heavy-shallow frame beams for beams greater than 200 plf and shallower than 24 inches (610 mm) in depth shall be considered as an alternative system.
16. Skewed beams shall utilize the link-beam fabrication method with CJP welded splices for skew angles. The skew angle shall be less than 15 degrees.
17. For two-sided bolted sideplate connections sharing the same side plates at the same height and depth across the column, the vertical offset in the beams shall not exceed 10 inches (254 mm).

## 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  $\frac{1}{4}$  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  $\frac{1}{2}$  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  $\frac{1}{8}$  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  $\frac{1}{4}$ -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  $\frac{1}{2}$  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 11.4.2 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.

**2212.5.3 Limitations on shear wall assemblies.** 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 or structures assigned to Occupancy Category II, III, IV, or buildings designed to be relocatable.

### **2212.6 Testing.**

**2212.6.1 Tests of high-strength bolts, nuts and washers.** High-strength bolts, nuts and washers shall be sampled and tested by an approved independent testing laboratory for conformance with the requirements of Section 2205.

**2212.6.2 Tests of end-welded studs.** End-welded studs shall be sampled and tested in accordance with the requirements of the AWS D1.1.

## **SECTION 2213 TESTING AND FIELD VERIFICATION [OSHPD 1R, 2 & 5]**

**2213.1 Tests of high-strength bolts, nuts and washers.** High-strength bolts, nuts and washers shall be sampled and tested by an approved agency for conformance with the requirements of applicable ASTM standards.

A minimum of nine samples per lot, as defined in the ASTM standards for bolts [not nuts and washers], shall be tested for tensile properties in accordance with ASTM F606, but need not exceed three samples per 400 bolts.

**2213.2 Tests of end-welded studs.** End-welded studs shall be tested in accordance with the requirements of the AWS D1.1, Sections 7.7 and 7.8.



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. The test beams or links shall be no less than 100 percent of the depth of the prototype beam or link.
- >| | 2. The test beams or links shall be no less than 100 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 inter-story 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 Pre-qualified Moment Connections modifications.**

The prequalified bolted moment connections are not permitted in buildings.

### **Exceptions:**

1. Erection bolts are permitted.
2. The approved bolted moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206A.2 and AISC 358-16 Supplement No. 1, Chapter 11.

**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,  $L_p/d$ , 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.

**2205A.5.3 Bolted Moment Connection - Chapter 11, Supplement No. 1.** The bolted sideplate steel moment connection in accordance with AISC 358-16 Supplement No. 1 shall be permitted provided:

1. A linear analysis procedure shall be used for design of the SMF and IMF systems using the bolted sideplate connection when permitted in accordance with ASCE 7. Nonlinear procedures will be considered as an alternative system.
2. The beams shall consist of either rolled or built-up wide flange sections. Columns shall consist of rolled or built-up wide flange sections or noncomposite built-up box or HSS with a minimum wall thickness of  $\frac{3}{4}$  inch (19 mm), or satisfy the requirements of width-

to-thickness ratios of highly ductile members in AISC 341-16.

3. The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.
4. For SMF and IMF systems, on the sideplate standard or configuration A the U-shaped cover plates shall be used with the  $k$  dimension extension. The  $k$  dimension extension length is defined as beam depth  $d_b/6$ , rounded to the nearest  $1/2$  inch (12.7 mm).
5. The hinge-to-hinge span to beam depth,  $L_h/d$ , shall be greater than or equal to 4.5.
6. The width-to-thickness ratios for beam flanges shall not be less than 3.5.  
**Exception:** For width-to-thickness ratios less than 3.5 the  $C_{pr}$  shall be calculated in accordance with that for welded sideplate connections but in no case shall the width-to-thickness ratio be less than 3.0.
7. The minimum bolt-to-bolt spacing shall not be less than 3 bolt diameters.
8. The extension of the side plates beyond the face of the column shall be within the range of  $0.65d$  to  $1.5d$ .
9. The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.
10. Demand Critical fillet welds {2}, {5}, {5a} and {8} 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 (152 mm) length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches (152 mm) on either side of the start/stop location.
11. The connection specific factor to account for peak connection strength,  $C_{pr}$ , shall be between 1.15 and 1.35. Calculations shall be submitted to OSHPD for review and approval.
12. For in-plane collectors transferring axial loads into the sideplate connection, coordination between sideplate and the registered design professional in responsible charge will be required to confirm the collector connection is sufficient to transfer the load into the moment frame system. This requirement shall be satisfied by designing the sideplate connections in the first bay of a multi-bay sideplate moment frame or an end bay to have a minimum connection capacity, including combined shear ( $V_u + V_g$ ) and moment ( $M_{pr}$ ) demands, of at least 1.2 times the  $M_{pr}$  at the plastic hinge location when the axial load, as determined by ASCE 7 Section 12.10.2.1 without  $\Omega_o$ , exceeds  $0.1 F_y A_g$  of the sideplate beam.
13. A complete frame analysis for gravity and design wind loading using LRFD load combinations in Section 1605A.2 shall be performed including Demand/

Capacity Ratios. Frame beam member nominal moment strengths ( $M_n$ ) used for gravity and design wind loading for the bolted sideplate connection using Class A or Class B faying surfaces shall be taken as  $0.80 F_y Z$  for frame beams up to 300 plf and  $0.60 F_y Z$  for frame beams greater than 300 plf.

14. For moment frame beams with maximum beam shear greater than 90 percent of the vertical bolt shear capacity, a secondary check is to be provided to confirm the vertical bolt shear capacities are sufficient.
15. Bolted sideplate connections used on heavy-shallow frame beams for beams greater than 200 plf and shallower than 24 inches (610 mm) in depth shall be considered as an alternative system.
16. Skewed beams shall utilize the link-beam fabrication method with CJP welded splices for skew angles. The skew angle shall be less than 15 degrees.
17. For two-sided bolted sideplate connections sharing the same side plates at the same height and depth across the column, the vertical offset in the beams shall not exceed 10 inches (254 mm).

## SECTION 2206A COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

**2206A.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.

**2206A.2 Seismic design.** Where required, the seismic design, fabrication and erection of composite steel and concrete systems shall be in accordance with Section 2206A.2.1.

**2206A.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 2207A STEEL JOISTS

**2207A.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.

**2207A.1.1 Seismic design.** Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205A.2 or 2211A.1.1.

**2207A.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 2207A.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 2207A.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 2207A.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 2207A.1.

**2207A.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 2207A.1 to support the load requirements of Section 2207A.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 2207A.1, such as cantilevered conditions and net uplift.
2. Connection design for:
  - 2.1. Connections that differ from the SJI specifications listed in Section 2207A.1, such as flush-framed or framed connections.

2.2. Field splices.

2.3. Joist headers.

**2207A.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 2207A.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207A.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 2207A.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 2207A.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.

**2207A.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 1704A.5 stating that work was performed in accordance with approved construction documents and with SJI specifications listed in Section 2207A.1.

**2207A.6 Joist chord bracing.** The chords of all joists shall be laterally supported at all points where the chords change direction.

## SECTION 2208A STEEL CABLE STRUCTURES

**2208A.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 2209A STEEL STORAGE RACKS

**2209A.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.

**2209A.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 2210A COLD-FORMED STEEL

**2210A.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 2211A. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210A.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.

**2210A.1.1 Steel decks.** The design and construction of cold-formed steel decks shall be in accordance with this section.

**2210A.1.1.1 Noncomposite steel floor decks.** Non-composite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

**2210A.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.

**2210A.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.

**2210A.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 2211A COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

**2211A.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 2211A.1.1 through 2211A.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.

**2211A.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 2211A.1.1.1 or 2211A.1.1.2, as applicable.

**2211A.1.1.1 Seismic Design Categories B and C.** *Not permitted by DSA-SS and OSHPD.*

**2211A.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.*

**2211A.1.2 Prescriptive framing.** *Not permitted by DSA-SS and OSHPD.*

**2211A.1.3 Truss design.** Cold-formed steel trusses shall comply with the additional provisions of Sections 2211A.1.3.1. through 2211A.1.3.3.

**2211A.1.3.1 Truss design drawings.** The truss design drawings shall conform to the requirements of Section II 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 II.6 of AISI S202 where these methods are utilized to provide restraint/bracing. *Deferred submittal per Section II.4.2 is not permitted by DSA-SS.*

**2211A.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 1705A.2.



**2211A.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 1704A.2.5 and 1705A.2, as applicable.

**2211A.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 AISI 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  $\Omega_0$  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 AISI Specification for Structural Members (ANSI/AISC 360) and the AISI North American Specifica-

tion 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:

$$\frac{\sum S_{bi} F_{ybi}}{\sum S_{cj} F_{ycj}} \geq 1.4 \quad (\text{Equation 22A-1})$$

where:

$F_{ybi}$  = The specified yield stress of beam "i."

$F_{ycj}$  = The specified yield stress of column "j."

$S_{bi}$  = The flexural section modulus of each beam "i" that is moment connected to the column "j" at the connection.

$S_{cj}$  = The flexural section modulus of each column "j" that is moment connected to the beam "i" at the connection.

#### Exceptions:

1. Beam-to-column connections at the floor level beams of first or second-story modules need not comply with this requirement.
2. Beam-to-column strength ratios less than 1.4 are allowed if proven to be acceptable by analysis or testing.

**2212A.2.3 Welding.** Weld filler metals shall be capable of producing weld metal with a minimum Charpy V-Notch toughness of 20 ft-lb at 0°F. Where beam bottom flanges attach to columns with complete joint penetration groove welds and weld backing is used at the bottom surface of the beam flange, such backing shall be removed and the root pass back-gouged, repaired and reinforced with a minimum  $3/16$  inch (5 mm) fillet weld.

**2212A.2.4 Connection design.** Connections of beams to columns shall have the design strength to resist the maximum seismic load effect,  $E_m$ , calculated in accordance with Section 12.4.3 of ASCE 7.

**2212A.2.5 Multistory assemblies.** Analysis of multistory assemblies shall be permitted to consider the stacked modules as a single assembly, with restraint conditions between the stacked units that represent the actual method of attachment. Alternatively, it shall be permitted to analyze the individual modules of stacked assemblies independently, with lateral and vertical reactions from modules above applied as concentrated loads at the top of the supporting module.

## SECTION 2213A TESTING AND FIELD VERIFICATION

**2213A.1 Tests of high-strength bolts, nuts and washers.** High-strength bolts, nuts and washers shall be sampled and tested by an approved agency for conformance with the requirements of applicable ASTM standards.

## STEEL

*[OSHPD 1 and 4] A minimum of nine samples per lot, as defined in the ASTM standards for bolts [not nuts and washers], shall be tested for tensile properties in accordance with ASTM F606, but need not exceed three samples per 400 bolts.*

**2213A.2 Tests of end-welded studs.** *End-welded studs shall be tested in accordance with the requirements of the AWS D1.1, Sections 7.7 and 7.8.*

# 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								
2304.1.2	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								
2304.10.1.2	X		X	X	X			X	X														
2304.11.3	X		X	X	X			X	X														
2304.11.4	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.



**2304.9.2.5 Controlled random pattern.** The decking shall extend across not fewer than three spans. End joints of pieces within 6 inches (152 mm) of the end joints of the adjacent pieces in either direction shall be separated by not fewer than two intervening courses. In the end bays, each piece shall bear on one support or more. Where an end joint occurs in an end bay, the next piece in the same course shall continue over the first inner support for not less than 24 inches (610 mm). The details of the controlled random pattern shall be as specified for each decking material in Section 2304.9.3.3, 2304.9.4.3 or 2304.9.5.3.

Decking that cantilevers beyond a support for a horizontal distance greater than 18 inches (457 mm), 24 inches (610 mm) or 36 inches (914 mm) for 2-inch (51 mm), 3-inch (76 mm) and 4-inch (102 mm) nominal thickness decking, respectively, shall comply with the following:

1. The maximum cantilevered length shall be 30 percent of the length of the first adjacent interior span.
2. A structural fascia shall be fastened to each decking piece to maintain a continuous, straight line.
3. End joints shall not be in the decking between the cantilevered end of the decking and the centerline of the first adjacent interior span.

**2304.9.3 Mechanically laminated decking.** Mechanically laminated decking shall comply with Sections 2304.9.3.1 through 2304.9.3.3.

**2304.9.3.1 General.** Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.

**2304.9.3.2 Nailing.** The length of nails connecting laminations shall be not less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center or less, side

nails shall be installed not more than 30 inches (762 mm) on center alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) on center, side nails shall be installed not more than 18 inches (457 mm) on center alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, nailing in accordance with Table 2304.9.3.2 shall be permitted. Two side nails shall be installed at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) on center, alternate laminations shall be toenailed to every support. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, toenailing in accordance with Table 2304.9.3.2 shall be permitted.

**2304.9.3.3 Controlled random pattern.** There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

**2304.9.4 Two-inch sawn tongue-and-groove decking.** Two-inch (51 mm) sawn tongue-and-groove decking shall comply with Sections 2304.9.4.1 through 2304.9.4.3.

**2304.9.4.1 General.** Two-inch (51 mm) decking shall have a maximum moisture content of 15 percent. Decking shall be machined with a single tongue-and-groove pattern. Each decking piece shall be nailed to each support.

**TABLE 2304.9.3.2  
FASTENING SCHEDULE FOR MECHANICALLY LAMINATED DECKING USING LAMINATIONS OF 2-INCH NOMINAL THICKNESS**

MINIMUM NAIL SIZE (Length x Diameter) (inches)	MAXIMUM SPACING BETWEEN FACE NAILS <sup>a, b</sup> (inches)		NUMBER OF TOENAILS INTO SUPPORTS <sup>c</sup>
	Decking Supports ≤ 48 inches o.c.	Decking Supports > 48 inches o.c.	
4 × 0.192	30	18	1
4 × 0.162	24	14	2
4 × 0.148	22	13	2
3½ × 0.162	20	12	2
3½ × 0.148	19	11	2
3½ × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
2¾ × 0.148	10	6	2
2¾ × 0.131	9	6	3
2¾ × 0.120	8	5	3

For SI: 1 inch = 25.4 mm

a. Nails shall be driven perpendicular to the lamination face, alternating between top and bottom edges.

b. Where nails penetrate through two laminations and into the third, they shall be staggered one-third of the spacing in adjacent laminations. Otherwise, nails shall be staggered one-half of the spacing in adjacent laminations.

c. Where supports are 48 inches on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches on center, alternate laminations shall be toenailed to every support.

