REVISION RECORD
FOR THE STATE OF CALIFORNIA

SUPPLEMENT

July 1, 2024

2022 Title 24, Part 2, Volume 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 the 2022 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2. 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 New, amended, or repealed building standards are identified by margin symbols.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 You may wish to retain the superseded material with this revision record so that the prior wording of any section can be easily ascertained.

Title 24, Part 2, Volume 2

Remove Existing Pages	Insert Blue-Colored Pages
iii through viii	iii through viii
xxv through xxviii	xxv through xxviii
xxxi through xxxiv	xxxi through xxxiv
16-1 and 16-2	16-1 and 16-2
16-9 and 16-10	16-9 and 16-10
16A-41 through 16A-44	16A-41 through 16A-44
16A-47 and 16A-48	16A-47 and 16A-48
17-1 and 17-2	17-1 and 17-2
17-9 through 17-12	17-9 through 17-12
17-17 and 17-18	17-17 and 17-18
17A-3 through 17A-6	17A-3 through 17A-6
18-1 and 18-2	18-1 and 18-2
18-21 and 18-22	18-21 and 18-22
18-25 through 18-34	18-25 through 18-34
19-1 through 19-10	19-1 through 19-10
19-13 and 19-14	19-13 and 19-14
19A-5 and 19A-6	19A-5 and 19A-6
21-1 through 21-10	21-1 through 21-10
21-19 and 21-20	21-19 and 21-20

Item No. 5520S2222

21A-5 through 21A-10	21A-5 through 21A-10
22-1 and 22-2	22-1 and 22-2
22-7 and 22-8	22-7 and 22-8
23-1 through 23-4	23-1 through 23-4
23-17 and 23-18	23-17 and 23-18
24-1 and 24-2	24-1 and 24-2
28-1 and 28-2	28-1 and 28-2
30-1 and 30-2	30-1 and 30-2
30-7 through 30-10	30-7 through 30-10
31-1 and 31-2	31-1 and 31-2
35-1 through 35-6	35-1 through 35-6
35-9 and 35-10	35-9 and 35-10
35-21 and 35-22	35-21 and 35-22
35-29 through 35-32	35-29 through 35-32
35-35 and 35-36	35-35 and 35-36
35-41 and 35-42	35-41 and 35-42
35-47 and 35-48	35-47 and 35-48
INDEX-11 through INDEX-14	INDEX-11 through INDEX-14
INDEX-21 through INDEX-22	INDEX-21 through INDEX-22
INDEX-35 through INDEX-36	INDEX-35 through INDEX-36
HIST-1 and HIST-2	HIST-1 and HIST-2

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:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833–2936

Phone: (916) 263–0916
Email: cbsc@dgs.ca.gov

Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *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.

Governor Gavin Newsom

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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.cdfa.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 ..... Contact Center (800) 952-8356

Option 5 > Option 2
Residential—Hotels, Motels, Apartments, Single-Family Dwellings, and Permanent Structures in Mobilehome & Special Occupancy Parks

Option 5 > Option 3
Manufactured Housing & Commercial Modular

Option 5 > Option 4
Factory-Built Housing

Option 5 > Option 5
Employee Housing Standards

Northern CA—Option 2 > Option 2 or 3

Southern CA—Option 2 > Option 4 or 5
Mobilehome—Permits & Inspections

Department of Public Health

www.dph.ca.gov .....(916) 449-5661

Organized Camps Standards
Public Swimming Pools Standards

Department of Water Resources

www.water.ca.gov .....DWRwebComment@water.ca.gov

Recycled Water Building 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 / California Department of Health Care Access and Information (HCAI)

www.hcai.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

How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

***[BSC]** This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.*

Legend of Acronyms of Adopting State Agencies

BSC	*California Building Standards Commission (see Section 1.2)*
BSC-CG	*California Building Standards Commission-CALGreen (see Section 1.2.2)*
BSCC	*Board of State and Community Corrections (see Section 1.3)*
SFM	*Office of the State Fire Marshal (see Section 1.11)*
HCD 1	*Department of Housing and Community Development (see Section 1.8.2.1.1)*
HCD 2	*Department of Housing and Community Development (see Section 1.8.2.1.3)*
HCD 1/AC	*Department of Housing and Community Development (see Section 1.8.2.1.2)*
DSA-AC	*Division of the State Architect-Access Compliance (see Section 1.9.1)*
DSA-SS	*Division of the State Architect-Structural Safety (see Section 1.9.2)*
DSA-SS/CC	*Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)*
OSHPD 1	*Office of Statewide Health Planning and Development (see Section 1.10.1)*
OSHPD 1R	*Office of Statewide Health Planning and Development (see Section 1.10.1)*
OSHPD 2	*Office of Statewide Health Planning and Development (see Section 1.10.2)*
OSHPD 3	*Office of Statewide Health Planning and Development (see Section 1.10.3)*
OSHPD 4	*Office of Statewide Health Planning and Development (see Section 1.10.4)*
OSHPD 5	*Office of Statewide Health Planning and Development (see Section 1.10.5)*
OSHPD 6	*Office of Statewide Health Planning and Development (see Section 1.10.6)*
DPH	*Department of Public Health (see Section 1.7)*
AGR	*Department of Food and Agriculture (see Section 1.6)*
CEC	*California Energy Commission (see Section 100 in Part 6, the California Energy Code)*
CA	*Department of Consumer Affairs (see Section 1.4):* *Board of Barbering and Cosmetology* *Board of Examiners in Veterinary Medicine* *Board of Pharmacy* *Acupuncture Board* *Bureau of Household Goods & Services* *Structural Pest Control Board (SPCB)*
SL	*State Library (see Section 1.12)*
SLC	*State Lands Commission (see Section 1.14)*
DWR	*Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)*

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages vii and viii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency's statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies' adoption as follows:

Adopt the entire IBC chapter without state amendments.

If there is an "X" under a particular state agency's acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE

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

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter			X																				
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below								S	A	M	P	L	E										
Chapter/Section																							

Adopt the entire IBC chapter as amended, state-amended sections are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an "X" in the column, by that particular section, under the agency's acronym, as well as an "X" by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

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																				
Adopt only those sections that are listed below								S	A	M	P	L	E										
Chapter/Section																							
202			X																				

Adopt only those sections that are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an "X" in the column under the agency's acronym, as well as an "X" by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

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					X	X		S	A	M	P	L	E										
Chapter/Section																							
202					X	X		S	A	M	P	L	E										
202					X	X			C	O	N	T.											
203					X	X																	
203					X	X																	

Marginal Markings

Symbols in the margin indicate the status of code changes as follows:

|| This symbol indicates that a change has been made to a California amendment.

> This symbol indicates deletion of California amendment language.

| This symbol indicates that a change has been made to International Code Council model language.

➡ This symbol indicates deletion of International Code Council model language.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2018 edition of the *International Building Code*.

2021 LOCATION	2018 LOCATION
508.5–508.5.11	419.1–419.9
904.12	904.14
904.13	904.12
904.14	904.13
1010.2	1010.1.9
1010.2.1	1010.1.9.6
1010.2.2	1010.1.9.1
1010.2.3	1010.1.9.2
1010.2.4	1010.1.9.4
1010.2.5	1010.1.9.5
1010.2.6	1010.1.9.6.1
1010.2.7	1010.1.9.12
1010.2.8	1010.1.4.4
1010.2.9	1010.1.10
1010.2.9.3	1010.1.10.1
1010.2.9.4	1010.1.10.2
1010.2.10	1010.1.9.3
1010.2.11	1010.1.9.10
1010.2.12	1010.1.9.9
1010.2.13	1010.1.9.8
1010.2.13.1	1010.1.9.8.1
1010.2.14	1010.1.9.7
1010.2.15	1010.1.9.11
1010.3	1010.1.4
1010.3.1	1010.1.4.1
Table 1010.3.1(1)	Table 1010.1.4.1(1)
Table 1010.3.1(2)	Table 1010.1.4.1(2)
1010.3.1.1	1010.1.4.1.1
1010.3.1.2	1010.1.4.1.2
1010.3.2	1010.1.4.2
1010.3.3	1010.1.4.3
1029.1	1028.4
1029.2	1028.4.2
1029.3	1028.4.2

(continued)

TABLE OF CONTENTS

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
CHAPTER 16 – STRUCTURAL DESIGN

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

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter				**X**	**X**								**X**										
Adopt entire chapter as amended (amended sections listed below)	**X**								**X**		**X**	**X**			**X**								
Adopt only those sections that are listed below						**X**	**X**															**X**	
Chapter / Section																							
1601.1.1									X		X	X			X								
1601.1.2									X		X	X			X								
1601.1.3									X														
1601.1.4									X		X	X			X								
1601.2									X		X	X			X								
1603.1											X	X			X								
Table 1604.5												X			X								
1605.2											X	X			X								
Table 1607.1											X	X			X								
1607.9						X																	
1607.9.2						X	X																
1612.3, *Exception*											X	X			X								
1613.1											X	X			X								
1613.1.1																						X	
1613.1.2	X																						
1613.1.3	X																						
1613.2.1, *Exception*											X	X			X								
Table 1613.2.3(1)											X	X			X								
Table 1613.2.3(2)											X	X			X								
1613.2.5, *Exception*											X	X			X								
1613.2.5.1											X	X			X								
1613.2.5.2											X	X			X								
1613.3											X	X			X								
1613.4											X	X			X								
1617									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.

following combinations. Where using these alternative allowable stress load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. 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. Where required by ASCE 7, Chapters 12, 13 and 15, the load combinations including overstrength of ASCE 7, > Section 2.3.6 shall be used. ***[OSHPD 1R, 2 & 5]*** *Each load combination shall be investigated with one or more of the variable loads set to zero.*

$D + L + (L_r \text{ or } S \text{ or } R)$ **(Equation 16-1)**

$D + L + 0.6W$ **(Equation 16-2)**

$D + L + 0.6W + S/2$ **(Equation 16-3)**

$D + L + S + 0.6W/2$ **(Equation 16-4)**

$D + L + S + E/1.4$ **(Equation 16-5)**

$0.9D + E/1.4$ **(Equation 16-6)**

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 pounds per square foot (1.44 kN/m^2) or less and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m^2), 20 percent shall be combined with seismic loads.

SECTION 1606
DEAD LOADS

1606.1 General. Dead loads are those loads defined in Chapter 2 of this code. Dead loads shall be considered to be permanent loads.

1606.2 Weights of materials of construction. For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606.4 Photovoltaic panel systems. The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.

SECTION 1607
LIVE LOADS

1607.1 General. Live loads are those loads defined in Chapter 2 of this code.

1607.2 Loads not specified. For occupancies or uses not designated in Section 1607, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607.1.

1607.4 Concentrated live loads. Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated live loads, given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of $2^1/_2$ feet by $2^1/_2$ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load is 80 psf (3.83 kN/m^2) or greater. The partition load shall be not less than a uniformly distributed live load of 15 psf (0.72 kN/m^2).