**2304.9.4.2 Nailing.** Each piece of decking shall be toenailed at each support with one 16d common nail through the tongue and face-nailed with one 16d common nail.

**2304.9.4.3 Controlled random pattern.** There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

**2304.9.5 Three- and four-inch sawn tongue-and-groove decking.** Three- and four-inch (76 mm and 102 mm) sawn tongue-and-groove decking shall comply with Sections 2304.9.5.1 through 2304.9.5.3.

**2304.9.5.1 General.** Three-inch (76 mm) and four-inch (102 mm) decking shall have a maximum moisture content of 19 percent. Decking shall be machined with a double tongue-and-groove pattern. Decking pieces shall be interconnected and nailed to the supports.

**2304.9.5.2 Nailing.** Each piece shall be toenailed at each support with one 40d common nail and face-nailed with one 60d common nail. Courses shall be spiked to each other with 8-inch (203 mm) spikes at maximum intervals of 30 inches (762 mm) through pre-drilled edge holes penetrating to a depth of approximately 4 inches (102 mm). One spike shall be installed at a distance not exceeding 10 inches (254 mm) from the end of each piece.

**2304.9.5.3 Controlled random pattern.** There shall be a minimum distance of 48 inches (1219 mm) between end joints in adjacent courses. Pieces not bearing on a support are permitted to be located in interior bays provided that the adjacent pieces in the same course continue over the support for not less than 24 inches (610 mm). This condition shall not occur more than once in every six courses in each interior bay.

**2304.10 Connectors and fasteners.** Connectors and fasteners shall comply with the applicable provisions of Sections 2304.10.1 through 2304.10.7.

**2304.10.1 Fastener requirements.** Connections for wood members shall be designed in accordance with the appropriate methodology in Section 2302.1. The number and size of fasteners connecting wood members shall be not less than that set forth in Table 2304.10.1.

**2304.10.1.1 Additional requirements. [DSA-SS and OSHPD 1, 1R, 2, 4 & 5]** Fasteners used for the attachment of exterior wall coverings shall be of hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

**2304.10.1.2 Connection fire-resistance rating. [BSC, DSA-SS, DSA-SS/CC, HCD-1, HCD-2, SFM]** Fire-resistance ratings for connections in Type IV-A, IV-B,

or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire-resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C) and a maximum temperature rise of 325°F (181°C) for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners and portions of wood members included in the structural design of the connection.

**2304.10.2 Sheathing fasteners.** Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

**2304.10.3 Joist hangers and framing anchors.** Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where approved. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D7147.

**2304.10.4 Other fasteners.** Clips, staples, glues and other approved methods of fastening are permitted where approved.

**2304.10.5 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood.** Fasteners, including nuts and washers, and connectors in contact with preservative-treated and fire-retardant-treated wood shall be in accordance with Sections 2304.10.5.1 through 2304.10.5.4. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F1667.

**2304.10.5.1 Fasteners and connectors for preservative-treated wood.** Fasteners, including nuts and washers, in contact with preservative-treated wood shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Connectors that are used in exterior applications and in contact with preservative-treated wood shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than ASTM A653, Type G185 zinc-coated galvanized steel, or equivalent, shall be used.

**Exception:** Plain carbon steel fasteners, including nuts and washers, in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

**2304.10.5.2 Fastenings for wood foundations.** Fastenings, including nuts and washers, for wood foundations shall be as required in AWC PWF.

**TABLE 2304.10.1—continued  
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing <sup>a</sup>			
		Edges (inches)	Intermediate supports (inches)
Interior paneling			
40. 1/4"	4d casing (1 1/2" × 0.080"); or 4d finish (1 1/2" × 0.072")	6	12
41. 3/8"	6d casing (2" × 0.099"); or 6d finish (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

- Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
- Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
- RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

**2304.10.5.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations.** Fasteners, including nuts and washers, for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.

**2304.10.5.4 Fasteners for fire-retardant-treated wood used in interior applications.** Fasteners, including nuts and washers, for fire-retardant-treated wood used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, Section 2304.10.5.3 shall apply.

**2304.10.6 Load path.** Where wall framing members are not continuous from the foundation sill to the roof, the members shall be secured to ensure a continuous load path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistant material not less than 0.0329-inch (0.836 mm) base metal thickness.

**2304.10.7 Framing requirements.** Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive loads, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

**2304.11 Heavy timber construction.** Where a structure, portion thereof or individual structural elements are required by provisions of this code to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimen-

sions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4. Lumber decking shall be in accordance with Section 2304.9.

**2304.11.1 Details of heavy timber structural members.**

Heavy timber structural members shall be detailed and constructed in accordance with Sections 2304.11.1 through 2304.11.1.3.

**2304.11.1.1 Columns.** Minimum dimensions of columns shall be in accordance with Table 2304.11. Columns shall be continuous or superimposed throughout all stories and connected in an approved manner. Girders and beams at column connections shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal loads across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof loads only. Where traditional heavy timber detailing is used, connections shall be by means of reinforced concrete or metal caps with brackets, by properly designed steel or iron caps, with pintles and base plates, by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other approved methods.

**2304.11.1.2 Floor framing.** Minimum dimensions of floor framing shall be in accordance with Table 2304.11. Approved wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by an approved metal hanger into which the ends of the beams shall be closely fitted. Where traditional heavy timber detailing is used, these connections shall be permitted to be supported by ledgers or blocks securely fastened to the sides of the girders.

**2304.11.1.3 Roof framing.** Minimum dimensions of roof framing shall be in accordance with Table 2304.11. Every roof girder and not less than every alternate roof beam shall be anchored to its supporting member to resist forces as required in Chapter 16.

**2304.11.2 Partitions and walls.** Partitions and walls shall comply with Section 2304.11.2.1 or 2304.11.2.2.

**2304.11.2.1 Exterior walls.** Exterior walls shall be permitted to be cross-laminated timber meeting the requirements of Section 2303.1.4.

**2304.11.2.2 Interior walls and partitions.** Interior walls and partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

**2304.11.3 Floors.** *[BSC, DSA-SS, DSA-SS/CC, HCD-1, HCD-2]* Floors shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.4. Wood floors shall be constructed in accordance with Section 2304.11.3.1 or 2304.11.3.2.

**2304.11.3.1 Cross-laminated timber floors.** Cross-laminated timber shall be not less than 4 inches (102 mm) in actual thickness. Cross-laminated timber shall be continuous from support to support and mechanically fastened to one another. Cross-laminated timber

shall be permitted to be connected to walls without a shrinkage gap providing swelling or shrinking is considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

**2304.11.3.2 Sawn or glued-laminated plank floors.** Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally,  $1\frac{5}{32}$ -inch (12 mm) wood structural panel or  $\frac{1}{2}$ -inch (12.7 mm) particleboard.
2. Planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or  $1\frac{5}{32}$ -inch (12 mm) wood structural panel or  $\frac{1}{2}$ -inch (12.7 mm) particleboard.

The lumber shall be laid so that continuous lines of joints will occur only at points of support. Floors shall not extend closer than  $\frac{1}{2}$  inch (12.7 mm) to walls. Such  $\frac{1}{2}$ -inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbelling of masonry walls under the floor shall be permitted to be used in place of molding.

**TABLE 2304.11  
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS**

SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
		Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	$6\frac{3}{4}$	$8\frac{1}{4}$	7	$7\frac{1}{2}$
	Wood beams and girders	6	10	5	$10\frac{1}{2}$	$5\frac{1}{4}$	$9\frac{1}{2}$
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	$8\frac{1}{4}$	$5\frac{1}{4}$	$7\frac{1}{2}$
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	$5\frac{1}{4}$	$5\frac{1}{2}$
	Framed timber trusses and other roof framing; <sup>a</sup> Framed or glued-laminated arches that spring from the top of walls or wall abutments	$4^b$	6	$3^b$	$6\frac{7}{8}$	$3\frac{1}{2}^b$	$5\frac{1}{2}$

For SI: 1 inch = 25.4 mm.

- a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.
- b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.



**2304.11.4 Roof decks.** *[BSC, DSA-SS, DSA-SS/CC, HCD-1, HCD-2]* Roofs shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.4. Roof decks shall be constructed in accordance with Section 2304.11.4.1 or 2304.11.4.2. Other types of decking shall be an alternative that provides equivalent fire resistance and structural properties. Where supported by a wall, roof decks shall be anchored to walls to resist forces determined in accordance with Chapter 16. Such anchors shall consist of steel bolts, lags, screws or approved hardware of sufficient strength to resist prescribed forces.

**2304.11.4.1 Cross-laminated timber roofs.** Cross-laminated timber roofs shall be not less than 3 inches (76 mm) nominal in thickness and shall be continuous from support to support and mechanically fastened to one another.

**2304.11.4.2 Sawn, wood structural panel, or glued-laminated plank roofs.** Sawn, wood structural panel, or glued-laminated plank roofs shall be one of the following:

1. Sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness.
2. 1<sup>1</sup>/<sub>8</sub>-inch-thick (32 mm) wood structural panel (exterior glue).
3. Planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors.

**2304.12 Protection against decay and termites.** Wood shall be protected from decay and termites in accordance with the applicable provisions of Sections 2304.12.1 through 2304.12.7.

**2304.12.1 Locations requiring waterborne preservatives or naturally durable wood.** Wood used above ground in the locations specified in Sections 2304.12.1.1 through 2304.12.1.5, 2304.12.3 and 2304.12.5 shall be naturally durable wood or preservative-treated wood using waterborne preservatives, in accordance with AWPA U1 for above-ground use.

**2304.12.1.1 Joists, girders and subfloor.** Wood joists or wood structural floors that are closer than 18 inches (457 mm) or wood girders that are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation shall be of naturally durable or preservative-treated wood.

**2304.12.1.1.1 [SPCB]** *There shall be a clearance of at least 18 inches (457 mm) between the underside of wood floor joists and the finished surface of the ground, and at least 12 inches (305 mm) between the underside of any other wood horizontal framing member and the finished surface of the ground. The ground underneath floor joists shall be leveled or smoothed off so as to maintain a reasonably even surface.*

**Exception:** *For purposes of structural pest control inspection, a minimum of 12 inches (305 mm)*

*of clearance under-floor joists shall be considered adequate except that such clearance shall not be necessary where the subarea soil is of such a nature as to prevent excavation or where excavation would create a hazard from shifting soil or other causes.*

**2304.12.1.2 Wood supported by exterior foundation walls.** Wood framing members, including wood sheathing, that are in contact with exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or preservative-treated wood.

**Exception:** *[DSA-SS and OSHPD 1, 1R, 2, 4 & 5] At exterior walls where the earth is paved with an asphalt or concrete slab at least 18 inches (457 mm) wide and draining away from the building, the bottom of sills are permitted to be 6 inches (152 mm) above the top of such slab. Other equivalent means of termite and decay protection may be accepted by the enforcement agency.*

**2304.12.1.3 Exterior walls below grade.** Wood framing members and furring strips in direct contact with the interior of exterior masonry or concrete walls below grade shall be of naturally durable or preservative-treated wood.

**2304.12.1.4 Sleepers and sills.** Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or preservative-treated wood.

**2304.12.1.4.1 Additional requirements.** *[DSA-SS and OSHPD 1, 1R, 2, 4 & 5] Stud walls or partitions at shower or toilet rooms with more than two plumbing fixtures, excluding floor drains, and stud walls adjacent to unroofed paved areas shall rest on a concrete curb extending at least 6 inches (152 mm) above finished floor and pavement level.*

**2304.12.1.5 Wood siding.** Clearance between wood siding and earth on the exterior of a building shall be not less than 6 inches (152 mm) or less than 2 inches (51 mm) vertical from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather except where siding, sheathing and wall framing are of naturally durable or preservative-treated wood.

**2304.12.2 Other locations.** Wood used in the locations specified in Sections 2304.12.2.1 through 2304.12.2.5 shall be naturally durable wood or preservative-treated wood in accordance with AWPA U1. Preservative-treated wood used in interior locations shall be protected with two coats of urethane, shellac, latex epoxy or varnish unless waterborne preservatives are used. Prior to application of the protective finish, the wood shall be dried in accordance with the manufacturer's recommendations.

**2304.12.2.1 Girder ends.** The ends of wood girders entering exterior masonry or concrete walls shall be provided with a 1/2-inch (12.7 mm) airspace on top, sides and end, unless naturally durable or preservative-treated wood is used.

**2304.12.2.2 Posts or columns.** Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or preservative-treated wood.

**Exception:** Posts or columns that meet all of the following:

1. Are not exposed to the weather, or are protected by a roof, eave, overhang, or other covering if exposed to the weather.
2. Are supported by concrete piers or metal pedestals projected not less than 1 inch (25 mm) above the slab or deck and are separated from the concrete pier by an impervious moisture barrier.
3. Are located not less than 8 inches (203 mm) above exposed earth.

**2304.12.2.3 Supporting member for permanent appurtenances.** Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.

**Exception:** Buildings located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use durable materials where the structure is exposed to the weather.

**2304.12.2.4 Laminated timbers.** The portions of glued-laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not fully protected from moisture by a roof, eave or similar covering shall be pressure treated with preservative or be manufactured from naturally durable or preservative-treated wood.

**2304.12.2.5 Supporting members for permeable floors and roofs.** Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier. The impervious moisture barrier system protecting the structure supporting floors shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.

**2304.12.2.6 Ventilation beneath balcony or elevated walking surfaces.** Enclosed framing in exterior balconies and elevated walking surfaces that are exposed to rain, snow or drainage from irrigation shall be provided with openings that provide a net free cross-ventilation area not less than  $\frac{1}{150}$  of the area of each separate space.

**2304.12.3 Wood in contact with the ground or fresh water.** Wood used in contact with exposed earth shall be naturally durable for both decay and termite resistance or preservative treated in accordance with AWP A U1 for soil or fresh water use.

**Exception:** Untreated wood is permitted where such wood is continuously and entirely below the ground-water level or submerged in fresh water.

**2304.12.3.1 Posts or columns.** Posts and columns that are supporting permanent structures and embedded in concrete that is exposed to the weather or in direct contact with the earth shall be of preservative-treated wood.

**2304.12.4 Termite protection.** In geographical areas where hazard of termite damage is known to be very heavy, wood floor framing in the locations specified in Section 2304.12.1.1 and exposed framing of exterior decks or balconies shall be of naturally durable species (termite resistant) or preservative treated in accordance with AWP A U1 for the species, product preservative and end use or provided with approved methods of termite protection.

**2304.12.5 Wood used in retaining walls and cribs.** Wood installed in retaining or crib walls shall be preservative treated in accordance with AWP A U1 for soil and fresh water use.

**2304.12.6 Attic ventilation.** For attic ventilation, see Section 1202.2.2.

**2304.12.7 Under-floor ventilation (crawl space).** For under-floor ventilation (crawl space), see Section 1202.4.

**2304.12.8 Separate wood framing. [SPCB]** *Correct the conditions in frame and stucco walls and similar appurtenant construction so that the wood framing is separate from the main structure by a complete concrete or masonry plug with no voids that will allow infestations to enter the structure from the wall. If there is no plug, the foundation shall be 2 inches (51 mm) or more above the grade levels and at least as high as the adjoining slabs or 4-inch (102 mm) concrete barrier seat off installed.*

**2304.12.9 Earth fills. [SPCB]** *Separate the earth fills such as under porches or paving from all woodwork by concrete, masonry, good quality cement plaster or other material approved by local building codes. Chemical treatment of earth fills is considered adequate if the foundation adjoining the fill meets standards of the current building codes.*

**2304.13 Long-term loading.** Wood members supporting concrete, masonry or similar materials shall be checked for the effects of long-term loading using the provisions of the ANSI/AWC NDS. The total deflection, including the effects of long-term loading, shall be limited in accordance with Section 1604.3.1 for these supported materials.

**Exception:** Horizontal wood members supporting masonry or concrete nonstructural floor or roof surfacing not more than 4 inches (102 mm) thick need not be checked for long-term loading.

# CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

## CHAPTER 30 – ELEVATORS AND CONVEYING SYSTEMS

(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	X	X								
Adopt entire chapter as amended (amended sections listed below)			X							X													
Adopt only those sections that are listed below				X	X	X	X																
Chapter / Section																							
3001.2			X																				
3001.4						X	X																
3001.4			X																				
3001.5			X																				
3001.6			X																				
3002.4a – 3002.4.7a			X																				
3002.5			X																				
3002.6.1			X																				
3002.9			X																				
3002.10 – 3002.10.5			X																				
3002.11			X																				
3003.1 – 3003.2.1.2			X																				
3003.4 – 3003.4.4			X																				
3005.1 – 3005.2			X																				
3005.4.1			X																				
3006.2			X																				
3006.3			X																				
3007.1			X																				
3007.6.1			X																				
3008.1 – 3008.1.4			X																				
3008.2.1			X																				
3008.7.1			X																				
3009										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 30

# ELEVATORS AND CONVEYING SYSTEMS

### User note:

**About this chapter:** Chapter 30 contains the provisions that regulate vertical and horizontal transportation and material-handling systems installed in buildings. This chapter also provides several elements that protect occupants and assist emergency responders during fires.

### SECTION 3001 GENERAL

**3001.1 Scope.** This chapter governs the design, construction, installation, alteration and repair of elevators and conveying systems and their components.

**3001.2 Emergency elevator communication systems for the deaf, hard of hearing and speech impaired.** An emergency two-way communication system shall be provided that:

1. Is a visual and text-based and a video-based 24/7 live interactive system.
2. Is fully accessible by the deaf, hard of hearing and speech impaired, and shall include voice-only options for hearing individuals.
3. Has the ability to communicate with emergency personnel utilizing existing video conferencing technology, chat/text software or other approved technology.

**3001.3 Referenced standards.** Except as otherwise provided for in this code, the design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*, and the applicable standard specified in Table 3001.3 and ASCE 24 for construction in flood hazard areas established in Section 1612.3.

**TABLE 3001.3  
ELEVATORS AND CONVEYING SYSTEMS AND COMPONENTS**

TYPE	STANDARD
Automotive lifts	ALI ALCTV
Belt manlifts	ASME A90.1
Conveyors and related equipment	ASME B20.1
Elevators, escalators, dumbwaiters, moving walks, material lifts	ASME A17.1/CSA B44, ASME A17.7/CSA B44.7
Industrial scissor lifts	ANSI MH29.1
Platform lifts, stairway chairlifts, wheelchair lifts	ASME A18.1

**3001.4 Accessibility.** Passenger elevators and platform (wheelchair) lifts required to be accessible or to serve as part of an accessible means of egress shall comply with Sections 1009 and either *Chapter 11A for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development* or *Chapter 11B for applications*

*listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance.*

**3001.5 Change in use.** A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**3001.6 Elevators utilized to transport hazardous materials.** Elevators utilized to transport hazardous materials shall also comply with the *California Fire Code Sections 5003.10.2.2, 5003.10.4 through 5003.10.7*.

### SECTION 3002 HOISTWAY ENCLOSURES

**3002.1 Hoistway enclosure protection.** Elevator, dumbwaiter and other hoistway enclosures shall be shaft enclosures complying with Sections 712 and 713.

**3002.1.1 Opening protectives.** Openings in hoistway enclosures shall be protected as required in Chapter 7.

**Exception:** The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I Emergency Recall Operation.

**3002.1.2 Hardware.** Hardware on opening protectives shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating mechanisms shall be exempt from the fire test requirements.

**3002.2 Number of elevator cars in a hoistway.** Where four or more elevator cars serve all or the same portion of a building, the elevators shall be located in not fewer than two separate hoistways. Not more than four elevator cars shall be located in any single hoistway enclosure.

**3002.3 Emergency signs.** An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS.

#### Exceptions:

1. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with Section 1009.4.

- The emergency sign shall not be required for elevators that are used for occupant self-evacuation in accordance with Section 3008.

**3002.4 Elevator car to accommodate ambulance stretcher.** Where elevators are provided in buildings four or more stories above, or four or more stories below, grade plane, not fewer than one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate an ambulance stretcher 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners, in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall be not less than 3 inches (76 mm) in height and shall be placed inside on both sides of the hoistway door frame.

*The following California sections replace the corresponding model code section for applications specified in section 1.11 for the Office of the State Fire Marshal.*

**3002.4a General stretcher requirements.** All buildings and structures with one or more passenger service elevators shall be provided with not less than one medical emergency service elevator to all landings meeting the provisions of Section 3002.4a. The medical emergency service elevator(s) shall be identified in the construction documents specified in Section 107 or the California Administrative Code.

**Exceptions:**

- Elevators in structures used only by maintenance and operating personnel.
- Elevators in jails and penal institutions.
- Elevators in buildings or structures where each landing is at ground level or is accessible at grade level or by a ramp.
- Elevator(s) in two-story buildings or structures equipped with stairs of a configuration that will accommodate the carrying of the gurney or stretcher as permitted by the local jurisdictional authority.
- Elevators in buildings or structures less than four stories in height for which the local jurisdictional authority has granted an exception in the form of a written document.

**3002.4.1a Gurney size.** The medical emergency service elevator shall accommodate the loading and transport of two emergency personnel, each requiring a minimum clear 21-inch (533 mm) diameter circular area and an ambulance gurney or stretcher [minimum size 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners] in the horizontal, open position.

**3002.4.2a Hoistway doors.** The hoistway landing openings shall be provided with power-operated doors.

**3002.4.3a Elevator recall.** The elevator(s) designated the medical emergency elevator shall be equipped with a key switch to recall the elevator nonstop to the main floor. For the purpose of this section, elevators in compliance with Section 3003.2 shall be acceptable.

**3002.4.4a Designation.** Medical emergency elevators shall be identified by the international symbol (Star of Life) for emergency medical services.

**3002.4.5a Symbol size.** The symbol shall not be less than 3 inches (76 mm) in size.

**3002.4.6a Symbol location.** A symbol shall be permanently attached to each side of the hoistway door frame on the portion of the frame at right angles to the hallway or landing area. Each symbol shall be not less than 78 inches (1981 mm) and not more than 84 inches (2134 mm) above the floor level at the threshold.

**3002.5 Emergency doors.** Where an elevator is installed in a single blind hoistway or on the outside of a building, emergency doors shall be in conformance with the California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

**3002.6 Prohibited doors.** Doors, other than hoistway doors and the elevator car door, shall be prohibited at the point of access to an elevator car unless such doors are readily openable from the car side without a key, tool, special knowledge or effort.

**3002.6.1 Prohibited Hoistway Access Doors and Panels.** The following types of access doors and panels are prohibited in accordance with the California Code Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders:

- Access panels or doors to working platforms in the line of movement of the car counterweight in the hoistway.
- Access panels or doors in the hoistway for access to car or hoistway transparent enclosures.

**3002.7 Common enclosure with stairway.** Elevators shall not be in a common shaft enclosure with a stairway.

**Exception:** Elevators within open parking garages need not be separated from stairway enclosures.

**3002.8 Glass in elevator enclosures.** Glass in elevator enclosures shall comply with Section 2409.2.

**3002.9 Plumbing and mechanical systems.** Plumbing and mechanical systems shall not be located in an elevator hoistway enclosure unless permitted by California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

**Exception:** Floor drains and sumps shall be permitted at the base of the hoistway enclosure provided that they are indirectly connected to the plumbing system.

**3002.10 Photoelectric tube bypass switch.**

**3002.10.1** Elevators equipped with photoelectric tube devices which control the closing of automatic, power-operated car or hoistway doors, or both, shall have a switch in the car which, when actuated, will render the photoelectric tube device ineffective.

**3002.10.2** The switch shall be constant-pressure type, requiring not less than 10 pounds (44.5N) or more than 15 pounds (66.7 N) pressure to actuate.

**3002.10.3** The switch shall be located not less than 6 feet (1829 mm) or more than 6 feet 6 inches (1981 mm) above the car floor and shall be located in or adjacent to the operating panel.

**3002.10.4** The switch shall be clearly labeled *TO BE USED IN CASE OF FIRE ONLY*.

**3002.10.5** Switches shall be kept in working order or be removed when existing installations are arranged to comply with Section 3002.10.5, Exception 1 or 2.

**Exceptions:**

1. Elevators installed and maintained in compliance with Section 3003.
2. Where alternate means acceptable to the fire authority having jurisdiction are provided that will ensure the doors can close under adverse smoke conditions.

**3002.11 Pit access door.** Where separate pit access door(s) are required for access to pit(s) located below the bottom hoistway door landing, permanent stairway access shall be provided to the access door.

## SECTION 3003 EMERGENCY OPERATIONS

**[F] 3003.1 Standby power.** In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with Section 1203 of the California Fire Code and Sections 3003.1.1 through 3003.1.5 of this code.

**[F] 3003.1.1 Manual transfer.** Standby power shall be manually transferable to all elevators in each bank.

**[F] 3003.1.2 One elevator.** Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

**[F] 3003.1.3 Two or more elevators.** Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, not less than one elevator shall remain operable from the standby power source.

**[F] 3003.1.4 Temperature and humidity control.** Where standby power is connected to elevators, the machine room, machine space, control room, and control space ventilation or air conditioning system shall be connected to the standby power source.

**3003.1.5 Emergency hoistway venting.** Where standby power is connected to elevators, the emergency hoistway

ventilation system, if required, shall be connected to the standby power source.

**[F] 3003.2 Fire fighters' emergency operation.** Elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

**3003.2.1 Floor numbers.** Elevator hoistways shall have a floor number not less than 4 inches (102 mm) in height, placed on the walls and/or doors of the hoistway at intervals such that a person in a stalled elevator, upon opening the car door, can determine the floor position.

**3003.2.1.1 Fire signs.** All automatic elevators shall have not less than one sign at each landing printed on a contrasting background in letters not less than  $\frac{1}{2}$  inch (12.7 mm) high to read: *IN CASE OF FIRE USE STAIRWAY FOR EXIT. DO NOT USE ELEVATOR.*

**3003.2.1.2 Call and car operation buttons.** Automatic passenger elevators shall have call and car operation buttons within 60 inches (1524 mm) of the floor. Emergency telephones shall also be within 60 inches (1524 mm) of the floor.

**[F] 3003.3 Standardized fire service elevator keys.** All elevators shall be equipped to operate with a standardized fire service elevator key in accordance with the California Fire Code.

**3003.4 Emergency hoistway venting.** Elevator hoistways containing the driving machine shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.

**3003.4.1 Location of vents.** Vents shall be located at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air.

**3003.4.2 Area of vents.** Except as provided for in Section 3003.1.4.4, the area of the vents shall be not less than  $3\frac{1}{2}$  percent of the area of the hoistway nor less than 3 square feet (0.28 m<sup>2</sup>) for each elevator car.

**3003.4.3 Operation of vents.** Vent openings shall automatically open upon detection of smoke in the elevator hoistway and upon activation of a manual override control. The manual override control shall be capable of opening and closing the vents and shall be located in an approved location. Smoke detectors provided in elevator hoistways to activate the hoistway ventilation system, shall also be required to activate the elevator Phase I emergency recall operation function in accordance with California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

**3003.4.4 Reduced vent area.** Where mechanical ventilation conforming to the California Mechanical Code is provided, a reduction in the required vent area is allowed provided that all of the following conditions are met:

1. The vents required by Section 3003.1.4.1 of the California Building Code do not have outside exposure.

2. *The hoistway does not extend to the top of the building.*
3. *The hoistway exhaust fan is automatically reactivated by thermostatic means.*
4. *Equivalent venting of the hoistway is accomplished.*

### SECTION 3004 CONVEYING SYSTEMS

**3004.1 General.** Escalators, moving walks, conveyors, personnel hoists and material hoists shall comply with the provisions of Sections 3004.2 through 3004.4.