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

	OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
1.	Apartments (see residential)		—	—	—
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms		150[b]	—	—
4.	Assembly areas	Fixed seats (fastened to floor)	60[a]	—	—
		Follow spot, projections and control rooms	50		
		Lobbies	100[a]		
		Movable seats	100[a]		
		Stage floors	150[b]		
		Platforms (assembly)	100[a]		
		Bleachers, folding and telescopic seating and grandstands	100[a] (See Section 1607.19)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60[a] (See Section 1607.19)		
		Other assembly areas	100[a]		
5.	Balconies and decks		1.5 times the live load for the area served, not required to exceed 100	—	—
6.	Catwalks for maintenance and service access		40	300	—
7.	Cornices		60	—	—
8.	Corridors	First floor	100	—	—
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants		100[a]	—	—
10.	Dwellings (see residential)		—	—	—
11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)		—	300	—
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)		—	200	—
13.	Fire escapes		100	—	—
		On single-family dwellings only	40		
14.	Fixed ladders		See Section 1607.17		—
15.	Garages	Passenger vehicles only	40[c]	See Section 1607.7	—
		Trucks and buses	See Section 1607.8		
16.	Handrails, guards and grab bars		See Section 1607.9		—
17.	Helipads		See Section 1607.6		—
18.	Hospitals	Corridors above first floor	80	1,000	—
		Operating rooms, laboratories	60	1,000	
		Patient rooms	40	1,000	
19.	Hotels (see residential)		—	—	—
20.	Libraries	Corridors above first floor	80	1,000	—
		Reading rooms	60	1,000	—
		Stack rooms	150[b]	1,000	Section 1607.18

(continued)

3. *Geologic Hazard and Geotechnical Investigation shall be performed using the 2020 NEHRP Provisions, Section 11.8.*

4. *Vertical Ground Motions, where required, shall be determined using the 2020 NEHRP Provisions, Section 11.9.*

5. *Site Classification shall be determined using the 2020 NEHRP Provisions, Chapter 20.*

6. *Site-Specific Ground Motion Procedures shall be determined using the 2020 NEHRP Provisions, Chapter 21.*

7. *Seismic Ground Motion and Long-period Transition Maps shall be used from Chapter 22 of the 2020 NEHRP Provisions.*

8. *S_{DS} and S_{D1} obtained from the multi-period spectra determined using the 2020 NEHRP Provisions shall be used, where required in Chapter 12, 13 and 15 of ASCE 7-16.*

1617A.1.4 ASCE 7, Table 12.2-1. *Modify ASCE 7, Table 12.2-1 as follows:*

A. BEARING WALL SYSTEMS

5. Intermediate Precast Shear Walls—*Not permitted by OSHPD.*

17. Light-framed walls with shear panels of all other materials—*Not permitted by OSHPD and DSA-SS.*

B. BUILDING FRAME SYSTEMS

3. Ordinary steel concentrically braced frames—*Not permitted by OSHPD.*

8. Intermediate Precast Shear Walls—*Not permitted by OSHPD.*

24. Light-framed walls with shear panels of all other materials—*Not permitted by OSHPD and DSA-SS.*

26. Special steel plate shear wall—*Not permitted by OSHPD.*

C. MOMENT-RESISTING FRAME SYSTEMS

2. Special steel truss moment frames—*Not permitted by OSHPD.*

3. Intermediate steel moment frames—*Not permitted by OSHPD.*

4. Ordinary steel moment frames—*Not permitted by OSHPD.*

12. Cold-formed steel–special bolted moment frame—*Not permitted by DSA-SS and OSHPD.*

G. CANTILEVER COLUMN SYSTEMS DETAILED TO CONFORM WITH THE REQUIREMENTS FOR:

1. Steel special cantilever column systems—***[OSHPD 1 & 4]*** *Not permitted by OSHPD except for single-story canopies and independent covered walkways where R, C_d and Ω_0 = 1.5 and roof dead load is less than 20 psf.*

3. Special reinforced concrete moment frames—*Not permitted by OSHPD.*

Exceptions:

1. *Systems listed in this section can be used as an alternative system when preapproved by the enforcement agency.*

2. *Rooftop or other supported structures not exceeding two stories in height and 10 percent of the total structure weight can use the systems in this section when designed as components per ASCE 7, Chapter 13.*

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, 12.2.3.1 and 12.2.3.2. *Modify ASCE 7, Sections 12.2.3, 12.2.3.1 and 12.2.3.2 as follows:*

1617A.1.5.1 ASCE 7, Section 12.2.3. *Replace ASCE 7, Section 12.2.3 with the following:*

Where different seismic force-resisting systems are used in combinations to resist seismic forces in the same direction, other than those combinations considered as dual systems, the design shall comply with the requirements of this section. The most stringent applicable structural system limitations contained in Table 12.2-1 shall apply, except as otherwise permitted by this section.

1617A.1.5.2 ASCE 7, Section 12.2.3.1. *Replace ASCE 7, Section 12.2.3.1, Items 1 and 2, by the following:*

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

1617A.1.5.3 ASCE 7, Section 12.2.3.2. *Modify ASCE 7, Section 12.2.3.2 by modifying Item a and adding Items f, g and h, as follows:*

a. The stiffness of the lower portion shall be at least 10 times the stiffness of the upper portion. *For purposes of determining this ratio, the base shear shall be computed and distributed vertically according to Section 12.8. Using these forces, the stiffness for each portion shall be computed as the ratio of the base shear for that portion to the elastic displacement, δ_{xe}, computed at the top of that portion, considering the portion fixed at its base. For the lower portion, the applied forces shall include the reactions from the upper portion, modified as required in Item d.*

f. The structural height of the upper portion shall not exceed the height limits of Table 12.2-1 for the seismic force-resisting system used, where the height is measured from the base of the upper portion. ***[OSHPD 1 & 4]*** *Not permitted by OSHPD.*

g. Where Horizontal Irregularity Type 4 or Vertical Irregularity Type 4 exists at the transition from the upper to the lower portion, the reactions from the upper portion shall be amplified in accordance with Sections 12.3.3.3, 12.10.1.1 and 12.10.3.3 as applicable, in addition to amplification required by Item d.

h. 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.1.6 Reserved.

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 12.3.3.1. *Modify first sentence of ASCE 7, Section 12.3.3.1 and add exceptions 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.

Exceptions:

1. 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.

2. Structures having a horizontal structural irregularity Type 1b of Table 12.3-1 are permitted, provided a redundancy factor, ρ, of 1.3 as defined in ASCE 7 12.3.4 is assigned to the seismic force-resisting system in both orthogonal directions and the structure is designed for one of the orthogonal procedures as defined in ASCE 7, Section 12.5.3.1.

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

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

1617A.1.12 Reserved.

1617A.1.13 Reserved.

1617A.1.14 ASCE 7, Section 12.12.3. [OSHPD 1 & 4] *Replace ASCE 7 Equation 12.12-1 by the following:*

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

1617A.1.15 ASCE 7, Section 12.13.1. *Modify ASCE 7, Section 12.13.1 by adding Section 12.13.1.1 as follows:*

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

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

1. The strength of the superstructure elements.

2. The maximum forces that can be delivered to the foundation in a fully yielded structural system.

3. Forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3.1.

Exceptions:

1. Where referenced standards specify the use of higher design loads.

2. When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.

3. Where seismic force-resisting system consists of light framed walls with shear panels, unless the reference standard specifies the use of higher design loads.

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

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

1617A.1.16 ASCE 7, Section 12.13.9.2. *Modify ASCE 7, Section 12.13.9.2 by the following sentence added to the end of Item b as follows:*

Seismic load effects determined in accordance with Section 12.4 need not be considered in this check.

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

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

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

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

13.1.4. *The following nonstructural 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 $^1/_2$ inch (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. ***[OSHPD 1, 2, 4 & 5]*** *Mobile Equipment: Equipment heavier than 400 pounds (181.4 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.*

   [DSA-SS] *Mobile Equipment: Equipment heavier than 400 pounds (181.4 kg) or has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly supports the equipment 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.*
4. ***[OSHPD 1, 2, 4 & 5]*** *Countertop Equipment: Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed, movable, mobile or other equipment, as applicable.*

   [DSA-SS] *Countertop Equipment: Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed or movable equipment, as applicable. Countertop equipment shall also be subject to the same requirements as mobile or other equipment if weight of equipment is greater than 100 pounds (45 kg) and has a center of mass located 4 feet (1219 mm) or more above the adjacent floor level or if equipment could fall and block a required means of egress.*
5. ***[OSHPD 1, 2, 4 & 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. ***[OSHPD 1, 2, 4 & 5]*** *Interim Equipment:*
   a. *Seismic design for supports and attachments for interim equipment shall meet the requirements of Chapter 13 with the following modifications; 1) The calculated F_p used in the design may be reduced by 50 percent. 2) It is acceptable to use ballasts for seismic or wind bracing supports and attachments and limit the design to overturning only without the consideration of sliding, unless directly or indirectly supported by the building structure. 3) Anticipated duration of use must be specified.*
   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. ***[OSHPD 1, 2, 4 & 5]** Essential to hospital operations and weight of equipment is greater than 100 pounds (45 kg).*

      ***[DSA-SS]** Weight of equipment is greater than 100 pounds (45 kg) and essential to operations for emergency preparedness, communications and operations centers, and other facilities required for emergency response of state-owned essential services buildings as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.*

   b. ***[OSHPD 1, 2, 4 & 5]** 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.*

   d. ***[OSHPD 1, 2, 4 & 5]** Weight of equipment is greater than 400 pounds (181.4 kg).*

   e. ***[DSA-SS]** Weight of equipment is greater than 400 pounds (181.4 kg) or center of mass is located greater than 4 feet (1219 mm) above the finished floor or roof level that directly supports the component.*

      ***[OSHPD 1, 2, 4 & 5]** Weight of equipment is greater than 200 pounds (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.*

10. *Wall-, Roof- or Floor-Hung Equipment: Seismic design and seismic details shall be provided for wall-, roof- or floor-hung nonstructural components and equipment when the component weighs more than 20 pounds (9 kg) **[OSHPD 1, 2, 4 & 5]** or, in the case of a distributed system, more than 5 pounds per foot (73 N/m).*

[OSHPD 1, 2, 4 & 5] 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 pounds (9 kg) or less or, in the case of a distributed system, 5 pounds per foot (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 pounds (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.*

***[DSA-SS] Exemptions:** The following nonstructural components are exempt from the requirements of ASCE 7, Chapter 13:*

1. *Furniture except storage cabinets as noted in Table 13.5-1.*
2. *Discrete architectural, mechanical and electrical components and fixed equipment that are positively attached to the structure, provided that none of the conditions in this section apply, 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 and may also be used in exterior conditions when permitted in accordance with a valid evaluation report.*

***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*

3. *Pneumatic tube systems supported with trapeze assemblies using $^{3}/_{8}$ inch (10 mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the tube support point to the connection at the supporting structure and the total weight supported by any single trapeze is 100 pounds (445 N) or less.*
4. *Pneumatic tube systems supported by individual rod hangers $^{3}/_{8}$ inch (10 mm) or $^{1}/_{2}$ inch (13 mm) in diameter, and each hanger in the run is 12 inches (305 mm) or less in length from the tube support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.*

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

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

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

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

1617A.1.29 Reserved.

1617A.1.30 Reserved.

1617A.1.31 Reserved.

1617A.1.32 Reserved.

1617A.1.33 Reserved.

1617A.1.34 Reserved.

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

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

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

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

1617A.1.37 Reserved.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Emergency and standby generators shall not be located below the higher of the Design Flood 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 & 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.*

   Exception: *OSHPD may perform the work of peer review when qualified staff is available.*
2. ***Timing of Independent Review.*** *The independent reviewer (s) shall be selected prior to initiation of sub-*

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			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**								
Adopt only those sections that are listed below			**X**																				
Chapter / Section																							
1701			X																				
1701.1.1											X	X			X								
1701.1.2											X	X			X								
1701.1.3											X	X			X								
1702			X																				
1703			X																				
1703.4											X	X			X								
1704.2, *Exception 5*				X	X																		
1704.2, *Exceptions 3 & 4*											X	X			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								
1705.1			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			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								
1705.3.9											X	X			X								
1705.3.9.1											X	X			X								
1705.3.9.2											X	X			X								
1705.4											X	X			X								
1705.4.1											X	X			X								
1705.5.3			X																				
Table 1705.5.3			X																				
1705.5.5											X	X			X								
1705.5.6											X	X			X								
1705.6.1											X	X			X								

(continued)

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS—continued

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**								
Adopt only those sections that are listed below			**X**																				
Chapter / Section																							
1705.7.1											X	X			X								
1705.12.1			X																				
1705.12.2			X																				
1705.13.1.1 Exception											X	X			X								
1705.13.1.2 Exception											X	X			X								
1705.13.2			X																				
1705.13.3			X																				
1705.14.3.1											X	X			X								
1705.15			X																				
1705.16			X																				
1705.17											X	X			X								
1705.18			X																				
1705.19			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.

TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	CBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	—
2. Reinforcing bar welding:				
a. Verify weldability of reinforcing bars other than ASTM A706;	—	X	AWS D1.4 ACI 318: 26.6.4	—
b. Inspect single-pass fillet welds, maximum $^5/_{16}$"; and	—	X		
c. Inspect all other welds.	X	—		
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b]				
a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.[c]	X	—	ACI 318: 17.8.2.4	—
b. Mechanical anchors and adhesive anchors not defined in 4.a.	—	X	ACI 318: 17.8.2	
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172 ACI 318: 26.5, 26.12	—
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	—
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	—
9. Inspect prestressed concrete for:				
a. Application of prestressing forces; and	X	—	ACI 318: 26.10	—
b. Grouting of bonded prestressing tendons.	X	—		
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspect such connections and reinforcement in the field for:			ACI 318: 26.13.1.3	—
a. Installation of the embedded parts	X	—	ACI 550.5	
b. Completion of the continuity of reinforcement across joints.	X	—		
c. Completion of connections in the field.	X	—		
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.13.