**3004.2 Escalators and moving walks.** Escalators and moving walks shall be constructed of approved noncombustible and fire-retardant materials. This requirement shall not apply to electrical equipment, wiring, wheels, handrails and the use of  $\frac{1}{28}$ -inch (0.9 mm) wood veneers on balustrades backed up with noncombustible materials.

**3004.2.1 Enclosure.** Escalator floor openings shall be enclosed with shaft enclosures complying with Section 713.

**3004.2.2 Escalators.** Where provided in below-grade transportation stations, escalators shall have a clear width of not less than 32 inches (815 mm).

**3004.3 Conveyors.** Conveyors and conveying systems shall comply with ASME B20.1.

**3004.3.1 Enclosure.** Conveyors and related equipment connecting successive floors or levels shall be enclosed with shaft enclosures complying with Section 713.

**3004.3.2 Conveyor safeties.** Power-operated conveyors, belts and other material-moving devices shall be equipped with automatic limit switches that will shut off the power in an emergency and automatically stop all operation of the device.

**3004.4 Personnel and material hoists.** Personnel and material hoists shall be designed utilizing an approved method that accounts for the conditions imposed during the intended operation of the hoist device. The design shall include, but is not limited to, anticipated loads, structural stability, impact, vibration, stresses and seismic restraint. The design shall account for the construction, installation, operation and inspection of the hoist tower, car, machinery and control equipment, guide members and hoisting mechanism. Additionally, the design of personnel hoists shall include provisions for field testing and maintenance that will demonstrate that the hoist device functions in accordance with the design. Field tests shall be conducted upon the completion of an installation or following a major alteration of a personnel hoist.

### SECTION 3005 MACHINE ROOMS

**3005.1 Access.** A permanent and approved means of access shall be provided to elevator machine rooms, control rooms, control spaces and machinery spaces.

**3005.2 Temperature and humidity control.** Elevator machine rooms, machinery spaces that contain the driving machine, and control rooms or spaces that contain the operation or motion controller for elevator operation shall be provided with an independent ventilation or air-conditioning system to protect against the overheating of the electrical equipment. The system shall *maintain the temperature and humidity* within the range established by the manufacturer of the elevator equipment.

**3005.3 Pressurization.** The elevator machine room, control rooms or control space with openings into a pressurized elevator hoistway shall be pressurized upon activation of a heat or smoke detector located in the elevator machine room, control room or control space.

**3005.4 Machine rooms, control rooms, machinery spaces, and control spaces.** Elevator machine rooms, control rooms, control spaces and machinery spaces outside of but attached to a hoistway that have openings into the hoistway shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors.

#### Exceptions:

1. For other than fire service access elevators and occupant evacuation elevators, where machine rooms, machinery spaces, control rooms and control spaces do not abut and do not have openings to the hoistway enclosure they serve, the fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted to be reduced to a 1-hour fire-resistance rating.
2. For other than fire service access elevators and occupant evacuation elevators, in buildings four stories or less above grade plane where machine room, machinery spaces, control rooms and control spaces do not abut and do not have openings to the hoistway enclosure they serve, the machine room, machinery spaces, control rooms and control spaces are not required to be fire-resistance rated.

**3005.4.1 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. *The requirements of NFPA 13, Section 8.15.5.3.*
2. *The elevator machine room, elevator machinery space, elevator control space, or elevator control room shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall not be less than the required rating of the hoistway*



*enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors. The exceptions to Section 3005.4 shall not apply.*

**3005.5 Shunt trip.** Where elevator hoistways, elevator machine rooms, control rooms and control spaces containing elevator control equipment are protected with automatic sprinklers, a means installed in accordance with Section 21.4 of NFPA 72 shall be provided to automatically disconnect the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting. The activation of automatic sprinklers outside the hoistway, machine room, machinery space, control room or control space shall not disconnect the main line power supply.

**3005.6 Plumbing systems.** Plumbing systems shall not be located in elevator equipment rooms.

## SECTION 3006 ELEVATOR LOBBIES AND HOISTWAY OPENING PROTECTION

**3006.1 General.** Elevator hoistway openings and enclosed elevator lobbies shall be provided in accordance with the following:

1. Where hoistway opening protection is required by Section 3006.2, such protection shall be in accordance with Section 3006.3.
2. Where enclosed elevator lobbies are required for underground buildings, such lobbies shall comply with Section 405.4.3.
3. Where an area of refuge is required and an enclosed elevator lobby is provided to serve as an area of refuge, the enclosed elevator lobby shall comply with Section 1009.6.
4. Where fire service access elevators are provided, enclosed elevator lobbies shall comply with Section 3007.6.
5. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall comply with Section 3008.6.

**3006.2 Hoistway opening protection required.** Elevator hoistway door openings shall be protected in accordance with Section 3006.3 where an elevator hoistway connects more than two stories in Group A, E, H, I, L, R-1, R-2, R-2.1 and R-2.2 occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, and more than three stories for all other occupancies. Hoistway opening protection is required to be enclosed within a shaft enclosure in accordance with Section 712.1.1 and any of the following conditions apply:

1. The building is not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Group A occupancies.
3. Group E occupancies.
4. Group H occupancies.

5. Group I occupancies.

6. Group L occupancies.

7. Group R-1, R-2, R-2.1, and R-2.2 occupancies.

8. High-rise buildings.

See Section 403.6 for additional requirements for high-rise buildings.

### Exceptions:

1. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.
2. Protection of elevator hoistway door openings is not required at the level(s) of exit discharge, provided that the level(s) of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Enclosed elevator lobbies and protection of elevator hoistway door openings are not required on levels where the elevator hoistway opens to the exterior.

**3006.2.1 Rated corridors.** Where corridors are required to be fire-resistance rated in accordance with Section 1020.1, elevator hoistway openings shall be protected in accordance with Section 3006.3.

**3006.3 Hoistway opening protection.** Where Section 3006.2 requires protection of the elevator hoistway door opening, the protection shall be provided by one of the following:

1. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by fire partitions in accordance with Section 708. In addition, doors protecting openings in the elevator lobby enclosure walls shall comply with Section 716.2.2.1 as required for corridor walls. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by smoke partitions in accordance with Section 710 where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2.2, 710.5.2.3 and 716.2.6.1. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
3. Additional doors shall be provided at each elevator hoistway door opening in accordance with Section 3002.6. Such door shall comply with the smoke and draft control door assembly requirements in Section 716.2.2.1.1 when tested in accordance with UL 1784 without an artificial bottom seal.
4. **[SFM]** When approved, in other than Group I-2 occupancies elevator hoistway shall be pressurized in accordance with Section 909.21.

5. *[SFM] Enclosed elevator lobbies are not required where the hoistway door has a fire-protection rating as required by Section 708.7 and the hoistway door opening is also protected by a listed and labeled smoke containment system complying with ICC ES AC 77.*

**3006.4 Means of egress.** Elevator lobbies shall be provided with not less than one means of egress complying with Chapter 10 and other provisions in this code. Egress through an enclosed elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2.

## SECTION 3007 FIRE SERVICE ACCESS ELEVATOR

**3007.1 General.** Where required by Section 403.6.1, every floor shall be served by fire service access elevators complying with Sections 3007.1 through 3007.9. Except as modified in this section, fire service access elevators shall be installed in accordance with this chapter and *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**Exception:** Below grade parking garage floors shall not be required to be served by fire service access elevators.

**3007.2 Automatic sprinkler system.** The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3007.2.1.

**3007.2.1 Prohibited locations.** Automatic sprinklers shall not be installed in machine rooms, elevator machinery spaces, control rooms, control spaces and elevator hoistways of fire service access elevators.

**3007.2.2 Sprinkler system monitoring.** The sprinkler system shall have a sprinkler control valve supervisory switch and water-flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

**3007.3 Water protection.** Water from the operation of an automatic sprinkler system outside the enclosed lobby shall be prevented from infiltrating into the hoistway enclosure in accordance with an approved method.

**3007.4 Shunt trip.** Means for elevator shutdown in accordance with Section 3005.5 shall not be installed on elevator systems used for fire service access elevators.

**3007.5 Hoistway enclosures.** The fire service access elevator hoistway shall be located in a shaft enclosure complying with Section 713.

**3007.5.1 Structural integrity of hoistway enclosures.** The fire service access elevator hoistway enclosure shall comply with Sections 403.2.3.1 through 403.2.3.4.

**3007.5.2 Hoistway lighting.** When fire-fighters' emergency operation is active, the entire height of the hoistway shall be illuminated at not less than 1 foot-candle (11 lux) as measured from the top of the car of each fire service access elevator.

**3007.6 Fire service access elevator lobby.** The fire service access elevator shall open into an enclosed fire service access elevator lobby in accordance with Sections 3007.6.1 through 3007.6.5. Egress is permitted through the enclosed elevator lobby in accordance with Item 1 of Section 1016.2.

**Exception:** Where a fire service access elevator has two entrances onto a floor, the second entrance shall be permitted to be protected in accordance with Section 3006.3.

**3007.6.1 Access to smokeproof enclosure.** The enclosed fire service access elevator lobby shall have direct access from the enclosed elevator lobby to a smokeproof enclosure complying with Section 909.20.

**Exception:** Access to a smokeproof enclosure shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.2.2.1.

**3007.6.2 Lobby enclosure.** The fire service access elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 3007.6.3.

**Exception:** Enclosed fire service access elevator lobbies are not required at the levels of exit discharge.

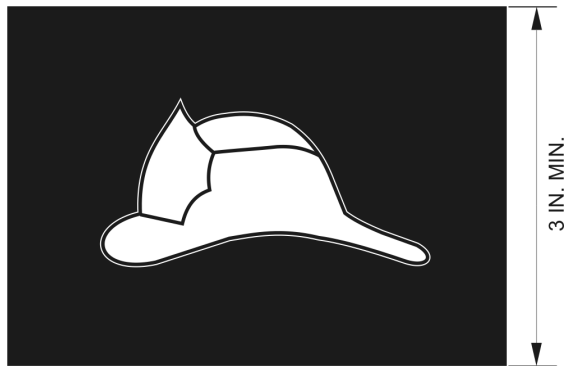
**3007.6.3 Lobby doorways.** Other than doors to the hoistway, elevator control room or elevator control space, each doorway to an enclosed fire service access elevator lobby shall be provided with a  $\frac{3}{4}$ -hour fire door assembly complying with Section 716. The fire door assembly shall comply with the smoke and draft control door assembly requirements of Section 716.2.2.1.1 and be tested in accordance with UL 1784 without an artificial bottom seal.

**3007.6.4 Lobby size.** Regardless of the number of fire service access elevators served by the same elevator lobby, the enclosed fire service access elevator lobby shall be not less than 150 square feet (14 m<sup>2</sup>) in an area with a dimension of not less than 8 feet (2440 mm).

**3007.6.5 Fire service access elevator symbol.** A pictorial symbol of a standardized design designating which elevators are fire service access elevators shall be installed on each side of the hoistway door frame on the portion of the frame at right angles to the fire service access elevator lobby. The fire service access elevator symbol shall be designed as shown in Figure 3007.6.5 and shall comply with the following:

1. The fire service access elevator symbol shall be not less than 3 inches (76 mm) in height.
2. The helmet shall contrast with the background, with either a light helmet on a dark background or a dark helmet on a light background.
3. The vertical center line of the fire service access elevator symbol shall be centered on the hoistway door frame. Each symbol shall be not less than 78 inches

(1981 mm), and not more than 84 inches (2134 mm) above the finished floor at the threshold.



For SI: 1 inch = 25.4 mm.

**FIGURE 3007.6.5**  
**FIRE SERVICE ACCESS ELEVATOR SYMBOL**

**3007.7 Elevator system monitoring.** The fire service access elevator shall be continuously monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.

**3007.8 Electrical power.** The following features serving each fire service access elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator hoistway lighting.
3. Ventilation and cooling equipment for elevator machine rooms, control rooms, machine spaces and control spaces.
4. Elevator car lighting.

**3007.8.1 Protection of wiring or cables.** Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 2 hours.

**Exception:** Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operations.

**3007.9 Standpipe hose connection.** A Class I standpipe hose connection in accordance with Section 905 shall be provided in the interior exit stairway and ramp having direct access from the enclosed fire service access elevator lobby.

**3007.9.1 Access.** The exit enclosure containing the standpipe shall have access to the floor without passing through the enclosed fire service access elevator lobby.

## **SECTION 3008** **OCCUPANT EVACUATION ELEVATORS**

**3008.1 General.** *Where elevators are to be used for occupant self-evacuation during fires, all passenger elevators for general public use shall comply with Sections 3008.1 through 3008.10. Where other elevators are used for occupant self-evacuation, those elevators shall comply with these sections.*

### **3008.1.1 Reserved.**

**3008.1.2 Additional exit stairway.** Where an additional means of egress is required in accordance with Section 403.5.2, an additional exit stairway shall not be required to be installed in buildings provided with occupant evacuation elevators complying with Section 3008.1.

**3008.1.3 Fire safety and evacuation plan.** The building shall have an approved fire safety and evacuation plan in accordance with the applicable requirements of Section 404 of the *California Fire Code*. The fire safety and evacuation plan shall incorporate specific procedures for the occupants using evacuation elevators.

**3008.1.4 Operation.** The occupant evacuation elevators shall be used for occupant self-evacuation in accordance with the occupant evacuation operation requirements in the building's fire safety and evacuation plan.

**3008.2 Automatic sprinkler system.** The building shall be equipped throughout with an approved, electrically supervised automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3008.2.1.

**3008.2.1 Prohibited locations.** Automatic sprinklers shall not be installed in elevator machine rooms, machinery spaces, control rooms, control spaces and elevator hoistways of occupant evacuation elevators *in accordance with this section and Section 3005.4.1.*

**3008.2.2 Sprinkler system monitoring.** The automatic sprinkler system shall have a sprinkler control valve supervisory switch and water-flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

**3008.3 Water protection.** Water from the operation of an automatic sprinkler system outside the enclosed lobby shall be prevented from infiltrating into the hoistway enclosure in accordance with an approved method.

**3008.4 Shunt trip.** Means for elevator shutdown in accordance with Section 3005.5 shall not be installed on elevator systems used for occupant evacuation elevators.

**3008.5 Hoistway enclosure protection.** Occupant evacuation elevator hoistways shall be located in shaft enclosures complying with Section 713.

**3008.5.1 Structural integrity of hoistway enclosures.** Occupant evacuation elevator hoistway enclosures shall comply with Sections 403.2.3.1 through 403.2.3.4.

**3008.6 Occupant evacuation elevator lobby.** Occupant evacuation elevators shall open into an enclosed elevator lobby in accordance with Sections 3008.6.1 through 3008.6.6. Egress is permitted through the elevator lobby in accordance with Item 1 of Section 1016.2.

**3008.6.1 Access to interior exit stairway or ramp.** The occupant evacuation elevator lobby shall have direct access from the enclosed elevator lobby to an interior exit stairway or ramp.

**Exceptions:**

1. Access to an interior exit stairway or ramp shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.2.2.1.
2. Elevators that only service an open parking garage and the lobby of the building shall not be required to provide direct access.

**3008.6.2 Lobby enclosure.** The occupant evacuation elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 3008.6.3.

**Exception:** Enclosed occupant evacuation elevator lobbies are not required at the levels of exit discharge.

**3008.6.3 Lobby doorways.** Other than the doors to the hoistway, elevator machine rooms, machinery spaces, control rooms and control spaces within the lobby enclosure smoke barrier, each doorway to an occupant evacuation elevator lobby shall be provided with a  $3/4$ -hour fire door assembly complying with Section 716. The fire door assembly shall comply with the smoke and draft control assembly requirements of Section 716.2.2.1.1 and be tested in accordance with UL 1784 without an artificial bottom seal.

**3008.6.3.1 Vision panel.** A vision panel shall be installed in each fire door assembly protecting the lobby doorway. The vision panel shall consist of fire-protection-rated glazing, shall comply with the requirements of Section 716 and shall be located to furnish clear vision of the occupant evacuation elevator lobby.

**3008.6.3.2 Door closing.** Each fire door assembly protecting the lobby doorway shall be automatic-closing upon receipt of any fire alarm signal from the emergency voice/alarm communication system serving the building.

**3008.6.4 Lobby size.** Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 square feet (0.28 m<sup>2</sup>) per person, not less than 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area shall accommodate one wheelchair space of 30 inches by 48 inches (760 mm by 1220 mm) for each

50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

**Exception:** The size of lobbies serving multiple banks of elevators shall have the minimum floor area approved on an individual basis and shall be consistent with the building's fire safety and evacuation plan.

**3008.6.5 Signage.** An approved sign indicating elevators are suitable for occupant self-evacuation shall be posted on all floors adjacent to each elevator call station serving occupant evacuation elevators.

**3008.6.6 Two-way communication system.** A two-way communication system shall be provided in each occupant evacuation elevator lobby for the purpose of initiating communication with the fire command center or an alternate location approved by the fire department. The two-way communication system shall be designed and installed in accordance with Sections 1009.8.1 and 1009.8.2.

**3008.7 Elevator system monitoring.** The occupant evacuation elevators shall be continuously monitored at the fire command center or a central control point approved by the fire department and arranged to display all of the following information:

1. Floor location of each elevator car.
2. Direction of travel of each elevator car.
3. Status of each elevator car with respect to whether it is occupied.
4. Status of normal power to the elevator equipment, elevator machinery and electrical apparatus cooling equipment where provided, elevator machine room, control room and control space ventilation and cooling equipment.
5. Status of standby or emergency power system that provides backup power to the elevator equipment, elevator machinery and electrical cooling equipment where provided, elevator machine room, control room and control space ventilation and cooling equipment.
6. Activation of any fire alarm initiating device in any elevator lobby, elevator machine room, machine space containing a motor controller or electric driving machine, control space, control room or elevator hoistway.

**3008.7.1 Elevator recall.** The fire command center or an alternate location approved by the fire department shall be provided with the means to manually initiate a Phase I Emergency Recall of the occupant evacuation elevators in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**3008.8 Electrical power.** The following features serving each occupant evacuation elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Ventilation and cooling equipment for elevator machine rooms, control rooms, machinery spaces and control spaces.
3. Elevator car lighting.

**3008.8.1 Determination of standby power load.** Standby power loads shall be based on the determination of the number of occupant evacuation elevators in Section 3008.1.1.

**3008.8.2 Protection of wiring or cables.** Wires or cables that are located outside of the elevator hoistway, machine room, control room and control space and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to occupant evacuation elevators shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 2 hours.

**Exception:** Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operation.

**3008.9 Emergency voice/alarm communication system.** The building shall be provided with an emergency voice/alarm communication system. The emergency voice/alarm communication system shall be accessible to the fire department. The system shall be provided in accordance with Section 907.5.2.2.

**3008.9.1 Notification appliances.** Not fewer than one audible and one visible notification appliance shall be installed within each occupant evacuation elevator lobby.

**3008.10 Hazardous material areas.** Building areas shall not contain hazardous materials exceeding the maximum allowable quantities per control area as addressed in Section 414.2.

## **SECTION 3009 SPECIAL REQUIREMENTS FOR ELEVATORS IN HOSPITALS**

**3009.1 General. [OSHPD 1]** *In hospital buildings, all elevators shall comply with the provisions of this section.*

**3009.1.1 Seismic switch.** *The seismic switch, as required by ASME A17.1, shall be connected to the essential electrical system.*

**3009.1.2 Annunciator.** *Either a visible or an audible annunciator shall be connected to the essential electrical system and be located in the elevator machine room. The annunciator will indicate if the seismic switch is inoperative due to a loss of power. If a visual annunciator is used, it shall be clearly visible in the room.*

**3009.1.3 Travel speed.** *After a seismic switch has been triggered, the elevator shall have the ability to operate at a "go slow" speed until the elevator can be inspected. "Go slow" speed is defined as a travel speed of not more than 150 feet per minute (45.72 meters per minute).*

**3009.1.4 Cable-operated elevators.** *For cable-operated elevators, an additional sensor switch shall be installed on the governor rope/sheave. The sensor shall prevent car movement when the governor tail sheave is dislodged from its normal position.*



# 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	X		X	X	X			X	X														
3102.3.1			X																				
3102.6.1.1	X		X	X	X			X	X														
3103			X																				
3104			X																				
3104.2, <i>Exception 2</i>						X	X																
3105			X																				
3106			X																				
3109				†	†																		
3109.1								X	X														
3109.2, <i>Note</i>	X																						
3110			X																				
3111			X																				
3111.1.1				X	X																		
3111.1.1, <i>Exception</i>								X	X														
3111.3				X	X			X	X														
3112.2				X																			
3112.3, <i>Exception</i>								X	X														
3113				†	†																		
3113.1								X	X														
3113.1.1								X	X														
3113.2, <i>Exception</i>								X	X														
3113.3, <i>Exception</i>								X	X														
3113.4, <i>Exception</i>								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 31

# SPECIAL CONSTRUCTION

### User notes:

**About this chapter:** Chapter 31 provides regulations for unique buildings and building elements. Those include buildings such as membrane structures, greenhouses and relocatable buildings. Special elements include pedestrian walkways and tunnels, awnings, canopies and marquees, vehicular gates and solar energy systems.

**Code development reminder:** Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2019 (Group B) Code Development Cycle. See explanation on page ix.

### SECTION 3101 GENERAL

**3101.1 Scope.** The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, automatic vehicular gates, awnings and canopies, marquees, signs, towers, antennas, relocatable buildings, swimming pool enclosures and safety devices, and solar energy systems.

### SECTION 3102 MEMBRANE STRUCTURES

**3102.1 General.** The provisions of Sections 3102.1 through 3102.8 shall apply to air-supported, air-inflated, membrane-covered cable, membrane-covered frame and tensile membrane structures, collectively known as membrane structures, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the *California Fire Code*. Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, greenhouses and similar facilities not used for human occupancy are required to meet only the requirements of Sections 3102.3.1 and 3102.7. Membrane structures erected on a building, balcony, deck or other structure for any period of time shall comply with this section.

**3102.2 Tensile membrane structures and air-supported structures.** Tensile membrane structures and air-supported structures, including permanent and temporary structures, shall be designed and constructed in accordance with ASCE 55. The provisions in Sections 3102.3 through 3102.6 shall apply.

**3102.3 Type of construction.** Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IV-HT construction. Other membrane structures shall be classified as Type V construction.

**Exception:** Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation per-

mance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

**3102.3.1 Membrane and interior liner material.** Membranes and interior liners shall be either noncombustible as set forth in Section 703.5 *shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8. Tops and sidewalls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).*

**Exception:** Plastic less than 20 mil (0.5 mm) in thickness used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

**3102.4 Allowable floor areas.** The area of a membrane structure shall not exceed the limitations specified in Section 506.

**3102.5 Maximum height.** Membrane structures shall not exceed one story nor shall such structures exceed the height limitations in feet specified in Section 504.3.

**Exception:** Noncombustible membrane structures serving as roofs only.

**3102.6 Mixed construction.** Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

**3102.6.1 Noncombustible membrane.** A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or atrium of a building of any type of construction provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

**3102.6.1.1 Membrane.** A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall be permitted to be used as the roof or as a skylight on buildings of Type IIB, III, IV-HT and V construction, provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

**3102.7 Engineering design.** The structure shall be designed and constructed to sustain dead loads; loads due to tension or inflation; live loads including wind, snow or flood and seismic loads and in accordance with Chapter 16.

**3102.7.1 Lateral restraint.** For membrane-covered frame structures, the membrane shall not be considered to provide lateral restraint in the calculation of the capacities of the frame members.

**3102.8 Inflation systems.** Air-supported and air-inflated structures shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of Sections 3102.8.1 through 3102.8.3.

**3102.8.1 Equipment requirements.** The inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

**3102.8.1.1 Auxiliary inflation system.** In addition to the primary inflation system, in buildings larger than 1,500 square feet (140 m<sup>2</sup>) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

**3102.8.1.2 Blower equipment.** Blower equipment shall meet all of the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the building official to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be approved.

**3102.8.2 Standby power.** Wherever an auxiliary inflation system is required, an approved standby power-generating system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. Standby power shall be capable of operating independently for not less than 4 hours.

**3102.8.3 Support provisions.** A system capable of supporting the membrane in the event of deflation shall be provided for in air-supported and air-inflated structures having an occupant load of 50 or more or where covering a swimming pool regardless of occupant load. The support

system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes not less than 7 feet (2134 mm) above the floor, seating area or surface of the water.

## SECTION 3103 TEMPORARY STRUCTURES

**3103.1 General.** The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. Tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall comply with the *California Fire Code*. Those erected for a longer period of time shall comply with applicable sections of this code.

**3103.1.1 Conformance.** Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

**3103.1.2 Permit required.** Temporary structures that cover an area greater than 120 square feet (11.16 m<sup>2</sup>), including connecting areas or spaces with a common means of egress or entrance that are used or intended to be used for the gathering together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a permit from the building official.

**3103.2 Construction documents.** A permit application and construction documents shall be submitted for each installation of a temporary structure. The construction documents shall include a site plan indicating the location of the temporary structure and information delineating the means of egress and the occupant load.

**3103.3 Location.** Temporary structures shall be located in accordance with the requirements of Table 602 based on the fire-resistance rating of the exterior walls for the proposed type of construction.

**3103.4 Means of egress.** Temporary structures shall conform to the means of egress requirements of Chapter 10 and shall have an exit access travel distance of 100 feet (30 480 mm) or less.

## SECTION 3104 PEDESTRIAN WALKWAYS AND TUNNELS

**3104.1 General.** This section shall apply to connections between buildings such as pedestrian walkways or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or the number of stories or height of connected buildings.

**3104.1.1 Application.** Pedestrian walkways shall be designed and constructed in accordance with Sections 3104.2 through 3104.9. Tunnels shall be designed and

## SECTION 3108 TELECOMMUNICATION AND BROADCAST TOWERS

**[BS] 3108.1 General.** Towers shall be designed and constructed in accordance with the provisions of TIA-222. Towers shall be designed for seismic loads; exceptions related to seismic design listed in Section 2.7.3 of TIA-222 shall not apply. In Section 2.6.6.2 of TIA 222, the horizontal extent of Topographic Category 2, escarpments, shall be 16 times the height of the escarpment.

**Exception:** Single free-standing poles used to support antennas not greater than 75 feet (22 860 mm), measured from the top of the pole to grade, shall not be required to be noncombustible.

**[BS] 3108.2 Location and access.** Towers shall be located such that guy wires and other accessories shall not cross or encroach on any street or other public space, or over above-ground electric utility lines, or encroach on any privately owned property without the written consent of the owner of the encroached-upon property, space or above-ground electric utility lines. Towers shall be equipped with climbing and working facilities in compliance with TIA-222. Access to the tower sites shall be limited as required by applicable OSHA, FCC and EPA regulations.

## SECTION 3109 SWIMMING POOLS, SPAS AND HOT TUBS

**3109.1 General.** The design and construction of swimming pools, spas and hot tubs shall comply with the *International Swimming Pool and Spa Code*. **[DSA-SS and DSA-SS/CC]** *Swimming pools utilized for public school purposes shall also be designed, constructed and inspected in accordance with this code.*

### 3109.2 California swimming pool safety act (statewide).

**NOTE:** These regulations are subject to local government modification. You should verify the applicable local government requirements at the time of application for a building permit.

*The following text in this section contains the statutory language in the Swimming Pool Safety Act (HS Code, §§ 115920 – 115929) that is required to be duplicated and published in California Code of Regulations, Title 24. As such, the section numbers reflect those within the Health and Safety Code.*

**115920.** *This act shall be known and may be cited as the Swimming Pool Safety Act.*

*(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)*

**115921.** *As used in this article the following terms have the following meanings:*

(a) “Swimming pool” or “pool” means any structure intended for swimming or recreational bathing that contains water over 18 inches deep. “Swimming pool” includes in-ground and aboveground structures and includes, but is not limited to, hot tubs, spas, portable spas, and nonportable wading pools.

(b) “Public swimming pool” means a swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a pri-

vate club. Public swimming pool does not include a swimming pool located on the grounds of a private single-family home.