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

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

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

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

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

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

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

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

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

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

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

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

1705.3.9 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.* <

1705.3.9.1 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.*

1705.3.9.2 Preconstruction tests. *A shotcrete mockup panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The mockup panel shall be representative of the project and simulate job conditions as closely as possible. The mockup panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. Adequate encasement of bars larger than No. 5 shall be demonstrated by the mockup panels. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704.5.*

1705.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602. ***[OSHPD 1R, 2 & 5]*** *as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21. Testing shall be performed in accordance with Section 2105. Special inspec-*

tion and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17 and 19.

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

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

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

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

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

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

1705.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved construction documents. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved construction documents.

1705.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater. Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705.5.3 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 1705.5.3.

1705.5.4 [OSHPD 1R, 2 & 5] Manufactured trusses and assemblies. *The fabrication of trusses and other assemblages 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.*

TABLE 1705.5.3
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.			
	Threaded fasteners	Verify use of proper installation equipment.	—	X
		Verify use of pre-drilled holes where required.	—	X
		Inspect screws, including diameter, length, head type, spacing, installation angle and depth.	—	X
	Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.		X	—
	Adhesive anchors not defined in preceding cell.		—	X
	Bolted connections.		—	X
	Concealed connections.		—	X

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1705.5.5 Structural glued laminated and cross-laminated timber. [OSHPD 1R, 2 & 5] *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 prismatic glued laminated members identified on drawings and sourced from stock or general inventory of $5^1/_2$-inch (140 mm) maximum width and 18-inch (457 mm) maximum depth, and with a maximum clear span of 32 feet (9754 mm), manufactured and marked in accordance with ANSI A190.1 Section 13.1 for non-custom members.*

1705.5.6 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.

1705.5.7 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.*

1705.6 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.

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,

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. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify 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

therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704.5.

1705.14.3.1 Special seismic certification. [OSHPD 1R, 2 & 5] *Special seismic certification shall be required in accordance with Section 1705A.14.3. for all of the following:*

1. *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.*
3. *[**OSHPD 2**] Alternate power systems including:*
   a. *Generators.*
   b. *UPS and batteries.*
   c. *Renewable electrical generation and control equipment.*
   d. *Panelboards as defined in the California Electrical Code (CEC) Article 100.*
   e. *Manual and automatic transfer switches.*
   f. *Switchgear and switchboards.*

1705.14.4 Seismic isolation systems. Seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F shall be tested in accordance with Section 17.8 of ASCE 7.

[BF] 1705.15 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 1705.15.1 through 1705.15.6. 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 concealment where applicable. The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705.15.4.1 through 1705.15.4.9.

[BF] 1705.15.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire-resistance rating:

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

[BF] 1705.15.2 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] 1705.15.3 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] 1705.15.4 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 1705.15.4.1.

[BF] 1705.15.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus 1/4 inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705.15.4.2 and 1705.15.4.3.

[BF] 1705.15.4.2 Floor, roof and wall assemblies. The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.4.3 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] 1705.15.4.4 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] 1705.15.4.5 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] 1705.15.4.6 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] 1705.15.4.7 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] 1705.15.4.8 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] 1705.15.4.9 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] 1705.15.5 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^2) 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^2) of floor area or portion thereof in each *story*.

[BF] 1705.15.6 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^2). 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 1705.15.6.1 through 1705.15.6.3.

[BF] 1705.15.6.1 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^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.6.2 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^2) of floor area or portion thereof in each story.

[BF] 1705.15.6.3 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] 1705.16 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 during construction. Additional visual inspection shall be performed after the rough installation and, where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

1705.17 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.

1705.17.1 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] 1705.18 Fire-resistant penetrations and joints. In high-rise buildings, in buildings assigned to *Risk Category* III or IV, or in fire areas containing Group R occupancies with an occupant load greater than 250, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire containment systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.

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

[BF] 1705.18.1 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] 1705.18.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3.1 and 715.4 shall be conducted by an approved agency in accordance with ASTM E2393.

[F] 1705.19 Testing for smoke control. Smoke control systems shall be tested by a special inspector.

[F] 1705.19.1 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.

CHAPTER 17*A*

SPECIAL INSPECTIONS AND TESTS

SECTION 1701*A* GENERAL

1701*A*.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 1702*A* NEW MATERIALS

1702*A*.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 1703*A* APPROVALS

1703*A*.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 1703*A*.1.1 through 1703*A*.1.3.

1703*A*.1.1 Independence. An approved agency shall be objective, competent and independent from *any other entity providing inspection services and* contractor*(s)* 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.

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

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

1703*A*.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.

1703*A*.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.

1703*A*.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.*

1703*A*.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.

1703*A*.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.

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

1703*A*.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.

1703*A*.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.

1703*A*.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.

1703*A*.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.

1703*A*.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.

1703*A*.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 1704*A*.2.5.

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

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

1704*A*.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.

1704*A*.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 1705*A* 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.
2. ***[DSA-SS, DSA-SS/CC]*** *Reference to Section 105 and Section 110 shall be to the California Administrative Code instead.*

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

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

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

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

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

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

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

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

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

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

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

1. The materials, systems, components and work required to have special inspections or tests by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspections or tests for seismic or wind resistance as specified in Sections 1705*A*.12, 1705.13 and 1705*A*.14.
5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined.

1704*A*.3.2 Seismic requirements in the statement of special inspections. Where Section 1705*A*.13 or 1705*A*.14 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the *equipment/components that require special seismic certification* and seismic force-resisting systems that are subject to the special inspections or tests.

1704*A*.3.3 Wind requirements in the statement of special inspections. Where Section 1705*A*.12 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to special inspections.

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

shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections.

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

1. *Reserved.*
2. Certificates of compliance for the *manufacturer's certification* of nonstructural components, supports and attachments in accordance with Section 1705*A*.14.2.
3. Certificates of compliance for *equipment/components requiring special seismic certification* in accordance with Section 1705*A*.14.3.
4. Reports of preconstruction tests for shotcrete in accordance with ACI 318 *and 1705A.3.9.2.*
5. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207*A*.5.
6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.
7. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category D, E or F.

1704*A*.6 Structural observations. *The* owner shall employ a registered design professional to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705*A* or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

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

SECTION 1705*A*
REQUIRED SPECIAL INSPECTIONS AND TESTS

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

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

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

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

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

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

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

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

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

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

2. N5, Item 2 (Quality Assurance).

3. N5, Item 3 (Coordinated Inspection).

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

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 18 – SOILS AND FOUNDATIONS

(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)				**X**	**X**						**X**	**X**			**X**								
Adopt only those sections that are listed below																							
Chapter / Section																							
1801.1.1– 1801.1.3											X	X			X								
1802.1				X																			
1803.1											X	X			X								
1803.1.1– 1803.1.1.5				X																			
1803.2												X											
1803.3.1											X	X			X								
1803.5.4 Exception											X	X			X								
1803.6											X	X			X								
1803.7											X	X			X								
1804.4.1				X																			
1805.2											X	X			X								
1805.4.1, Exception 2				X																			
1805.4.3																							
1807.1.3											X	X			X								
1807.1.4											X	X			X								
1807.1.5 Exception											X	X			X								
1807.1.6											X	X			X								
1807.2											X	X			X								
1807.2.2											X	X			X								
1807.2.5											*X*	*X*			*X*								
1808.8 Exception											X	X			X								
Table 1808.8.1											X	X			X								
1808.8.6											X	X			X								
1809.3											X	X			X								
1809.7											X	X			X								
1809.8											X	X			X								
1809.9											X	X			X								
1809.12											X	X			X								
1809.14											X	X			X								
1810.3.1.5.1											X	X			X								
1810.3.2.4											X	X			X								
1810.3.3.1.9 #3											X	X			X								
1810.3.5.3.3											X	X			X								
1810.3.8 Exceptions											X	X			X								
1810.3.8.3.3 Exception											X	X			X								
1810.3.9.4.2.1											X	X			X								
1810.3.10.4				X																			
1810.3.10.4.1											X	X			X								
1810.3.11											X	X			X								

(continued)

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 18 – SOILS AND FOUNDATIONS—continued

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)				X	X						X	X			X								
Adopt only those sections that are listed below																							
Chapter / Section																							
1810.3.11.2 #3, Exception #2											X	X			X								
1810.3.12 Exception											X	X			X								
1810.4.1.5											X	X			X								
1811											X	X			X								
1812											X	X			X								
1813											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.

perpendicular to grain in untreated timber footings supported on treated piles shall not exceed 70 percent of the allowable stresses for the species and grade of timber as specified in the ANSI/AWC NDS.

1809.13 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.

1809.14 Pipes and Trenches. [OSHPD 1R, 2 & 5] *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.*

SECTION 1810
DEEP FOUNDATIONS

1810.1 General. Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810.1 through 1810.4.

1810.1.1 Geotechnical investigation. Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803.

1810.1.2 Use of existing deep foundation elements. Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

1810.1.3 Deep foundation elements classified as columns. Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810.2.1.

Exception: Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

1810.1.4 Special types of deep foundations. The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

1810.2 Analysis. The analysis of deep foundations for design shall be in accordance with Sections 1810.2.1 through 1810.2.5.

1810.2.1 Lateral support. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

1810.2.2 Stability. Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered to be braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced not less than 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is not less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810.2.1 is provided for the entire height and the height does not exceed 12 times the least horizontal dimension.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-

family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided that the centers of the elements are located within the width of the supported wall.

1810.2.3 Settlement. The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810.2.4 Lateral loads. The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

1810.2.4.1 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613.2.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section 1810.3.8.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 as required by Section 1810.3.9.4.2.2.

1810.2.5 Group effects. The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element. Group effects shall be evaluated using a generally accepted method of analysis; the analysis for uplift of grouped elements with center-to-center spacing less than three times the least horizontal dimension of an element shall be evaluated in accordance with Section 1810.3.3.1.6.

1810.3 Design and detailing. Deep foundations shall be designed and detailed in accordance with Sections 1810.3.1 through 1810.3.13.

1810.3.1 Design conditions. Design of deep foundations shall include the design conditions specified in Sections 1810.3.1.1 through 1810.3.1.6, as applicable.

1810.3.1.1 Design methods for concrete elements. Where concrete deep foundations are laterally supported in accordance with Section 1810.2.1 for the entire height and applied forces cause bending moments not greater than those resulting from accidental eccentricities, structural design of the element using the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the strength load combinations specified in ASCE 7, Section 2.3 and approved strength design methods.

1810.3.1.2 Composite elements. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

1810.3.1.3 Mislocation. The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by not less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

1810.3.1.4 Driven piles. Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

1810.3.1.5 Helical piles. Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

1810.3.1.5.1 Helical piles seismic requirements. [OSHPD 1R, 2 & 5] *For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to design strength determined by using load combinations in ASCE 7, Section 2.3.6.*

Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least $^{1}/_{16}$ inch corrosion allowance.

Helical piles shall not be considered as carrying any horizontal loads.

1810.3.1.6 Casings. Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist

settlements at design load in accordance with Section 1810.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (for example, net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance.

1810.3.3.1.3 Load test evaluation methods. It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90-percent Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

1810.3.3.1.4 Allowable shaft resistance. The assumed shaft resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1806.2, up to 500 psf (24 kPa), unless a greater value is allowed by the building official on the basis of a geotechnical investigation as specified in Section 1803 or a greater value is substantiated by a load test in accordance with Section 1810.3.3.1.2. Shaft resistance and end-bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803.

1810.3.3.1.5 Uplift capacity of a single deep foundation element. Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810.3.3.1.2, using the results of load tests conducted in accordance with ASTM D3689, divided by a factor of safety of two.

Exception: Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

1810.3.3.1.6 Allowable uplift load of grouped deep foundation elements. For grouped deep foundation elements subjected to uplift, the allowable uplift load for the group shall be calculated by a generally accepted method of analysis. Where the deep foundation elements in the group are placed at a center-to-center spacing less than three times the least horizontal dimension of the largest single element, the allowable uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual allowable uplift load times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

1810.3.3.1.7 Load-bearing capacity. Deep foundation elements shall develop ultimate load capacities of not less than twice the design working loads in the designated load-bearing layers. Analysis shall show that soil layers underlying the designated load-bearing layers do not cause the load-bearing capacity safety factor to be less than two.

1810.3.3.1.8 Bent deep foundation elements. The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

1810.3.3.1.9 Helical piles. The allowable axial design load, P_a, of helical piles shall be determined as follows:

$$P_a = 0.5\ P_u \qquad \textbf{(Equation 18-4)}$$

where P_u is the least value of:

1. Base capacity plus shaft resistance of the helical pile. The base capacity is equal to the sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum. The shaft resistance is equal to the area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests where required by Section 1810.3.3.1.2. ***[OSHPD 1R, 2 & 5]*** *Load tests are required to determine the ultimate capacity.* <
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

1810.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests to not less than twice the proposed design working load. The resulting allowable load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the

top of foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810.3.4 Subsiding soils or strata. Where deep foundation elements are installed through subsiding soils or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces potentially imposed on the elements by the subsiding upper strata.

Where the influence of subsiding soils or strata is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

1810.3.5 Dimensions of deep foundation elements. The dimensions of deep foundation elements shall be in accordance with Sections 1810.3.5.1 through 1810.3.5.3, as applicable.

1810.3.5.1 Precast. The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

1810.3.5.2 Cast-in-place or grouted-in-place. Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

1810.3.5.2.1 Cased. Cast-in-place or grouted-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

1810.3.5.2.2 Uncased. Cast-in-place or grouted-in-place deep foundation elements without a permanent casing shall have a specified diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the specified diameter.

Exception: The length of the element is permitted to exceed 30 times the specified diameter, provided that the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

1810.3.5.2.3 Micropiles. Micropiles shall have a nominal diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810.3.5 shall not apply to micropiles.

1810.3.5.3 Steel. Steel deep foundation elements shall satisfy the requirements of this section.

1810.3.5.3.1 Structural steel H-piles. Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^3/_8$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

1810.3.5.3.2 Fully welded steel piles fabricated from plates. Sections of fully welded steel piles fabricated from plates shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^3/_8$ inch (9.5 mm).

1810.3.5.3.3 Structural steel sheet piling. Individual sections of structural steel sheet piling shall conform to the profile indicated by the manufacturer, and shall conform to the general requirements specified by ASTM A6.

[OSHPD 1R, 2 & 5] *Installation of sheet piling shall satisfy inspection, monitoring and observation requirements in Sections 1812.6 and 1812.7.*

1810.3.5.3.4 Steel pipes and tubes. Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have not less than 0.34 square inch (219 mm^2) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to Seismic Design Category C,

D, E or F shall have a wall thickness of not less than $^3/_{16}$ inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than $^3/_8$ inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

Exceptions:

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be $^1/_{10}$ inch (2.5 mm).

1810.3.5.3.5 Helical piles. Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

1810.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Exception: For buildings assigned to Seismic Design Category A or B, splices need not comply with the 50-percent tension and bending strength requirements where justified by supporting data.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

1810.3.6.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element.
2. The axial and shear forces and moments from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810.3.7 Top of element detailing at cutoffs. Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

1810.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with ACI 318.

Exceptions:

1. For precast prestressed piles in Seismic Design Category C, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.4 of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_0. In such cases, minimum transverse reinforcement index shall be as specified in Section 13.4.5.6 of ACI 318. ***[OSHPD 1R, 2 & 5]*** *not permitted by OSHPD.* <
2. For precast prestressed piles in Seismic Design Categories D through F, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.5(c) of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_0. In such cases, minimum transverse reinforcement shall be as specified in Section 13.4.5.6 of ACI 318. ***[OSHPD 1R, 2 & 5]*** *not permitted by OSHPD.* <

   [OSHPD 1R, 2 & 5] Exception: *Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_0, the axial load limits in Section 18.13.5.10.6 of ACI 318 may be increased by two times.* <

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

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

$$\phi M_n = 3\sqrt{f'_c}S_m \qquad \textbf{(Equation 18-5)}$$

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

where:

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

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

1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of ASCE 7, Section 2.3 exceeds the design cracking moment determined in

accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

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

Exceptions:

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

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

Exceptions:

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

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

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

1. One-third of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

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

diameters throughout the remainder of the reinforced length.

Exceptions:

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

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

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

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

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

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

Exceptions:

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

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

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

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

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

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

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

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

1810.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of $^{3}/_{16}$ inch (4.8 mm). Splices shall comply with Section 1810.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

1810.3.10.4 Seismic reinforcement. For structures assigned to Seismic Design Category C, a permanent steel casing shall be provided from the top of the micropile down to the point of zero curvature. For structures assigned to Seismic Design Category D, E or F, the micropile shall be considered as an alternative system in accordance with Sections 104.11 *or 1.8.7, as applicable*. The alternative system design, supporting documentation and test data shall be submitted to the building official for review and approval.

1810.3.10.4.1 Seismic requirements. [OSHPD 1R, 2 & 5] *For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of $^{3}/_{8}$ inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to design strength determined by using load combinations in ASCE 7, Section 2.3.6.*

Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 18.13.5.

Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least $^{1}/_{16}$-inch corrosion allowance.

Micropiles shall not be considered as carrying any horizontal loads.

1810.3.11 Pile caps. Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load, with the exception of a combined pile raft. ***[OSHPD 1R, 2 & 5]*** *A combined pile raft foundation shall be an alternative system.* The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend not less than 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

1810.3.11.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap in accordance with ACI 318.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

1810.3.11.2 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
    1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element.

1.2. The nominal tensile strength of a steel element.

1.3. The frictional force developed between the element and the soil multiplied by 1.3.

Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.

3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7, Section 12.4.3 or 12.14.3.2.
2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810.3.12 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7. ***[OSHPD 1R, 2 & 5]*** *Need not comply with Section 18.13.3 of ACI 318.*

1810.3.13 Seismic ties. Seismic ties shall comply with the provisions of ACI 318.

Exception: In Group R-3 and U occupancies of light-frame construction, deep foundation elements supporting foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

1810.4 Installation. Deep foundations shall be installed in accordance with Section 1810.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

1810.4.1 Structural integrity. Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that would adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

1810.4.1.1 Compressive strength of precast concrete piles. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of not less than 75 percent of the specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1810.4.1.2 Shafts in unstable soils. Where cast-in-place deep foundation elements are formed through unstable soils, the open hole shall be stabilized by a casing, slurry, or other approved method prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

1810.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If driving near uncased concrete elements causes the concrete surface in any completed element to rise or drop significantly or bleed additional water, the completed element shall be replaced.

1810.4.1.4 Driving near cased concrete. Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

1810.4.1.5 Defective timber piles. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Any substantial sudden change in rate of penetration of a timber pile shall be investigated for possible damage. If the sudden change in rate of penetration cannot be correlated to soil strata, the pile shall be removed for inspection or rejected.

1810.4.2 Identification. Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the

specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1810.4.3 Location plan. A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

1810.4.4 Preexcavation. The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be advanced below the preexcavated depth until the required resistance or penetration is obtained.

1810.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.
2. The pile is to be used only for lateral resistance.

1810.4.6 Heaved elements. Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810.3.3.1.2.

1810.4.7 Enlarged base cast-in-place elements. Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

1810.4.8 Hollow-stem augered, cast-in-place elements. Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

1810.4.9 Socketed drilled shafts. The rock socket and pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

1810.4.10 Micropiles. Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means

employed to ensure grout coverage outside the casing.

1810.4.11 Helical piles. Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the manufacturer's rated maximum installation torque resistance of the helical pile.

1810.4.12 Special inspection. Special inspections in accordance with Sections 1705.7 and 1705.8 shall be provided for driven and cast-in-place deep foundation elements, respectively. Special inspections in accordance with Section 1705.9 shall be provided for helical piles.

SECTION 1811
PRESTRESSED ROCK AND SOIL FOUNDATION ANCHORS [OSHPD 1R, 2 & 5]

1811.1 General. *The requirements of this section address the use of vertical rock and soil anchors in resisting seismic or wind overturning forces, resulting in tension on shallow foundations.*

1811.2 Adoption. *Except for the modifications as set forth in Sections 1811.3 and 1811.4, all prestressed rock and soil foundation anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.*

1811.3 Geotechnical requirements*. The geotechnical report for the Prestressed Rock & Soil Foundation Anchors shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tendon.*
3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress.*
5. *Anchor axial tension stiffness recommendations at the anticipated anchor axial tension displacements, when required for structural analysis.*
6. *Minimum grout pressure for installation and post-grout pressure.*
7. *Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.*
8. *Performance test shall be at a minimum of 1.6 times the design loads, but shall not exceed 80 percent of the specified minimum tensile strength of the tendons. There shall be a minimum of two preproduction test anchors. Preproduction test anchors shall be tested to ultimate load or a maximum of 0.80 times the specified minimum tensile strength of the tendon. A creep test is required for all prestressed anchors with greater than 10 kips of lock-off prestressing load.*
9. *Lock-off prestressing load requirements.*
10. *Acceptable drilling methods.*
11. *Geotechnical observation and monitoring requirements.*

1811.4 Structural Requirements*.*

1. *Tendons shall be thread-bar anchors conforming to ASTM A722.*
2. *The anchors shall be placed vertical.*
3. *Design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
4. *Ultimate load shall be based upon the lesser of the strength of the superstructure elements, the maximum forces from a fully yielded structural system and forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3 and shall not exceed 80 percent of the specified minimum tensile strength of the tendons.*
5. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge by group effect.*
6. *Foundation design shall incorporate the effect of lock-off loads.*
7. *Design shall account for as-built locations of soil anchors considering all the acceptable construction tolerances.*
8. *Design shall account for both short- and long-term deformation.*
9. *Enforcement agency may require consideration of anchor deformation in evaluating deformation compatibility or building drift where it may be significant.*

SECTION 1812
EARTH RETAINING SHORING [OSHPD 1R, 2 & 5]

1812.1 General. *The requirements of this section shall apply to temporary and permanent earth-retaining shoring using soldier piles and lagging with or without tie-back anchors in soil or rock, only when existing or new facilities are affected. Shoring used as construction means and methods only, which does not affect existing or new facilities, is not regulated by this section and shall satisfy the requirements of the authorities having jurisdiction.*

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1812.2 through 1812.8.

1812.2 Duration. *Shoring shall be considered temporary when elements of the shoring will be exposed to site conditions for a period of less than or equal to 2 years, and shall be considered permanent otherwise. Permanent shoring shall account for the increase in lateral soil pressure due to earthquake. At the end of the construction period, the existing and new structures shall not rely on the temporary shoring for support in anyway. Wood components shall not be used for permanent shoring lasting more than 2 years. Wood compo-*

nents of the temporary shoring that may affect the performance of permanent structure shall be removed after the shoring is no longer required.

All components of the shoring shall have corrosion protection or preservative treatment for their expected duration. Wood components of the temporary shoring that will not be removed shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall be identified in accordance with Section 2303.1.9.