(c) “Enclosure” means a fence, wall, or other barrier that isolates a swimming pool from access to the home.

(d) “Approved safety pool cover” means a manually or power-operated safety pool cover that meets all of the performance standards of the American Society for Testing and Materials (ASTM), in compliance with standard F1346-91.

(e) “Exit alarms” means devices that make audible, continuous alarm sounds when any door or window, that permits access from the residence to the pool area that is without any intervening enclosure, is opened or is left ajar. Exit alarms may be battery operated or may be connected to the electrical wiring of the building.

(f) “ANSI/APSP performance standard” means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).

(g) “Suction outlet” means a fitting or fixture typically located at the bottom or on the sides of a swimming pool that conducts water to a recirculating pump.

*[Amended by Stats. 2012, Ch. 679, Sec. 1. (AB 2114) Effective January 1, 2013.]*

**115922.** (a) *Except as provided in Section 115925, when a building permit is issued for the construction of a new swimming pool or spa or the remodeling of an existing swimming pool or spa at a private single-family home, the respective swimming pool or spa shall be equipped with at least two of the following seven drowning prevention safety features:*

(1) *An enclosure that meets the requirements of Section 115923 and isolates the swimming pool or spa from the private single-family home.*

(2) *Removable mesh fencing that meets American Society for Testing and Materials (ASTM) Specifications F2286 standards in conjunction with a gate that is self-closing and self-latching and can accommodate a key lockable device.*

(3) *An approved safety pool cover, as defined in subdivision (d) of Section 115921.*

(4) *Exit alarms on the private single-family home’s doors that provide direct access to the swimming pool or spa. The exit alarm may cause either an alarm noise or a verbal warning, such as a repeating notification that “the door to the pool is open.”*

(5) *A self-closing, self-latching device with a release mechanism placed no lower than 54 inches above the floor on the private single-family home’s doors providing direct access to the swimming pool or spa.*

(6) *An alarm that, when placed in a swimming pool or spa, will sound upon detection of accidental or unauthorized entrance into the water. The alarm shall meet and be independently certified to the ASTM Standard F2208 “Standard Safety Specification for Residential Pool Alarms,” which includes surface motion, pressure, sonar, laser, and infrared type alarms. A swimming pro-*

tection alarm feature designed for individual use, including an alarm attached to a child that sounds when the child exceeds a certain distance or becomes submerged in water, is not a qualifying drowning prevention safety feature.

(7) Other means of protection, if the degree of protection afforded is equal to or greater than that afforded by any of the features set forth above and has been independently verified by an approved testing laboratory as meeting standards for those features established by the ASTM or the American Society of Mechanical Engineers (ASME).

(b) Before the issuance of a final approval for the completion of permitted construction or remodeling work, the local building code official shall inspect the drowning safety prevention features required by this section and, if no violations are found, shall give final approval.

[Amended by Stats. 2017, Ch. 670, Sec. 4. (SB 442) Effective January 1, 2018.]

**115923.** An enclosure shall have all of the following characteristics:

(a) Any access gates through the enclosure open away from the swimming pool, and are self-closing with a self-latching device placed no lower than 60 inches above the ground.

(b) A minimum height of 60 inches.

(c) A maximum vertical clearance from the ground to the bottom of the enclosure of two inches.

(d) Gaps or voids, if any, do not allow passage of a sphere equal to or greater than four inches in diameter.

(e) An outside surface free of protrusions, cavities, or other physical characteristics that would serve as hand-holds or footholds that could enable a child below the age of five years to climb over.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

**115924.** (a) Any person entering into an agreement to build a swimming pool or spa, or to engage in permitted work on a pool or spa covered by this article, shall give the consumer notice of the requirements of this article.

(b) Pursuant to existing law, the Department of Health Services shall have available on the department's Web site, commencing January 1, 2007, approved pool safety information available for consumers to download. Pool contractors are encouraged to share this information with consumers regarding the potential dangers a pool or spa poses to toddlers. Additionally, pool contractors may provide the consumer with swimming pool safety materials produced from organizations such as the United States Consumer Product Safety Commission, Drowning Prevention Foundation, California Coalition for Children's Safety & Health, Safe Kids Worldwide, Association of Pool and Spa Professionals, or the American Academy of Pediatrics.

(Amended by Stats. 2006, Ch. 478, Sec. 3. Effective January 1, 2007.)

**115925.** The requirements of this article do not apply to any of the following:

(a) Public swimming pools.

(b) Hot tubs or spas with locking safety covers that comply with the American Society for Testing and Materials (ASTM F1346).

(c) An apartment complex, or any residential setting other than a single-family home.

[Amended by Stats. 2017, Ch. 670, Sec. 5. (SB 442) Effective January 1, 2018.]

**115926.** This article does not apply to any facility regulated by the State Department of Social Services even if the facility is also used as the private residence of the operator. Pool safety in those facilities shall be regulated pursuant to regulations adopted therefor by the State Department of Social Services.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

**115927.** Notwithstanding any other provision of law, this article shall not be subject to further modification or interpretation by any regulatory agency of the state, this authority being reserved exclusively to local jurisdictions, as provided for in subdivision (e) of Section 115922 and subdivision (c) of Section 115924.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

**115928.** Whenever a building permit is issued for the construction of a new swimming pool or spa, the pool or spa shall meet all of the following requirements:

(a) (1) The suction outlets of the pool or spa for which the permit is issued shall be equipped to provide circulation throughout the pool or spa as prescribed in paragraphs (2) and (3).

(2) The swimming pool or spa shall either have at least two circulation suction outlets per pump that shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets, or be designed to use alternatives to suction outlets, including, but not limited to, skimmers or perimeter overflow systems to conduct water to the recirculation pump.

(3) The circulation system shall have the capacity to provide a complete turnover of pool water, as specified in Section 3124B of Chapter 31B of the California Building Standards Code (Title 24 of the California Code of Regulations).

(b) Suction outlets shall be covered with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or successor standard designated by the federal Consumer Product Safety Commission, that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area, and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### CHAPTER 33 – SAFEGUARDS DURING 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			OSHDP						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	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below				X	X		X																
Chapter / Section																							
3301				X	X																		
3302				X	X																		
3303				X	X																		
3304				X	X																		
3304.1.5				X																			
3305				X	X																		
3306				X	X																		
3306.2							X																
3307				X	X																		
3307.1, Note				X	X																		
3308				X	X																		
3310																							

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.



design live load shall be not less than 150 psf (7.2 kN/m<sup>2</sup>) for the entire structure.

**Exception:** Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6kN/m<sup>2</sup>) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.
4. Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.
5. The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification not less than <sup>23</sup>/<sub>32</sub> inch (18.3 mm) thick nailed to the joists.
6. Each post shall be knee braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.
7. A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.

**[BS] 3306.8 Repair, maintenance and removal.** Pedestrian protection required by this chapter shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

**[BS] 3306.9 Adjacent to excavations.** Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16.

### SECTION 3307 PROTECTION OF ADJOINING PROPERTY

**[BS] 3307.1 Protection required.** Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water

runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

**[HCD 1 & HCD 2] Note:** See Civil Code Section 832 for additional requirements related to adjoining properties and excavations.

### SECTION 3308 TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

**3308.1 Storage and handling of materials.** The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.

**3308.1.1 Obstructions.** Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

**3308.2 Utility fixtures.** Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

### SECTION 3309 FIRE EXTINGUISHERS

**[F] 3309.1 Where required.** Structures under construction, alteration or demolition shall be provided with not fewer than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

**[F] 3309.2 Fire hazards.** The provisions of this code and the *California Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

### SECTION 3310 MEANS OF EGRESS

**3310.1 Stairways required.** Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

**[F] 3310.2 Maintenance of means of egress.** Means of egress and required accessible means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

**Exception:** Existing means of egress need not be maintained where approved temporary means of egress systems and facilities are provided.

### SECTION 3311 STANDPIPES

**[F] 3311.1 Where required.** In buildings required to have standpipes by Section 905.3.1, not fewer than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to stairways complying with Section 3310.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

**[F] 3311.2 Buildings being demolished.** Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

**[F] 3311.3 Detailed requirements.** Standpipes shall be installed in accordance with the provisions of Chapter 9.

**Exception:** Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 as to capacity, outlets and materials.

### SECTION 3312 AUTOMATIC SPRINKLER SYSTEM

**[F] 3312.1 Completion before occupancy.** In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 111.3.

**[F] 3312.2 Operation of valves.** Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly

completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

### SECTION 3313 WATER SUPPLY FOR FIRE PROTECTION

**[F] 3313.1 Where required.** An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material arrives on the site.

### SECTION 3314 FIRE WATCH DURING CONSTRUCTION

**[F] 3314.1 Fire watch during combustible construction.** Where required by the fire code official, a fire watch shall be provided during nonworking hours for construction that exceeds 40 feet (12 192 mm) in height above the lowest adjacent grade.



# 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			OSHDP						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/APA PRG 320-18	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			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	†	†	†		†	†								

(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																							
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 D3498-03 (2011)	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)

# AMCA

Air Movement and Control Association International  
30 West University Drive  
Arlington Heights, IL 60004

**540—13: Test Method for Louvers Impacted by Wind Borne Debris**  
1609.2.1

# ANSI

American National Standards Institute  
25 West 43rd Street, Fourth Floor  
New York, NY 10036

**A13.1—2015: Scheme for the Identification of Piping Systems**  
415.11.6.5

**A108.1A—16: Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar**  
2103.2.3

**A108.1B—99: Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Mortar**  
2103.2.3

**A108.4—99: Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive**  
2103.2.3.6

**A108.5—99: Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-Portland Cement Mortar**  
2103.2.3.1, 2103.2.3.2

**A108.6—99: Installation of Ceramic Tile with Chemical-resistant, Water Cleanable Tile-setting and -grouting Epoxy**  
2103.2.3.3

**A108.8—99: Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout**  
2103.2.3.4

**A108.9—99: Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout**  
2103.2.3.5

**A108.10—99: Installation of Grout in Tilework**  
2103.2.3.7

**A118.1—16: American National Standard Specifications for Dry-set Portland Cement Mortar**  
2103.2.3.1

**A118.3—13: American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive**  
2103.2.3.3

**A118.4—16: American National Standard Specifications for Modified Dry-set Cement Mortar**  
2103.2.3.2, 2103.2.4

**A118.5—99: American National Standard Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation**  
2103.2.3.4

**A118.6—10: American National Standard Specifications for Cement Grouts for Tile Installation**  
2103.2.3.7

**A118.8—99: American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout**  
2103.2.3.5

**A136.1—08: American National Standard Specifications for the Installation of Ceramic Tile**  
2103.2.3.6

**A137.1—17: American National Standard Specifications for Ceramic Tile**  
202

**S3.41: American National Standard Specifications for Audible Emergency Evacuation Signal**  
907.5.2.1.3

**Z 97.1—14: Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test**  
2406.1.2, 2406.2, Table 2406.2(2), 2406.3.1, 2407.1, 2407.1.4.1, 2408.2.1, 2408.3, 2409.2, 2409.3, 2409.4.1

## APA

APA - Engineered Wood Association  
7011 South 19th Street  
Tacoma, WA 98466

**ANSI 117—15: Standard Specification for Structural Glued Laminated Timber of Softwood Species**  
2303.1.3.1, 2306.1

**ANSI/APA A190.1—17: Structural Glued Laminated Timber**  
1705A.5.4, 2303.1.3, 2306.1

**ANSI/APA PRG 320-18: Standard for Performance-rated Cross-Laminated Timber**  
2303.1.4, 602.4

**ANSI/APA PRP 210—14: Standard for Performance-Rated Engineered Wood Siding**  
2303.1.5, 2304.7, 2306.3, Table 2306.3(1)

**ANSI/APA PRR 410—16: Standard for Performance-Rated Engineered Wood Rim Boards**  
2303.1.13

**APA PDS—12: Panel Design Specification**  
2306.1

**APA PDS Supplement 1—12: Design and Fabrication of Plywood Curved Panels (revised 2013)**  
2306.1

**APA PDS Supplement 2—12: Design and Fabrication of Plywood-lumber Beams (revised 2013)**  
2306.1

**APA PDS Supplement 3—12: Design and Fabrication of Plywood Stressed-skin Panels (revised 2013)**  
2306.1

**APA PDS Supplement 4—12: Design and Fabrication of Plywood Sandwich Panels (revised 2013)**  
2306.1

**APA PDS Supplement 5—16: Design and Fabrication of All-plywood Beams (revised 2013)**  
2306.1

**ANSI/APA PRG 320—17: Standard for Performance-rated Cross-laminated Timber**  
2303.1.4

**APA R540—13: Builders Tips: Proper Storage and Handling of Glulam Beams**  
2306.1

**APA S475—16: Glued Laminated Beam Design Tables**  
2306.1

**APA S560—14: Field Notching and Drilling of Glued Laminated Timber Beams**  
2306.1

**APA T300—16: Glulam Connection Details**  
2306.1

**APA X440—17: Product Guide: Glulam**  
2306.1

**APA X450—01: Glulam in Residential Construction—Western Edition**  
2306.1

## ASABE

American Society of Agricultural and Biological Engineers  
2950 Niles Road  
St. Joseph, MI 49085

**EP 484.3 MON2016: Diaphragm Design of Metal-clad, Wood-frame Rectangular Buildings**  
2306.1

**EP 486.2 OCT 2012ED: Shallow-post and Pier Foundation Design**  
2306.1

**EP 559.2 MON2016: Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies**  
2306.1

# 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/CSA B44 the edition as referenced in: Safety Code for Elevators and Escalators, California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders

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

- D2843—16: Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics**  
2606.4
- D2859—16: Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials**  
804.4.1, 804.4.2
- D2898—10: Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing**  
1505.1, 2303.2.4, 2303.2.6
- D3019—08: Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered and Nonasbestos Fibered**  
Table 1507.10.2
- D3161/D3161M—15: Test Method for Wind Resistance of Steep Slope Roofing Products (Fan Induced Method)**  
1504.1.1, Table 1504.1.1, 1504.3.3, 1507.17.8
- D3200—74(2012): Standard Specification and Test Method for Establishing Recommended Design Stresses for Round Timber Construction Poles**  
2303.1.12
- D3201/D3201M—13: Test Method for Hygroscopic Properties of Fire-retardant-treated Wood and Wood-based Products**  
2303.2.7
- D3278—96(2011): Test Methods for Flash Point of Liquids by Small Scale Closed-cup Apparatus**  
202
- D3462/D3462M—10a: Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules**  
1507.2.4
- D3468/D3468M—99(2013)e1: Specification for Liquid-applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing**  
1507.15.2
- D3498—03(2011): Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems**  
703.9
- D3679—13: Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding**  
1403.9, 1404.14
- D3689/D3698M—07(2013)e1: Test Methods for Deep Foundations under Static Axial Tensile Load**  
1810.3.3.1.5
- D3737—12: Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)**  
2303.1.3
- D3746—85(2008): Test Method for Impact Resistance of Bituminous Roofing Systems**  
1504.7
- D3747—79(2007): Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation**  
Table 1507.10.2
- D3909/D3909M—14: Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules**  
1507.2.8.2, 1507.6.5, Table 1507.10.2
- D3957—09: Standard Practices for Establishing Stress Grades for Structural Members Used in Log Buildings**  
2303.1.11
- D3966—07(2013): Standard Test Method for Deep Foundations Under Lateral Loads**  
1810A.3.3.2
- D4022/D4022M—07(2012)e1: Specification for Coal Tar Roof Cement, Asbestos Containing**  
Table 1507.10.2
- D4272—15: Test Method for Total Energy Impact of Plastic Films by Dart Drop**  
1504.7
- D4318—10e1: Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils**  
1803.5.3
- D4434/D4434M—12: Specification for Poly (Vinyl Chloride) Sheet Roofing**  
1507.13.2
- D4479/D4479M—07(2012)e1: Specification for Asphalt Roof Coatings—Asbestos-free**  
Table 1507.10.2
- D4586/D4586M—07(2012)e1: Specification for Asphalt Roof Cement—Asbestos-free**  
Table 1507.10.2
- D4601/D4601M—04(2012)e1: Specification for Asphalt-coated Glass Fiber Base Sheet Used in Roofing**  
Table 1507.10.2, 1507.11.2.1

## REFERENCED STANDARDS

### ASTM—continued

- D4637/D4637M—14e1:** Specification for EPDM Sheet Used in Single-ply Roof Membrane  
1507.12.2
- D4829—11:** Test Method for Expansion Index of Soils  
1803.5.3
- D4869/D4869M—15:** Specification for Asphalt-saturated (Organic Felt) Underlayment Used in Steep Slope Roofing  
1507.1.1, Table 1507.1.1(1), 1507.18.3, 1507.18.4.1
- D4897/D4897M—01(2009):** Specification for Asphalt-coated Glass Fiber Venting Base Sheet Used in Roofing  
Table 1507.10.2
- D4945—12:** Test Method for High-strain Dynamic Testing of Deep Foundations  
1810.3.3.1.2
- D4990—97a(2013):** Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing  
Table 1507.10.2
- D5019—07a:** Specification for Reinforced Nonvulcanized Polymeric Sheet Used in Roofing Membrane  
1507.12.2
- D5055—13e1:** Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists  
2303.1.2
- D5456—14b:** Specification for Evaluation of Structural Composite Lumber Products  
2303.1.10
- D5516—09:** Test Method of Evaluating the Flexural Properties of Fire-retardant Treated Softwood Plywood Exposed to Elevated Temperatures  
2303.2.5.1
- D5643/D5643M—06(2012)e1:** Specification for Coal Tar Roof Cement, Asbestos-free  
Table 1507.10.2
- D5664—10:** Standard Test Method for Evaluating the Effects of Fire-retardant Treatment and Elevated Temperatures on Strength Properties of Fire-retardant Treated Lumber  
2303.2.5.2
- D5665/D5665M—99a(2014)e1:** Specification for Thermoplastic Fabrics Used in Cold-applied Roofing and Waterproofing  
Table 1507.10.2
- D5726—98(2013):** Specification for Thermoplastic Fabrics Used in Hot-applied Roofing and Waterproofing  
Table 1507.10.2
- D5778—12:** *Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils*  
1813, 1813A.2
- D6083—05e01:** Specification for Liquid Applied Acrylic Coating Used in Roofing  
Table 1507.10.2, Table 1507.14.3, 1507.15.2
- D6162/D6162M—00a(2015)e1:** Specification for Styrene-butadiene-styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements  
1507.11.2
- D6163/D6163M—00(2015)e1:** Specification for Styrene-butadiene-styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements  
1507.11.2
- D6164/D6164M—11:** Specification for Styrene-butadiene-styrene (SBS) Modified Bituminous Sheet Metal Materials Using Polyester Reinforcements  
1507.11.2
- D6222/D6222M—11:** Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements  
1507.11.2
- D6223/D6223M—02(2009)e1:** Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements  
1507.11.2
- D6298—13:** Specification for Fiberglass Reinforced Styrene-butadiene-styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface  
1507.11.2
- D6305—08(2015)e1:** Practice for Calculating Bending Strength Design Adjustment Factors for Fire-retardant-treated Plywood Roof Sheathing  
2303.2.5.1



# 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/IS.2/A440—17: North American Fenestration Standard/Specifications for Windows, Doors and Unit Skylights**  
1709.5.1, 2405.5

> | **ASME A17.1/CSA B44 the edition as referenced in: Safety Code for Elevators and Escalators, California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders**  
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 *as amended\**  
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<sup>2</sup> (0.93m<sup>2</sup>) 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.

**8.15.5.1** [Not adopted by SFM]

**8.15.5.2** [Not adopted by SFM]

*Revise Section 8.15.5.3 as follows:*

**8.15.5.3 Automatic sprinkler system.** Automatic fire sprinklers shall not be required in elevator machine rooms, elevator machinery spaces, control spaces, or hoistways of traction elevators installed in accordance with the applicable provisions in *the California Building Code*, where all of the following conditions are met:

- (1) The elevator machine room, machinery space, control room, control space, or hoistway of traction elevator is dedicated to elevator equipment only.
- (2) The elevator machinery space, control room, control space, or hoistway of traction elevators is separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire-resistance rating of not less than that specified by the applicable building code.

**NFPA—continued**

(3) No materials unrelated to elevator equipment are permitted to be stored in elevator machine rooms, machinery spaces, control rooms, control spaces, or hoistways of traction elevators.

(4) The elevator machinery is not of the hydraulic type.

**Add new Sections 8.15.5.6.1 as follows:**

**8.15.5.6.1** *The sprinkler required at the top and bottom of the elevator hoistway by 8.15.5.6 shall not be required where permitted by Chapter 30 of the California Building Code.*

**Revise Section 8.15.7.1\* as follows:**

**8.15.7.1\*** Unless the requirements of 8.15.7.2 or 8.15.7.3 are met, sprinklers shall be installed under exterior roofs, canopies, portecochere, balconies, decks, or similar projections exceeding 4 ft (1.2 m) in width.

**Revise Section 8.15.7.2\* as follows:**

**8.15.7.2\*** Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, portecocheres, balconies, decks, or similar projections are constructed with materials that are noncombustible, limited-combustible, or fire retardant treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials*.

**Delete Section A.8.15.7.2 of Annex**

**Revise Section 8.15.7.3**

**8.15.7.3** Sprinklers shall be permitted to be omitted from below the canopies, roofs, balconies, decks, or similar projections are combustible construction, provided the exposed finish material on the roof, or canopy is noncombustible, limited-combustible, or fire retardant treated wood as defined in NFPA 703, *Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials*, and the roofs, or canopies contains only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:

(1) *Combustible concealed spaces filled entirely with noncombustible insulation.*

(2) *Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft<sup>3</sup> (4.5 m<sup>3</sup>) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic [See 11.2.3.1.5.2(9)].*

(3) *Concealed spaces over isolated small roofs, or canopies not exceeding 55 ft<sup>2</sup> (5.1 m<sup>2</sup>).*

**Delete language to section 8.15.7.4 and reserve section number.**

**8.15.7.4 Reserved.**

**Revise Annex Section A.8.15.7.5 as follows:**

**A.8.15.7.5** *The presence of planters, newspaper machines and similar items, should not be considered storage.*

**Add Section 8.15.7.6 as follows:**

**8.15.7.6** *Sprinklers may be omitted for 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.*

**Add new Sections 8.16.1.1.1.4 and 8.16.1.1.1.5 as follows:**

**8.16.1.1.1.4** *Where a system includes floor control valves, a hydraulic design information sign containing information for the floor shall be provided at each floor control valve. A hydraulic design information sign shall be provided for each area calculated. The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain, or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve, or deluge valve supplying the corresponding hydraulically designed area.*

**8.16.1.1.1.5** *Control valves, check valves, drain valves, antifreeze valves shall be readily accessible for inspection, testing, and maintenance. Valves located more than 7 feet above the finished floor shall be provided with a means of opening and closing the valve from the floor level.*

**Add new Sections 8.16.1.6, 8.16.1.6.1, 8.16.1.6.1.1, 8.16.1.6.1.2, 8.16.1.6.1.3, 8.16.1.6.2, as follows:**

**8.16.1.6 Sectional Valves.**

**8.16.1.6.1** *Private fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.*

NFPA—continued

**8.16.1.6.1.1** Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.

**8.16.1.6.1.2** Sectional control valves shall be indicating valves in accordance with Section 6.6.1.3.

**8.16.1.6.1.3** 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.

**8.16.1.6.1.4** The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.

**8.16.1.6.2** A valve shall be provided on each bank where a main crosses a body of water or outside the building foundation(s) where the main or section of main runs under a building.

**Add new Section 9.1.3.9.1.1 as follows:**

**9.1.3.9.1.1** Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic design Categories C, D, E and F.

**Revise Section 9.3.5.11.4 as follows:**

**9.3.5.11.4** Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.

**Replace Section 9.3.5.12.5 as follows:**

**9.3.5.12.5** Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.

**Replace Section 9.3.5.12.6 as follows:**

**9.3.5.12.6** Fastening methods other than those identified in 9.3.5.12 shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 9.3.5.9. Calculations shall be submitted to the authority having jurisdiction.

**Revise Section 9.3.5.12.8.4 as follows:**

**9.3.5.12.8.4** Concrete anchors other than those shown in Table 9.3.5.12.2(a) through Table 9.3.5.12.2(f) and identified in 9.3.5.11.11 shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.

**Revise Section 9.3.6.1(3) as follows:**

**9.3.6.1\*(3)** No. 12, 440 lb (200 Kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Powder-driven fasteners for attaching restraint is allowed to be used provided that the restraint component does not support the dead load.

**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 Section 10.4.3.2.
2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

**Revise Section 11.2.3.1.5.2(9) as follows:**

**11.2.3.1.5.2(9)** Exterior columns under 10 ft<sup>2</sup> (0.93m<sup>2</sup>) 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.

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

**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**

426.1

**68—13: Standard on Explosion Protection by Deflagration Venting**

Table 414.5.1

NFPA—continued

**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<sup>2</sup> (93 m<sup>2</sup>) 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:**

**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.



NFPA—continued

- (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 40°F (4°C) or exceed 100°F (38°C).
- (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.
- (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.

NFPA—continued

(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**

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*\*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<sup>2</sup>) 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<sup>2</sup>) 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.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### APPENDIX D – FIRE DISTRICTS

(Not adopted by state agencies)

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																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

## APPENDIX D

### FIRE DISTRICTS

*The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency, or referenced in the adopting ordinance.*

#### User note:

**About this appendix:** Appendix D establishes a framework by which a jurisdiction can establish a portion of a jurisdiction as a fire district. Fire districts are often designated in a more densely developed portion of a city where limiting the potential spread of fire is a key consideration. Within a fire district specific construction types and users are prohibited.

#### SECTION D101 GENERAL

**D101.1 Scope.** The fire district shall include such territory or portion as outlined in an ordinance or law entitled “An Ordinance (Resolution) Creating and Establishing a Fire District.” Wherever, in such ordinance creating and establishing a fire district, reference is made to the fire district, it shall be construed to mean the fire district designated and referred to in this appendix.

**D101.1.1 Mapping.** The fire district complying with the provisions of Section D101.1 shall be shown on a map that shall be available to the public.

**D101.2 Establishment of area.** For the purpose of this code, the fire district shall include that territory or area as described in Sections D101.2.1 through D101.2.3.

**D101.2.1 Adjoining blocks.** Two or more adjoining blocks, exclusive of intervening streets, where not less than 50 percent of the ground area is built upon and more than 50 percent of the built-on area is devoted to hotels and motels of Group R-1; Group B occupancies; theaters, nightclubs, restaurants of Group A-1 and A-2 occupancies; garages, express and freight depots, warehouses and storage buildings used for the storage of finished products (not located with and forming a part of a manufactured or industrial plant); or Group S occupancy. Where the average height of a building is two and one-half stories or more, a block should be considered if the ground area built upon is not less than 40 percent.

**D101.2.2 Buffer zone.** Where four contiguous blocks or more comprise a fire district, there shall be a buffer zone of 200 feet (60 960 mm) around the perimeter of such district. Streets, rights-of-way and other open spaces not subject to building construction can be included in the 200-foot (60 960 mm) buffer zone.

**D101.2.3 Developed blocks.** Where blocks adjacent to the fire district have developed to the extent that not less than 25 percent of the ground area is built upon and 40 percent or more of the built-on area is devoted to the occupancies specified in Section D101.2.1, they can be considered for inclusion in the fire district, and can form all or a portion of the 200-foot (60 960 mm) buffer zone required in Section D101.2.2.

#### SECTION D102 BUILDING RESTRICTIONS

**D102.1 Types of construction permitted.** Within the fire district every building hereafter erected shall be either Type I, II, III or IV, except as permitted in Section D104.

**D102.2 Other specific requirements.**

**D102.2.1 Exterior walls.** Exterior walls of buildings located in the fire district shall comply with the requirements in Table 601 except as required in Section D102.2.6.