1812.3 Surcharge. *Surcharge pressure due to footings, traffic or other sources shall be considered in the design. If the footing surcharge is located within the semicircular distribution or bulb of earth pressure (when shoring is located close to a footing), lagging shall be designed for lateral earth pressure due to footing surcharge. Soil arching effects may be considered in the design of lagging. Underpinning of the footing may be used in lieu of designing the shoring and lagging for surcharge pressure. Alternatively, continuously contacting drilled pier shafts near the footings shall be permitted. The lateral surcharge design pressure shall be derived using Boussinesq equations modified for the distribution of stresses in an elastic medium due to a uniform, concentrated or line surface load as appropriate and soil arching effects.*

1812.4 Design and testing. *Except for the modifications as set forth in Sections 1812.4.1 through 1812.4.3, all Prestressed Rock and Soil Tie-back Anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.*

1812.4.1 Geotechnical requirements. *The geotechnical report for the earth retaining shoring shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tie-back anchors.*
3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress for the anchor. For permanent anchors, a minimum factor of safety of 2.0 shall be applied to the ground soil interface as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.6.*
5. *Minimum grout pressure for installation and post-grout pressure for the anchor. The presumptive post-grout pressure of 300 psi may be used for all soil types.*
6. *Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.*
7. *Performance test for the anchors shall be at a minimum of two times the design loads and shall not exceed 80 percent of the specified minimum tensile strength of the anchor rod. A creep test is required for all prestressed anchors that are performance tested. All production anchors shall be tested at 150 percent of design loads and shall not be greater than 70 percent of the specified minimum tensile strength of the anchor rod.*
8. *Earth pressure, surcharge pressure and the seismic increment of earth pressure loading, when applicable.*
9. *Maximum recommended lateral deformation at the top of the soldier pile, at the tie-back anchor locations and the drilled pier concrete shafts at the lowest grade level.*
10. *Allowable vertical soil bearing pressure, friction resistance and lateral passive soil resistance for the drilled pier concrete shafts and associated factors of safety for these allowable capacities.*
11. *Soil-pier shaft/pile interaction assumptions and lateral soil stiffness to be used in design for drilled pier concrete shaft or pile lateral loads.*
12. *Acceptable drilling methods.*
13. *Geotechnical observation and monitoring recommendations.*

1812.4.2 Structural requirements*:*

1. *Tendons shall be thread-bar anchors conforming to ASTM A722.*
2. *Anchor design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
3. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge.*
4. *Design of shoring system shall account for as-built locations of soil anchors considering all specified construction tolerances in Section 1812.8*
5. *Design of shoring system shall account for both short- and long-term deformation.*

1812.4.3 Testing of tie-back anchors*:*

1. *The geotechnical engineer shall keep a record at the job site of all test loads and total anchor movement, and report their accuracy.*
2. *If a tie-back anchor initially fails the testing requirements, the anchor shall be permitted to be re-grouted and retested. If the anchor continues to fail, the followings steps shall be taken:*
    a. *The contractor shall determine the cause of failure: (variations of the soil conditions, installation methods, materials, etc.).*
    b. *The contractor shall propose a solution to remedy the problem. The proposed solution will need to be reviewed and approved by geotechnical engineer, shoring design engineer and the building official.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 19 – CONCRETE

(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**								
Adopt only those sections that are listed below																							
Chapter / Section																							
1901.1.1									X		X	X			X								
1901.1.2									X		X	X			X								
1901.1.3									X		X	X			X								
1901.1.4									X		X	X			X								
1901.3.1											X	X			X								
1901.3.2											X	X			X								
1901.3.3											X	X			X								
1901.3.4											X	X			X								
1901.3.4.2											X	X			X								
1901.3.4.3 Exception 6												X											
1901.3.4.5											X	X			X								
1903.2											X	X			X								
1903.4											X	X			X								
1903.5											X	X			X								
1903.7											X	X			X								
1903.8											X	X			X								
1905.1.2																							
1905.1.3																							
1905.1.7											X	X			X								
1905.1.8																							
1906											X	X			X								
1907.1.1				X																			
1908.1											X	X			X								
1908.2											X	X			X								
1908.3											X	X			X								
1908.5											X	X			X								
1908.7											X	X			X								
1908.9											X	X			X								
1908.10.2											X	X			X								
1909									X														
1910											X	X			X								
1911											X	X			X								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 19

CONCRETE

Italics are used for text within Sections 1903 through 1905 of this code to indicate model code provisions that differ from ACI 318. State of California amendments in these sections are shown in italics and underlined.

User notes:

About this chapter: *Chapter 19 provides minimum accepted practices for the design and construction of buildings and structural components using concrete—both plain and reinforced. Chapter 19 relies primarily on the reference to American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete. Structural concrete must be designed and constructed to comply with this code and all listed standards. There are also specific provisions addressing concrete slabs and shotcrete.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 1901
GENERAL

1901.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

1901.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 19 is as follows:*

1. *Structures regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.*
2. *Office of Statewide Health Planning and Development*

   Applications listed in Sections 1.10.1, 1.10.2 and 1.10.5, regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings.

1901.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS/CC adopts 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/Community Colleges:*

   [DSA-SS/CC] *For applications listed in Section 1.9.2.2.*
2. *Office of Statewide Health Planning and Development*

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

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

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

1901.1.3 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

1901.1.4 Amendments. [DSA-SS/CC, OSHPD]

1. ***[OSHPD 1R, 2 & 5]*** *See Section 1910 for additional requirements applicable to hospital buildings that have been removed from acute care service, skilled nursing and intermediate care facility buildings, and acute psychiatric hospital buildings.*
2. ***[DSA-SS/CC]*** *See Section 1909 for additional requirements applicable to community colleges.*

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.

1901.3 Anchoring to concrete. Anchoring to concrete shall be in accordance with ACI 318 as amended in Section 1905, and applies to cast-in (headed bolts, headed studs and hooked J- or L-bolts), post-installed expansion (torque-controlled and displacement-controlled), undercut, screw, and adhesive anchors.

1901.3.1 Power actuated fasteners. [OSHPD 1R, 2 & 5] *Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of ASCE 7, Section 13.4.5.*

Power actuated fasteners shall be permitted in seismic shear for components exempt from construction documents review by ASCE 7, Section 13.1.4 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.

1901.3.2 Mechanical anchors and specialty inserts. [OSHPD 1R, 2 & 5] *Mechanical anchors qualified in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section.*

Specialty inserts, including cast-in-place specialty inserts, tested in accordance with ICC-ES AC 232 or AC 446 shall be deemed to satisfy the requirements of this section.

1901.3.3 Post-installed adhesive anchors. [OSHPD 1R, 2 & 5] *Adhesive anchors qualified in accordance with ICC-ES AC 308 shall be deemed to satisfy the requirements of this section.*

1901.3.4 Tests for post-installed anchors in concrete. [OSHPD 1R, 2 & 5] *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.*

1901.3.4.1 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.

1901.3.4.2 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 1R, 2 & 5]*** *Tension testing to verify proper installation shall be performed in accordance with ASTM E3121.*

Exception: *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.*

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

1901.3.4.3 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 pounds 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 twelve (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 nonshear wall partitions for shear only, where there are at least three fasteners per segment of track.*
6. ***[OSHPD 2]*** *In state detention and correctional facilities, tension testing is not required for post-installed anchors used for attaching nonstructural components, such as grab bars and shower seats, to concrete walls if the components do not contribute to security/detainment, life safety and the continuous operation of the institution following an event of extreme environmental loading from flood, wind, snow or earthquakes, as determined by the enforcing agency.*

1901.3.4.4 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 ($1^1/_4$) times the maximum design strength of anchors as provided in 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 approved evaluation report using criteria adopted in this code.*

1901.3.4.5 Test acceptance criteria. *Acceptance criteria for post-installed anchors shall be based on*

approved evaluation report using criteria adopted in this code. Field test shall satisfy following minimum requirements.

1. Hydraulic ram method:

Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

The testing apparatus support locations shall be greater than or equal to 1.5 times the anchor's embedment depth to avoid restricting the concrete shear cone type failure mechanism from occurring.

***Exception:** When denoted accordingly on the approved construction documents, adhesive anchors complying with ACI 318 Equation 17.8.2a and for which concrete breakout does not control the design tensile strength may be tested with apparatus support locations closer than 1.5 times the anchor embedment depth.*

2. Torque wrench method:

Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $^1/_2$ turn of the nut; or one-quarter ($^1/_4$) turn of the nut for a $^3/_8$-inch sleeve anchor only.

1901.4 Composite structural steel and concrete structures. Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with Section 2206 of this code.

1901.5 Construction documents. The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.

1901.6 Special inspections and tests. Special inspections and tests of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17.

1901.7 Tolerances for structural concrete. Where not indicated in construction documents, structural tolerances for concrete structural elements shall be in accordance with this section.

1901.7.1 Cast-in-place concrete tolerances. Structural tolerances for cast-in-place concrete structural elements shall be in accordance with ACI 117.

Exceptions:

1. Group R-3 detached one- or two-family dwellings are not required to comply with this section.
2. Shotcrete is not required to comply with this section.

1901.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

SECTION 1902
COORDINATION OF TERMINOLOGY

1902.1 General. Coordination of terminology used in ACI 318 and ASCE 7 shall be in accordance with Sections 1902.1.1 and 1902.1.2.

1902.1.1 Design displacement. Design displacement at each level shall be the total lateral deflection at the level calculated for the design earthquake using the procedures defined in Section 12.8.6 of ASCE 7.

1902.1.2 Special structural wall. Special structural walls made of cast-in-place or precast concrete shall comply with the requirements of Sections 18.2.4 through 18.2.8, 18.10 and 18.11 of ACI 318, as applicable, in addition to the requirements for ordinary reinforced concrete structural walls or ordinary precast structural walls, as applicable. Where ASCE 7 refers to a "special reinforced concrete shear wall," it shall be deemed to mean a "special structural wall."

SECTION 1903
SPECIFICATIONS FOR TESTS AND MATERIALS

1903.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

***Exception:** The following standards as referenced in Chapter 35 shall be permitted to be used.*

1. ASTM C150

2. ASTM C595

3. ASTM C1157

1903.2 Special inspections. *Where required, special inspections and tests shall be in accordance with Chapter 17.* ***[OSHPD 1R, 2 & 5]*** *and Section 1901.*

1903.3 Glass fiber-reinforced concrete. *Glass fiber-reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.*

1903.4 Flat wall insulating concrete form (ICF) systems. ***[OSHPD 1R, 2 & 5]*** *Not Permitted by OSHPD. Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E2634.*

1903.5 Aggregates - [OSHPD 1R, 2 & 5] *Modify ACI 318 Section 26.4.1.2.1(a).(1) as follows:*

(1) ***Normal weight aggregate:*** *Aggregate shall be nonreactive as determined by one of the methods in ASTM C33 Appendix X1: Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix X1 of ASTM C33, when approved by the building official.*

1903.6 Limits on Cementitious Materials. [OSHPD 1R, 2 & 5] *Modify ACI 318 Section 26.4.2.2(b) and Table 26.4.2.2(b) as follows:*

The maximum percentage of pozzolans, including fly ash and silica fume, and slag cement in concrete assigned to all exposure categories shall be in accordance with Table 26.4.2.2(b) and Section 26.4.2.2(b) Items (1) and (2).

Where pozzolans are used as cementitious materials, duration for minimum specified compressive strength of concrete (f'_c) that exceeds 28 days shall be considered an alternative system.

1903.7 Steel fiber reinforcement - [OSHPD 1R, 2 & 5] *Not permitted by OSHPD.*

1903.8 Welding of reinforcing bars - [OSHPD 1R, 2 & 5] *Modify ACI 318 Section 26.6.4.1(b) by adding the following:*

Subject to prior approval of the enforcing agency, longitudinal holding wires conforming to ASTM A1064, of maximum wire size W5, that are machine resistance welded to stirrup/tie cage (or spiral assemblies) consisting of low alloy steel reinforcing conforming to ASTM A706 are permitted when performed under continuous competent control in a fabrication shop. Tack welding of primary reinforcing bars together or to stirrups/ties is not permitted. Holding wire weld locations shall not occur on any longitudinal or primary reinforcing nor on any portion of a reinforcing bar that is or will be bent in accordance with ACI 318 Section 25.3 for the extents specified in AWS D1.4 Section 4.2.6.

Quality control tests shall be performed on shop welded specimens by the fabricator. Reinforcing steel specimens containing the holding wire shall be tested for yield and tensile strength at the frequency required by Section 1910.2. Test reports shall be available on request to the approved agency, design professional and enforcement agency.

SECTION 1904
DURABILITY REQUIREMENTS

1904.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

Exception: *For Group R-2 and R-3 occupancies not more than three stories above grade plane, the specified compressive strength, f'_c, for concrete in basement walls, foundation walls, exterior walls and other vertical surfaces exposed to the weather shall be not less than 3,000 psi (20.7 MPa).*

1904.2 Nonstructural concrete. *The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f´c, of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.*

SECTION 1905
MODIFICATIONS TO ACI 318

1905.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through 1905.1.8.

1905.1.1 ACI 318, Section 2.3. Modify existing definitions and add the following definitions to ACI 318, Section 2.3.

DETAILED PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, including 14.6.2.

ORDINARY PRECAST STRUCTURAL WALL. A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

ORDINARY REINFORCED CONCRETE STRUCTURAL WALL. A cast-in-place wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

ORDINARY STRUCTURAL PLAIN CONCRETE WALL. A wall complying with the requirements of Chapter 14, *excluding 14.6.2.*

1905.1.2 ACI 318, Section 18.2.1. Modify ACI 318 Sections 18.2.1.2 and 18.2.1.6 to read as follows:

- *18.2.1.2 – Structures assigned to Seismic Design Category* A shall satisfy requirements of Chapters 1 through 17 and 19 through 26; *Chapter 18 does not apply*. Structures assigned to *Seismic Design Category* B, C, D, E or F shall satisfy 18.2.1.3 through 18.2.1.7, as applicable. *Except for structural elements of plain concrete complying with Section 1905.1.7 of the California Building Code, structural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E or F.*

- 18.2.1.6 – Structural systems designated as part of the *seismic force-resisting system* shall be restricted to those *permitted by ASCE 7*. Except for *Seismic Design Category* A, for which Chapter 18 does not apply, the following provisions shall be satisfied for each structural system designated as part of the *seismic force-resisting system*, regardless of the *seismic design category*:
  (a) Ordinary moment frames shall satisfy 18.3.
  (b) *Ordinary reinforced concrete structural walls and ordinary precast structural walls* need not satisfy any provisions in Chapter 18.
  (c) Intermediate moment frames shall satisfy 18.4.
  (d) Intermediate precast *structural* walls shall satisfy 18.5.
  (e) Special moment frames shall satisfy 18.6 through 18.9.
  (f) Special structural walls shall satisfy 18.10.
  (g) Special structural walls constructed using precast concrete shall satisfy 18.11.

Special moment frames and special structural walls shall also satisfy 18.2.4 through 18.2.8.

1905.1.3 ACI 318, Section 18.5. Modify ACI 318, Section 18.5 by adding new Section 18.5.2.2 and renumbering existing Sections 18.5.2.2 and 18.5.2.3 to become 18.5.2.3 and 18.5.2.4, respectively.

18.5.2.2 – Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the deformation induced by the design displacement or shall use Type 2 mechanical splices.

18.5.2.3 – Elements of the connection that are not designed to yield shall develop at least 1.5 S_y.

18.5.2.4 – In structures assigned to SDC D, E or F, wall piers shall be designed in accordance with 18.10.8 or 18.14 in ACI 318.

1905.1.4 ACI 318, Section 18.11. Modify ACI 318, Section 18.11.2.1 to read as follows:

18.11.2.1 – Special structural walls constructed using precast concrete shall satisfy all the requirements of 18.10 *for cast-in-place special structural walls* in addition to 18.5.2.

1905.1.5 ACI 318, Section 18.13.1.1. Modify ACI 318, Section 18.13.1.1 to read as follows:

18.13.1.1 – Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and ground shall comply with the requirements of 18.13 and other applicable provisions of ACI 318 *unless modified by Chapter 18 of the California Building Code.*

1905.1.6 ACI 318, Section 14.6. Modify ACI 318, Section 14.6 by adding new Section 14.6.2 to read as follows:

14.6.2 – Detailed plain concrete structural walls.

14.6.2.1 – Detailed plain concrete structural walls are walls conforming to the requirements of ordinary structural plain concrete walls and 14.6.2.2.

14.6.2.2 – Reinforcement shall be provided as follows:

- *Vertical reinforcement of at least 0.20 square inch (129 mm^2) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening and at the ends of walls. The continuous vertical bar required beside an opening is permitted to substitute for one of the two No. 5 bars required by 14.6.1.*
- *Horizontal reinforcement at least 0.20 square inch (129 mm^2) in cross-sectional area shall be provided:*
  1. *Continuously at structurally connected roof and floor levels and at the top of walls.*
  2. *At the bottom of load-bearing walls or in the top of foundations where doweled to the wall.*
  3. *At a maximum spacing of 120 inches (3048 mm).*

Reinforcement at the top and bottom of openings, where used in determining the maximum spacing specified in Item 3 above, shall be continuous in the wall.

1905.1.7 ACI 318, Section 14.1.4. Delete ACI 318, Section 14.1.4 and replace with the following:

[OSHPD 1R, 2 & 5] *Plain concrete shall not be permitted for a structure assigned to Seismic Design Category (SDC) D, E and F.* <

14.1.4 – Plain concrete in structures assigned to Seismic Design Category C, D, E or F.

14.1.4.1 – Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete, except as follows:

- *Structural plain concrete basement, foundation or other walls below the base as defined in ASCE 7 are permitted in detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls. In dwellings assigned to Seismic Design Category D or E, the height of the wall shall not exceed 8 feet (2438 mm), the thickness shall be not less than 7$^1/_2$ inches (190 mm), and the wall shall retain no more than 4 feet (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with 14.6.1.*
- *Isolated footings of plain concrete supporting pedestals or columns are permitted, provided the projection of the footing beyond the face of the supported member does not exceed the footing thickness.*

  Exception: *In detached one- and two-family dwellings three stories or less in height, the*

projection of the footing beyond the face of the supported member is permitted to exceed the footing thickness.

- *Plain concrete footings supporting walls are permitted, provided the footings have at least two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 4 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing. For footings that exceed 8 inches (203 mm) in thickness, a minimum of one bar shall be provided at the top and bottom of the footing. Continuity of reinforcement shall be provided at corners and intersections.*

  Exceptions:

  1. *In Seismic Design Categories A, B and C, detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.*
  2. *For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, a minimum of one bar shall be provided at the top of the stemwall and at the bottom of the footing.*
  3. *Where a slab on ground is cast monolithically with the footing, one No. 5 bar is permitted to be located at either the top of the slab or bottom of the footing.*

1905.1.8 ACI 318, Section 17.10. Modify ACI 318 Sections 17.10.5.2, 17.10.5.3(d) and 17.10.6.2 to read as follows:

- 17.10.5.2 – *Where* the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.5.3. The anchor design tensile strength shall be determined in accordance with 17.10.5.4.

  Exception: *Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy Section 17.10.5.3(d).*

- 17.10.5.3(d) – *The* anchor or group *of anchors* shall be designed for the maximum tension obtained from design load combinations that include *E*, with *E* increased by Ω_0. The anchor design tensile strength shall *be calculated from 17.10.5.4.*

- 17.10.6.2 – *Where* the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.6.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7.

  Exceptions:

  1. *For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:*
     - *1.1. The allowable in-plane shear strength of the anchor is determined in accordance with ANSI/AWC NDS Table 12E for lateral design values parallel to grain.*
     - *1.2. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).*
     - *1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).*
     - *1.4. Anchor bolts are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.*
     - *1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.*
     - *1.6. The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.*
  2. *For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:*
     - *2.1. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).*
     - *2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).*

2.3. Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.

3. In light-frame construction bearing or non-bearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).

SECTION 1906
FOOTINGS FOR LIGHT-FRAME CONSTRUCTION

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

1906.1 Plain concrete footings. For Group R-3 occupancies and buildings of other occupancies less than two stories above grade plane of light-frame construction, the required thickness of plain concrete footings is permitted to be 6 inches (152 mm), provided that the footing does not extend more than 4 inches (102 mm) on either side of the supported wall.

SECTION 1907
MINIMUM SLAB PROVISIONS

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

Exception: A vapor retarder is not required:

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

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

SECTION 1908
SHOTCRETE

1908.1 General. Shotcrete shall be in accordance with the requirements of ACI 318 ***[OSHPD 1R, 2 & 5]*** *and the provisions of ACI 506R. The evaluation of the shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 shall be in accordance with the requirements of ACI 506.4R with a core quality category of Very Good given in ACI 506.6T.* <

1908.2 Tests and inspections. [OSHPD 1R, 2 & 5] *Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705.3.9.* <

1908.3 Forms and ground wires for shotcrete. [OSHPD 1R, 2 & 5] *Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.* <

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

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

1909.1 General.

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

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

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

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

1909.2.2 Steel fiber reinforcement *- Not permitted.*

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

1909.2.4 Tests of reinforcing bars. *Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.*

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

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings or 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.

1909.2.5 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 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.*

1909.2.6 Composite construction cores. *Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).*

At least one core shall be taken from each building for each 5,000 square feet (465 m^2) of area of composite concrete construction and not 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.

1909.2.7 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.*

1909.2.7.1 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.

1909.2.7.2 Testing procedure. *The test procedure shall be as permitted by an approved evaluation report using*

debris, dirt and dust. Concrete and masonry shall be brought to a saturated surface-dry (SSD) before shotcrete is deposited.

1909.3.9 ACI 318, Section 26.12.2.1(a). *Replace ACI 318 Section 26.12.2.1(a) by the following:*

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

1909.4 Shotcrete.

1909.4.1 General. *Shotcrete shall also conform to the provisions of ACI 506.2 and ACI 506R. The specified compressive strength of shotcrete shall not be less than 4,000 psi (27.6 MPa). The use of a shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7.1 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 is subject to the approval of the building official. Tolerances for shotcrete construction shall be defined by the construction documents.*

1909.4.2 Tests and inspections. *Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705A.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705A.3.9.*

1909.4.3 Forms and ground wires for shotcrete. *Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.*

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

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

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m^2) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed $^3/_4$ inch (19 mm).

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

1910.1 General.

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

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

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

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

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

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

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

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site

shall be furnished by the contractor and tested by an approved independent testing agency:

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

   Variations of the bearing plate size need not be considered.

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

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

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

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

1910.3 Modifications to ACI 318

1910.3.1 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.*

1910.3.2 ACI 318, Section 18.12.6. *Add Section 18.12.6.2 to ACI 318 as follows:*

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

1910.3.3 ACI 318, Table 19.2.1.1. *Modify ACI 318 Table 19.2.1.1 as follows:*

For concrete designed and constructed in accordance with this chapter, f'_c, shall not be less than 3,000 psi (20.7 MPa). Reinforced normal weight concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall require prior approval of structural design method and acceptance criteria by the enforcement agency.

1910.3.4 ACI 318, Table 21.2.2. *Replace Table 21.2.2 as follows:*

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

NET TENSILE STRAIN ε_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\varepsilon_t \le \varepsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\varepsilon_{ty} < \varepsilon_t < \varepsilon_{ty} + 0.003$	Transition[1, 2]	$0.75 + 0.15\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(c)	$0.65 + 0.25\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(d)
$\varepsilon_t \ge \varepsilon_{ty} + 0.003$	Tension-controlled[3]	0.9	(e)	0.9	(f)

1. *For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.*
2. *ε_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_g f'_c$ and $\varepsilon_{ty} + 0.003$.*
3. *For sections with factored axial compression force $P_u \ge 0.1A_g f'_c$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.*

SECTION 1911
EXISTING CONCRETE STRUCTURES [OSHPD 1R, 2 & 5]

1911.1 Concrete Core Sampling. *Where concrete cores are required to be taken for material property determination, cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed $^3/_4$ inch (19 mm).*

SECTION 1904*A*
DURABILITY REQUIREMENTS

1904*A*.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

1904*A*.2 Nonstructural concrete. *The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f'_c, of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.*

SECTION 1905*A*
MODIFICATIONS TO ACI 318

1905*A*.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905*A*.1.1 through *1905A.1.17*.

1905A.1.1 ACI 318, Section 4.12.2.2. *Modify ACI 318, Section 4.12.2.2 by adding the following:*

Where prestressed concrete elements are restrained from movement, an analysis of the stresses in the prestressed elements and loads in the adjoining structural system induced by the above-described effects shall be made in accordance with PCI Design Handbook.

1905A.1.2 ACI 318, Section 4.12.2.3. *Modify ACI 318, Section 4.12.2.3 by adding the following:*

For prestressed concrete members with recessed or dapped ends, an analysis of the connections shall be made in accordance with procedures given in PCI Design Handbook.

1905A.1.3 ACI 318, Section 9.6.1.3. *Modify ACI 318, Section 9.6.1.3 by adding the following:*

This section shall not be used for members that resist seismic loads, except for either of the following conditions:

1. *Foundation members for one-story wood-frame or one-story light steel buildings.*
2. *Foundation members designed for seismic load combinations including the overstrength factor.* ***[OSHPD 1 & 4]*** *The A_s provided shall not be less than that required by 1.2 times the cracking load based upon f_r defined in Section 19.2.3.*

1905A.1.4 ACI 318, Section 11.2.4.1. *Replace ACI 318, Section 11.2.4.1 as follows:*

11.2.4.1 – Walls shall be anchored to intersecting elements such as floors or roofs; or to columns, pilasters, buttresses, of intersecting walls and footings with reinforcement at least equivalent to No. 4 bars at 12 inches (305 mm) on center for each layer of reinforcement.