**D102.2.2 Group H prohibited.** Group H occupancies shall be prohibited from location within the fire district.

**D102.2.3 Construction type.** Every building shall be constructed as required based on the type of construction indicated in Chapter 6.

**D102.2.4 Roof covering.** Roof covering in the fire district shall conform to the requirements of Class A or B roof coverings as defined in Section 1505.

**D102.2.5 Structural fire rating.** Walls, floors, roofs and their supporting structural members shall be not less than 1-hour fire-resistance-rated construction.

**Exceptions:**

1. Buildings of Type IV-*HT* construction.
2. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Automobile parking structures.
4. Buildings surrounded on all sides by a permanently open space of not less than 30 feet (9144 mm).
5. Partitions complying with Section 603.1, Item 11.

**D102.2.6 Exterior walls.** Exterior load-bearing walls of Type II buildings shall have a fire-resistance rating of 2 hours or more where such walls are located within 30 feet (9144 mm) of a common property line or an assumed property line. Exterior nonload-bearing walls of Type II buildings located within 30 feet (9144 mm) of a common property line or an assumed property line shall have fire-resistance ratings as required by Table 601, but not less than 1 hour. Exterior walls located more than 30 feet (9144 mm) from a common property line or an assumed property line shall comply with Table 601.

**Exception:** In the case of one-story buildings that are 2,000 square feet (186 m<sup>2</sup>) or less in area, exterior walls located more than 15 feet (4572 mm) from a common property line or an assumed property line need only comply with Table 601.

**D102.2.7 Architectural trim.** Architectural trim on buildings located in the fire district shall be constructed of approved noncombustible materials or fire-retardant-treated wood.

**D102.2.8 Permanent canopies.** Permanent canopies are permitted to extend over adjacent open spaces provided that all of the following are met:

1. The canopy and its supports shall be of noncombustible material, fire-retardant-treated wood, Type IV construction or of 1-hour fire-resistance-rated construction.

**Exception:** Any textile covering for the canopy shall be flame resistant as determined by tests conducted in accordance with NFPA 701 after

both accelerated water leaching and accelerated weathering.

2. Any canopy covering, other than textiles, shall have a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723 in the form intended for use.
3. The canopy shall have one long side open.
4. The maximum horizontal width of the canopy shall be not greater than 15 feet (4572 mm).
5. The fire resistance of exterior walls shall not be reduced.

**D102.2.9 Roof structures.** Structures, except aerial supports 12 feet (3658 mm) high or less, flagpoles, water tanks and cooling towers, placed above the roof of any building within the fire district shall be of noncombustible material and shall be supported by construction of noncombustible material.

**D102.2.10 Plastic signs.** The use of plastics complying with Section 2611 for signs is permitted provided that the structure of the sign in which the plastic is mounted or installed is noncombustible.

**D102.2.11 Plastic veneer.** Exterior plastic veneer is not permitted in the fire district.

## SECTION D103 CHANGES TO BUILDINGS

**D103.1 Existing buildings within the fire district.** An existing building shall not be increased in height or area unless it is of a type of construction permitted for new buildings within the fire district or is altered to comply with the requirements for such type of construction. Nor shall any existing building be extended on any side, nor square footage or floors added within the existing building unless such modifications are of a type of construction permitted for new buildings within the fire district.

**D103.2 Other alterations.** Nothing in Section D103.1 shall prohibit other alterations within the fire district provided that such alterations do not create a change of occupancy that is otherwise prohibited or increase the fire hazard.

**D103.3 Moving buildings.** Buildings shall not hereafter be moved into the fire district or to another lot in the fire district unless the building is of a type of construction permitted in the fire district.

## SECTION D104 BUILDINGS LOCATED PARTIALLY IN THE FIRE DISTRICT

**D104.1 General.** Any building located partially in the fire district shall be of a type of construction required for the fire district, unless the major portion of such building lies outside of the fire district and all portions of it extend not more than 10 feet (3048 mm) inside the boundaries of the fire district.

## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE APPENDIX L – EARTHQUAKE RECORDING INSTRUMENTATION

(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																							
Adopt entire chapter as amended (amended sections listed below)										X				X									
Adopt only those sections that are listed below																							
Chapter / Section																							
L101.1										X				X									
L101.2										X				X									
L101.3										X													

### APPENDIX L

## EARTHQUAKE RECORDING INSTRUMENTATION

*The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency, or referenced in the adopting ordinance.*

#### User notes:

**About this appendix:** The purpose of Appendix L is to foster the collection of ground motion data, particularly from strong-motion earthquakes. When this ground motion data is synthesized, it may be useful in developing future improvements to the earthquake provisions of the code.

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

### SECTION L101 GENERAL

**L101.1 General.** Every structure located where the 1-second spectral response acceleration,  $S_1$ , determined in accordance with Section 1613.2, is greater than 0.40 and either exceeds six stories in height with an aggregate floor area of 60,000 square feet (5574 m<sup>2</sup>) or more, or exceeds 10 stories in height regardless of floor area, shall be equipped with not fewer than three approved recording accelerographs. The accelerographs shall be interconnected for common start and common timing.

**[OSHPD 1 & 4]** There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent.

**L101.2 Location.** As a minimum, instruments shall be located at the lowest level, mid-height, and near the top of the structure. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating “MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT” in 1-inch (25 mm) block letters shall be posted in a conspicuous location.

**[OSHPD 1 & 4]** A proposal for instrumentation and equipment specifications shall be forwarded to the enforcement agency for review and approval.

**L101.3 Maintenance.** Maintenance and service of the instrumentation shall be provided by the owner of the structure. Data produced by the instrument shall be made available to the building official on request.

Maintenance and service of the instruments shall be performed annually by an approved testing agency. The owner shall file with the building official a written report from an approved testing agency certifying that each instrument has been serviced and is in proper working condition. This report shall be submitted when the instruments are installed and annually thereafter. Each instrument shall have affixed to it an externally visible tag specifying the date of the last maintenance or service and the printed name and address of the testing agency.

**[OSHPD 1]** Data retrieval from the instrument and processing of the records shall be the responsibility of the enforcement agency.



## CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

### APPENDIX O – EMERGENCY HOUSING

(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																		
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

## APPENDIX O

### EMERGENCY HOUSING

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

#### SECTION O101 GENERAL

**O101.1 Scope.** This appendix shall be applicable to emergency housing and emergency housing facilities, as defined in Section O102.

#### SECTION O102 DEFINITIONS

**O102.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

**DECLARATION OF SHELTER CRISIS.** The duly proclaimed existence of a situation in which a significant number of persons are without the ability to obtain shelter, resulting in a threat to their health and safety. (See Government Code Section 8698.)

**DEPENDENT UNIT.** Emergency housing not equipped with a kitchen area, toilet, and sewage disposal system. Recreational vehicles that are not self-contained and without utility service connections shall be considered dependent units.

**EMERGENCY HOUSING.** Housing in a permanent or temporary structure(s), occupied during a declaration of state of emergency, local emergency, or shelter crisis. Emergency housing may include, but is not limited to, buildings and structures constructed in accordance with the California Building Standards Code; and emergency sleeping cabins, emergency transportable housing units, and tents constructed in accordance with this appendix.

**EMERGENCY HOUSING FACILITIES.** On-site common use facilities supporting emergency housing. Emergency housing facilities include, but are not limited to, kitchen areas, toilets, showers and bathrooms with running water. The use of

emergency housing facilities is limited exclusively to the occupants of the emergency housing, personnel involved in operating the housing, and other emergency personnel.

**EMERGENCY HOUSING SITE.** A site containing emergency housing and emergency housing facilities supporting the emergency housing.

**EMERGENCY SLEEPING CABIN.** Relocatable hard-sided structure constructed in accordance with this appendix, which may be occupied only for emergency housing if allowed by the enforcing agency.

**EMERGENCY TRANSPORTABLE HOUSING UNIT.** A single- or multiple-section prefabricated structure that is transportable by a vehicle and that can be installed on a permanent or temporary site in response to a need for emergency housing. Emergency transportable housing units include, but are not limited to, manufactured homes, mobile-homes, multifamily manufactured homes, recreational vehicles, and park trailers. For the purposes of this appendix, emergency transportable housing units may also include commercial modulars as defined in the Health and Safety Code Section 18001.8, if approved by the enforcing agency.

Emergency transportable housing units do not include factory-built housing as defined in the Health and Safety Code Section 19971.

**LANDING PLATFORM.** A landing provided as the top step of a stairway accessing a loft.

**LOCAL EMERGENCY.** Local Emergency as defined in the Government Code, Section 8558.

**LOFT.** A floor level located more than 30 inches (762 mm) above the main floor and open to it on at least one side with a ceiling height of less than 6 feet 8 inches (2032 mm), used as a living or sleeping space.

**MANUFACTURED HOME.** A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18007.

**MEMBRANE STRUCTURE.** An air-inflated, air-supported, cable or frame-covered structure, not otherwise defined as a tent. (See Chapter 31 of this code.)

**MOBILEHOME.** A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18008.

**MULTIFAMILY MANUFACTURED HOME.** A structure designed to contain not less than two dwelling units, as defined in the Health and Safety Code, Section 18008.7.

**PARK TRAILER.** A trailer designed for human habitation that meets all requirements in the Health and Safety Code, Section 18009.3.

**RECREATIONAL VEHICLE.** A motor home, travel trailer, truck camper, or camping trailer, with or without motive power, designed for human habitation, that meets all requirements in the Health and Safety Code, Section 18010.

**STATE OF EMERGENCY.** State of Emergency as defined in the Government Code, Section 8558.

**TENT.** A structure, enclosure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported by any manner except by air or the contents that it protects.

## SECTION O103 EMERGENCY HOUSING

**O103.1 General.** Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and/or assembled in accordance with this appendix, shall be occupied only during declaration of state of emergency, local emergency, or shelter crisis.

Buildings and structures constructed in accordance with the California Building Standards Code, used as emergency housing, shall be permitted to be permanently occupied.

**O103.2 Existing buildings.** Existing residential and nonresidential buildings or structures shall be permitted to be used as emergency housing and emergency housing facilities provided such buildings or structures comply with the building code provisions and/or other regulations in effect at the time of original construction and/or alteration. Existing buildings or structures used as emergency housing shall not become or continue to be substandard buildings, as determined by the enforcing agency.

**O103.2.1 New additions, alterations, and change of occupancy.** New additions, alterations, and change of occupancy to existing buildings shall comply with the requirements of the California Building Standards Code effective at the time of addition, alteration, or change of occupancy. The requirements shall apply only to and/or within the specific area of the addition, alteration, or change of occupancy.

**Exception:** Existing buildings and structures used for emergency housing and emergency housing facilities may not be required to comply with the California Energy Code, as determined by the enforcing agency.

**O103.3 Occupant load.** Except as otherwise stated in this appendix, the maximum occupant load allowed in buildings and structures used as emergency housing shall be determined by the enforcing agency, but the interior floor area shall not be less than 70 square feet (6.5 m<sup>2</sup>) for one occupant. Where more than one person occupies the building/structure, the required floor area shall be increased at the rate of 50 square feet (4.65 m<sup>2</sup>) for each occupant in excess of one.

### Exceptions:

1. Tents.
2. Recreational vehicles and park trailers designed for human habitation that meet the requirements in the Health and Safety Code, Sections 18009.3 and 18010, as applicable.
3. For emergency housing, including emergency sleeping cabins, the minimum interior floor area may be reduced to 53 square feet (4.9 m<sup>2</sup>) if the enforcing agency determines that 53 square feet (4.9 m<sup>2</sup>) is adequate space for a single-occupancy sleeping unit.

**O103.4 Fire and life safety requirements not addressed in this appendix.** If not otherwise addressed in this appendix, fire and life safety measures, including, but not limited to, means of egress, fire separation, fire sprinklers, smoke alarms, and carbon monoxide alarms, shall be determined and enforced by the enforcing agency.

**O103.5 Privacy.** Emergency housing shall be provided with a privacy lock on each entrance door and all windows for use by the occupants.

**O103.6 Heating.** All sleeping areas shall be provided with adequate heating as determined by the enforcing agency.

## SECTION O104 EMERGENCY SLEEPING CABINS

**O104.1 General.** Emergency sleeping cabins shall have an interior floor area of not less than 70 square feet (6.5 m<sup>2</sup>) for one occupant. Where more than one person occupies the cabin, the required floor area shall be increased at the rate of 50 square feet (4.65 m<sup>2</sup>) for each occupant in excess of one. The interior floor area shall not exceed 400 square feet (37 m<sup>2</sup>), excluding lofts.

**O104.2 Live loads.** Emergency sleeping cabins shall be designed to resist intrusion of wind, rain, and to support the following live loads:

1. Floor live loads not less than 40 pounds per square foot (1.92 kPa) of floor area.
2. Horizontal live loads not less than 15 pounds per square foot (718 Pa) of vertical wall and roof area.
3. Roof live loads not less than 20 pounds per square foot (958 Pa) of horizontal roof area.
4. In areas where snow loads are greater than 20 pounds per square foot (958 Pa), the roof shall be designed and constructed to resist these additional loads.

**O104.3 Minimum ceiling height.** Habitable space and hallways in emergency sleeping cabins shall have a ceiling height of not less than 80 inches (2032 mm). Bathrooms, toilet rooms, and kitchens, if provided, shall have a ceiling height of not less than 76 inches (1930 mm). Obstructions



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**SUPPLEMENT—BLUE  
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## TOWERS

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# HISTORY NOTE APPENDIX

## 2019 California Building Code California Code of Regulations, Title 24, Part 2 Volume 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, 11, 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.
3. Erratum to correct editorial errors in a Matrix Adoption Table and miscellaneous corrections throughout Chapters 2, 3, 4, 5, 7, 9, 10, 14, 16, 16A, effective October 1, 2020.
4. 2019 Intervening Cycle update; BSC 02/19, DSA-AC 01/19, DSA-SS/CC 02/19, HCD 01/19, HCD 1AC-02/19, OSHPD 02/19, OSHPD 03/19, SFM 01/19 – Approved by the California Building Standards Commission July 14 & 15, 2020, August 13, 2020, and November 5, 2020. Published on January 1, 2021 and effective July 1, 2021.





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