1905A.1.5 ACI 318, Section 11.7. *Add Section 11.7.6 to ACI 318.1 as follows:*

11.7.6 – ***Reinforcement.*** *Perimeters of precast walls shall be reinforced continuously with a minimum of one No. 5 bar extending the full height and width of the wall panel. Where wall panels do not connect to columns or other wall panels to develop at least 75 percent of the horizontal wall steel as noted below, vertical perimeter bars shall be retained by hooked wall bars.*

A continuous tie or bond beam shall be provided at the roof line either as a part of the roof structure or part of the wall panels as described in the next paragraph below. This tie may be designed as the edge member of the roof diaphragm but, in any case, shall not be less than equivalent to two No. 6 bars continuous. A continuous tie equivalent to two No. 5 bars minimum shall also be provided either in the footing or with an enlarged section of the floor slab.

Wall panels of shear wall buildings shall be connected to columns or to each other in such a manner as to develop at least 75 percent of the horizontal wall steel. No more than half of this continuous horizontal reinforcing shall be concentrated in bond or tie beams at the top and bottom of the walls and at points of intermediate lateral support. If possible, cast-in-place joints with reinforcing bars extending from the panels into the joint a sufficient distance to meet the splice requirements of ACI 318, Section 25.5.2, for Class A shall be used. The reinforcing bars or welded tie details shall not be spaced over eight times the wall thickness vertically nor fewer than four used in the wall panel height. Where wall panels are designed for their respective overturning forces, the panel connections need not comply with the requirements of this paragraph.

Exception: *Nonbearing, nonshear panels such as nonstructural architectural cladding panels or column covers are not required to meet the provisions of this section.*

1905A.1.6 ACI 318, Section 11.9. *Modify ACI 318 by adding Section 11.9 as follows:*

11.9 – ***Foundation walls.*** *Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.*

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318, Section 11.6 and 11.7.

1905A.1.7 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.

1905*A*.1.8 ACI 318, Section *17.10*. Modify ACI 318 Sections 17.10.5.2, 17.10.5.3(d) and 17.10.6.2 to read as follows:

- 17.10.5.2 – *Where* the tensile component of the strength-level earthquake-induced force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.5.3. The anchor design tensile strength shall be determined in accordance with 17.10.5.4.

  Exception: *Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7, Equation 12.11-1 or 12.14-10, and Section 1604A.8.2 of this code shall be deemed to satisfy Section 17.10.5.3(d).*

- 17.10.5.3(d) – *The* anchor or group *of anchors* shall be designed for the maximum tension obtained from design load combinations that include *E*, with *E* increased by Ω_0. The anchor design tensile strength shall *be calculated in accordance with 17.10.5.4.*

- 17.10.6.2 – *Where* the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.6.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7.

  Exceptions:

  1. *For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:*

     1.1. *The allowable in-plane shear strength of the anchor is determined in accordance with ANSI/AWC NDS Table 12E for lateral design values parallel to grain.*

     1.2. *The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).*

     1.3. *Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).*

     1.4. *Anchor bolts are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.*

     1.5. *Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.*

     1.6. *The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.*

  2. *For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:*

     2.1. *The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).*

     2.2. *Anchors are embedded into concrete a minimum of 7 inches (178 mm).*

     2.3. *Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.*

     2.4. *Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.*

     2.5. *The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.*

     Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.

  3. *In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).*

1905*A*.1.*9* ACI 318, Section 18.5. Modify ACI 318, Section 18.5, by adding new Section 18.5.2.2 and renumbering existing Sections 18.5.2.2 and 18.5.2.3 to become 18.5.2.3 and 18.5.2.4, respectively. ***[DSA-SS]*** *Modify ACI 318, Section 18.5.2.1.*

18.5.2.1 – In connections between wall panels, yielding shall be restricted to steel elements or reinforcement. ***[DSA-SS]*** *Connections between wall panels and the foundation shall be designed per Section 1617A.1.15.*

18.5.2.2 – Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at deformation induced by the design displacement or shall use type 2 mechanical splices.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 21 – MASONRY

(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										
Adopt entire chapter as amended (amended sections listed below)									X		X	X			X								
Adopt only those sections that are listed below			X																	X			
Chapter / Section																							
2101.1.1									X														
2101.1.2									X		X	X			X								
2101.1.3									X														
2101.1.4									X														
2101.2											X	X			X								
2101.2.2											X	X			X								
2103.1											X	X			X								
2103.4											X	X			X								
2103.5											X	X			X								
2104.1											X	X			X								
2104.2											X	X			X								
2104.3											X	X			X								
2105.2											X	X			X								
2105.3											X	X			X								
2105.4											X	X			X								
2106.1.1											X	X			X								
2106.1.2											X	X			X								
2106.1.3											X	X			X								
2107.1											X	X			X								
2107.4											X	X			X								
2107.5											X	X			X								
2107.6											X	X			X								
2107.7											X	X			X								
Table 2107.5											X	X			X								
2108.1											X	X			X								
2108.4											X	X			X								
2109											X	X			X								
2109.2.4.8.2																					X		
2110.1											X	X			X								
2113.9.2			X																				
2115									X														

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 21

MASONRY

User notes:

About this chapter: *Chapter 21 establishes minimum requirements for masonry construction. The provisions address: material specifications and test methods; types of wall construction; criteria for engineered and empirical designs; and required details of construction, including the execution of construction. The provisions provide a framework for applying applicable standards to the design and construction of masonry structures. Masonry design methodologies including allowable stress design, strength design and empirical design are covered by the provisions of this chapter. Also addressed are masonry fireplaces and chimneys, masonry heaters and glass unit masonry.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 2101
GENERAL

2101.1 Scope. This chapter shall govern the materials, design, construction and quality of masonry.

2101.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 21 is as follows:*

1. *Structures regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC) which include those applications listed in Section 1.9.2.2.*
2. *Office of Statewide health planning and development (OSHPD). Buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings regulated by OSHPD. Applications listed in Sections 1.10.1, 1.10.2 and 1.10.5.*

2101.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS/CC, OSHPD adopt this chapter and all amendments.*

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

1. **[DSA-SS/CC]** – For *applications* listed in Section 1.9.2.2.
2. *Office of Statewide Health Planning and Development:*

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

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

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

2101.1.3 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

2101.1.4 Amendments. [DSA-SS/CC] *See Section 2115 for additional requirements.*

2101.2 Design methods. Masonry shall comply with the provisions of TMS 402, TMS 403 or TMS 404 as well as applicable requirements of this chapter. ***[OSHPD 1R, 2 & 5]*** *TMS 403 Not permitted by OSHPD.*

2101.2.1 Masonry veneer. Masonry veneer shall comply with the provisions of Chapter 14.

2101.2.2 Prohibition. [OSHPD 1R, 2 & 5] *The following design methods, systems and materials in TMS402/602 are not permitted by OSHPD:* <

1. *Unreinforced masonry.*
2. *Autoclaved Aerated Concrete (AAC) Masonry.*
3. *Empirical design of masonry and prescriptive design of masonry partition walls.*
4. *Adobe construction.*
5. *Ordinary reinforced masonry shear walls.*
6. *Intermediate reinforced masonry shear walls.*
7. *Prestressed masonry shear walls.*
8. *Direct design of masonry.*

2101.3 Special inspection. The special inspection of masonry shall be as defined in Chapter 17, or an itemized testing and inspection program shall be provided that meets or exceeds the requirements of Chapter 17.

SECTION 2102
NOTATIONS

2102.1 General. The following notations are used in the chapter:

NOTATIONS.

d_b = Diameter of reinforcement, inches (mm).

F_s = Allowable tensile or compressive stress in reinforcement, psi (MPa).

f_r = Modulus of rupture, psi (MPa).

f'_{AAC} = Specified compressive strength of AAC masonry, the minimum compressive strength for a class of AAC masonry as specified in TMS 602, psi (MPa).

f'_m = Specified compressive strength of masonry at age of 28 days, psi (MPa).

f'_{mi} = Specified compressive strength of masonry at the time of prestress transfer, psi (MPa).

K = The lesser of the masonry cover, clear spacing between adjacent reinforcement, or five times db, inches (mm).

L_s = Distance between supports, inches (mm).

l_d = Required development length or lap length of reinforcement, inches (mm).

P = The applied load at failure, pounds (N).

S_t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

S_w = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

SECTION 2103
MASONRY CONSTRUCTION MATERIALS

2103.1 Masonry units. Concrete masonry units, clay or shale masonry units, stone masonry units, glass unit masonry and AAC masonry units shall comply with Article 2.3 of TMS 602. Architectural cast stone shall conform to ASTM C1364 and TMS 504. Adhered manufactured stone masonry veneer units shall conform to ASTM C1670. ***[OSHPD 1R, 2 & 5]*** *Architectural cast stone construction shall be considered as an alternative system.*

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Table 705.5.

2103.1.1 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2103.2 Mortar. Mortar for masonry construction shall comply with Section 2103.2.1, 2103.2.2, 2103.2.3 or 2103.2.4.

2103.2.1 Masonry mortar. Mortar for use in masonry construction shall conform to Articles 2.1 and 2.6 A of TMS 602.

2103.2.2 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

2103.2.3 Mortars for ceramic wall and floor tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103.2.3.

2103.2.3.1 Dry-set Portland cement mortars. Premixed prepared Portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

TABLE 2103.2.3
CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $^1/_5$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $^1/_2$ hydrated lime; 5 damp sand to 1 cement; 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $^1/_{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $^1/_2$ hydrated lime; $2^1/_2$ dry sand or 3 damp sand

2103.2.3.2 Latex-modified Portland cement mortar. Latex-modified Portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

2103.2.3.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103.2.3.4 Furan mortar and grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103.2.3.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2103.2.3.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall be not less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103.2.3.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2103.2.4 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to ASTM C270 for Type N or S, or shall comply with ANSI A118.4 for latex-modified Portland cement mortar.

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 ***[OSHPD 1R, 2 & 5]****, or bar reinforcement without mill certification,* 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.*

SECTION 2104
CONSTRUCTION

2104.1 Masonry construction. Masonry construction shall comply with the requirements of Sections 2104.1.1 and 2104.1.2 and with the requirements of either TMS 602 or TMS 604.

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

2104.2.1 TMS 602, Article 3.3 B Placing mortar and units. *Modify TMS 602, Article 3.3 B.2.c as follows:*

c. Remove masonry protrusions extending *greater than* $^1/_4$ inch (*6.4* mm) into cells or cavities to be grouted.

2104.2.2 TMS 602, Article 3.4 B Reinforcement. *Modify TMS 602, Article 3.4 B.1 and Article 3.4 B.3 as follows:*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances. *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.*

3. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_4$ inch (6.4 mm) for fine grout and $^1/_2$ inch (12.7 mm) for coarse grout, *and the space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter,* except where cross webs of hollow units are used as supports for horizontal reinforcement. *Reinforcement, embedded items and bolts shall be solidly embedded in grout.*

2104.2.3 TMS 602, Article 3.4 D Anchor bolts. *Replace TMS 602, Article 3.4 D.3 and add Articles 3.4 D.5 and 3.4 D.6 as follows:*

3. *Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $^1/_2$ inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $^1/_4$ inch (6.4 mm) when using fine grout and at least $^1/_2$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.*

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

6. *Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*

2104.2.4 TMS 602, Article 3.5 C Grout pour height. *Add to TMS 602, Article 3.5 C the following:*

1. *For grout pours not greater than 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry, the top of grout pour shall be at the top of constructed masonry, or within 8 inches (200 mm) of the top of the constructed masonry. After construction of each grout lift height of wall, column, pier or beam, masonry cells or cavities shall be inspected prior to placement of grout. Grout pours not terminated at the top of constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.e.*

2. *Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to approval of the enforcement agency.*

   a. *Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to the following:*

      Grouting shall be done in a continuous pour in lifts not exceeding 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry.

   b. *An approved admixture of a type that reduces early water loss and produces an expansive action shall be used.*

c. *The grouting of any section of a wall between control barriers shall be completed in 1 day with no interruptions greater than 1 hour.*

d. *For multiple grout lifts within a grout pour, each grout lift height of wall, column, pier or beam shall be inspected before placement of additional units.*

e. *Cleanout openings shall be provided at the bottom of each pour of grout.*

2104.2.5 TMS 602, Article 3.5 F.1 Grout key. *Replace TMS 602, Article 3.5 F.1 as follows:*

1. *Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of $1^1/_2$ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of $^1/_2$ inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above reinforcing steel for each grout pour.*

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 1,500 psi (10.34 MPa) for all structural masonry construction using materials and details of construction required herein. Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.*

Exception: *Where values of f'_m greater than 2,000 psi (13.79 MPa) are used in the design of reinforced grouted multi-wythe masonry and reinforced hollow-unit masonry, they shall be based on prism test results in accordance with TMS 602, Article 1.4 B.3 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 exceed 3,000 psi (20.7MPa).*

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 documents. Verification of compliance with the requirements for the specified strength of masonry during construction shall be provided using the prism test method in accordance with TMS 602, Article 1.4 B.3. Verification of compliance with the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in accordance with TMS 602, Article 1.4 B.3.

2105.3 Mortar and grout tests. [OSHPD 1R, 2 & 5] TMS 602, Article 1.4 B Compressive strength determination. < *Modify TMS 602, Article 1.4 B as follows by adding:*

5. Additional testing requirements:

a. *At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests.*

b. *Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet (464.5 m^2) of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602 Section 2.2 or greater as specified.*

c. *Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.*

d. *Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.*

Exception: *For nonbearing nonshear masonry walls not exceeding total wall height of 12 feet (3658 mm) 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^2) 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 $3^3/_4$ inch (95.25 mm) 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^2*) of the wall.*

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 [OSHPD 1R, 2 & 5] TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b).*** *Replace TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b) as follows:*

a. Ties shall be at least $^3/_8$ *inch (9.525 mm) 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.*

b. 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).

2106.1.2 [OSHPD 1R, 2 & 5] TMS 402, Chapter 5. *Add TMS 402, Section 5.6 as follows:* <

5.6 – Lateral Support of Members

5.6.1 – 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.

2106.1.3 [OSHPD 1R, 2 & 5] TMS 402, Sections 7.4.4.1 and 7.4.5.1. *Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:* <

7.4.4.1 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. Where stack bond is used in reinforced hollow-unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.*

All cells shall be solidly filled with grout.

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 for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.*

7.4.4.1.1 *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.*

7.4.4.1.2 *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.*

7.4.4.1.3 *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.*

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

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

SECTION 2107
ALLOWABLE STRESS DESIGN

2107.1 General. 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 2107.3. ***[OSHPD 1R, 2 & 5]*** *through 2107.7.* >

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:

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

For SI: $l_d = 0.29 d_b f_s$

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

d_b = Diameter of reinforcement, inches (mm)

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

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

2107.3 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] TMS 402, Section 8.3.4.4 Walls. *Modify TMS 402 by adding Section 8.3.4.4 as follows by adding:* <

8.3.4.4.1 *The minimum thickness of walls is given in this section. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.*

8.3.4.4.2 *The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.*

8.3.4.4.3 *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 8.3.4.4
MINIMUM THICKNESS OF MASONRY WALLS[1, 2]

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

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

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

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

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, ρ_{max}, not greater than that computed by Equation 8-20.

> ***2107.7 Masonry Compressive Strength. [OSHPD 1R, 2 & 5]*** *The specified compressive strength of structural masonry, f'_m, shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.*

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.*4*.

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.

> ***2108.4 [OSHPD 1R, 2 & 5] TMS 402, Section 9.1.9.1.1.*** *Modify TMS 402, Section 9.1.9.1.1 as follows:*

9.1.9.1.1 Masonry Compressive Strength. The specified compressive strength of *structural* masonry, f'_m, shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength values in this chapter shall not exceed *3,000 psi (20.7 MPa)* for concrete masonry and shall not exceed *4,500* psi (*31.03* MPa) for clay masonry.

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.

2109.2.1.2.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

2109.2.1.2.4 Modulus of rupture determination. The modulus of rupture shall be determined by the equation:

$$f_r = 3\,PL_s/[2\,S_w(S_t^2)] \qquad \textbf{(Equation 21-2)}$$

where, for the purposes of this section only:

S_w = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

f_r = Modulus of rupture, psi (MPa).

L_s = Distance between supports, inches (mm).

S_t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

P = The applied load at failure, pounds (N).

2109.2.1.3 Moisture content requirements. Adobe units shall have a moisture content not exceeding 4 percent by weight.

2109.2.1.4 Shrinkage cracks. Adobe units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76 mm) in length or $^1/_8$ inch (3.2 mm) in width.

2109.2.2 Stabilized adobe. Stabilized adobe shall comply with Section 2109.2.1 for unstabilized adobe in addition to Sections 2109.2.2.1 and 2109.2.2.2.

2109.2.2.1 Soil requirements. Soil used for stabilized adobe units shall be chemically compatible with the stabilizing material.

2109.2.2.2 Absorption requirements. A 4-inch (102 mm) cube, cut from a stabilized adobe unit dried to a constant weight in a ventilated oven at 212°F to 239°F (100°C to 115°C), shall not absorb more than $2^1/_2$ percent moisture by weight when placed on a constantly water-saturated, porous surface for seven days. Not fewer than five specimens shall be tested and each specimen shall be cut from a separate unit.

2109.2.3 Allowable stress. The allowable compressive stress based on gross cross-sectional area of adobe shall not exceed 30 psi (207 kPa).

2109.2.3.1 Bolts. Bolt values shall not exceed those set forth in Table 2109.2.3.1.

2109.2.4 Detailed requirements. Adobe construction shall comply with Sections 2109.2.4.1 through 2109.2.4.9.

2109.2.4.1 Number of stories. Adobe construction shall be limited to buildings not exceeding one story, except that two-story construction is allowed where designed by a registered design professional.

2109.2.4.2 Mortar. Mortar for adobe construction shall comply with Sections 2109.2.4.2.1 and 2109.2.4.2.2.

TABLE 2109.2.3.1
ALLOWABLE SHEAR ON BOLTS IN ADOBE MASONRY

DIAMETER OF BOLTS (inches)	MINIMUM EMBEDMENT (inches)	SHEAR (pounds)
$^1/_2$	—	—
$^5/_8$	12	200
$^3/_4$	15	300
$^7/_8$	18	400
1	21	500
$1^1/_8$	24	600

For SI: 1 inch = 25.4 mm, 1 pound = 4.448 N.

2109.2.4.2.1 General. Mortar for adobe units shall be in accordance with Section 2103.2.1, or be composed of adobe soil of the same composition and stabilization as the adobe brick units. Unstabilized adobe soil mortar is permitted in conjunction with unstabilized adobe brick units.

2109.2.4.2.2 Mortar joints. Adobe units shall be laid with full head and bed joints and in full running bond.

2109.2.4.3 Parapet walls. Parapet walls constructed of adobe units shall be waterproofed.

2109.2.4.4 Wall thickness. The minimum thickness of exterior walls in one-story buildings shall be 10 inches (254 mm). The walls shall be laterally supported at intervals not exceeding 24 feet (7315 mm). The minimum thickness of interior load-bearing walls shall be 8 inches (203 mm). The unsupported height of any wall constructed of adobe units shall not exceed 10 times the thickness of such wall.

2109.2.4.5 Foundations. Foundations for adobe construction shall be in accordance with Sections 2109.2.4.5.1 and 2109.2.4.5.2.

2109.2.4.5.1 Foundation support. Walls and partitions constructed of adobe units shall be supported by foundations or footings that extend not less than 6 inches (152 mm) above adjacent ground surfaces and are constructed of solid masonry (excluding adobe) or concrete. Footings and foundations shall comply with Chapter 18.

2109.2.4.5.2 Lower course requirements. Stabilized adobe units shall be used in adobe walls for the first 4 inches (102 mm) above the finished first-floor elevation.

2109.2.4.6 Isolated piers or columns. Adobe units shall not be used for isolated piers or columns in a load-bearing capacity. Walls less than 24 inches (610 mm) in length shall be considered to be isolated piers or columns.

2109.2.4.7 Tie beams. Exterior walls and interior load-bearing walls constructed of adobe units shall have a continuous tie beam at the level of the floor or roof bearing and meeting the following requirements.

2109.2.4.7.1 Concrete tie beams. Concrete tie beams shall be 6 inches (152 mm) or more in depth and 10 inches (254 mm) or more in width. Concrete tie beams shall be continuously reinforced with not fewer than two No. 4 reinforcing bars. The specified compressive strength of concrete shall be not less than 2,500 psi (17.2 MPa).

2109.2.4.7.2 Wood tie beams. Wood tie beams shall be solid or built up of lumber having a nominal thickness of not less than 1 inch (25 mm), and shall have a depth of not less than 6 inches (152 mm) and a width of not less than 10 inches (254 mm). Joints in wood tie beams shall be spliced not less than 6 inches (152 mm). Splices shall not be allowed within 12 inches (305 mm) of an opening. Wood used in tie beams shall be approved naturally decay-resistant or preservative-treated wood.

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this section or Chapter 14, except where stated otherwise in this section.

SECTION 2114
DRY-STACK MASONRY

2114.1 General. The design of dry-stack masonry structures shall comply with the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2114.2 through 2114.5.

2114.2 Limitations. Dry-stack masonry shall be prohibited in *Risk Category* IV structures.

2114.3 Materials. Concrete masonry units complying with ASTM C90 shall be used.

2114.4 Strength. Dry-stack masonry shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2114.4. Allowable stresses not specified in Table 2114.4 shall comply with the requirements of Chapter 8 of TMS 402.

TABLE 2114.4
GROSS CROSS-SECTIONAL AREA
ALLOWABLE STRESS FOR DRY-STACK MASONRY

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression	45
Flexural tension	
Horizontal span	30
Vertical span	18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2114.5 Construction. Construction of dry-stack masonry shall comply with ASTM C946.

SECTION 2115
ADDITIONAL REQUIREMENTS
FOR COMMUNITY COLLEGES [DSA-SS/CC]

2115.1 General. *In addition to the provisions of this chapter, the following requirements shall apply to community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC).*

2115.1.1 Prohibitions. *The following design, systems and materials in TMS 402/602 are not permitted by DSA:*

1. *Unreinforced masonry.*
2. *Autoclaved aerated concrete (AAC) masonry.*
3. *Empirical design of masonry and prescriptive design of masonry partition walls.*
4. *Ordinary reinforced masonry shear walls.*
5. *Intermediate reinforced masonry shear walls.*
6. *Prestressed masonry shear walls.*
7. *Direct design of masonry.*

2115.2 Metal reinforcement and accessories. *The frequency of sampling for unidentifiable reinforcing bars may alternatively be in accordance with Section 1909.2.4.*

2115.3 Air entrainment. *Air-entraining substances shall not be used in grout.*

2115.4 Masonry construction. *Architectural cast stone construction shall be considered as an alternative system.*

2115.5 Reinforced grouted masonry.

2115.5.1 TMS 602, Article 3.3 B Placing mortar and units. *Modify TMS 602, Article 3.3 B.2.c as follows:*

c. Remove masonry protrusions extending *greater than* $^1/_4$ inch (*6.4* mm) into cells or cavities to be grouted.

2115.5.2 TMS 602, Article 3.4 B Reinforcement. *Modify TMS 602, Article 3.4 B.1 and Article 3.4 B.3 as follows:*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances. *Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.*

3. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_4$ inch (6.4 mm) for fine grout and $^1/_2$ inch (12.7 mm) for coarse grout, except where cross webs of hollow units are used as supports for horizontal reinforcement. *Reinforcement and embedded items shall be solidly embedded in grout.*

2115.5.3 TMS 602, Article 3.4 D Anchor bolts. *Replace TMS 602, Article 3.4 D.3 and add Articles 3.4 D.5 and 3.4 D.6 as follows:*

3. *Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $^1/_2$ inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $^1/_4$ inch (6.4 mm) when using fine grout and at least $^1/_2$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.*

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

6. *Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*

2115.5.4 TMS 602, Article 3.5 A Placing time. *Modify TMS 602, Article 3.5 A by adding Article 3.5 A.3 as follows:*

3. The grouting of any section of a wall between control barriers shall be completed in one day with no interruptions greater than one hour.

2115.5.5 TMS 602, Article 3.5 B Confinement. *Add the following to TMS 602, Article 3.5 B:*

2. All cells shall be solidly filled with grout in reinforced hollow unit masonry.

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

2115.5.6 TMS 602, Article 3.5 E Consolidation. *Modify TMS 602, Article 3.5 E.1.b as follows:*

b. Consolidate pours exceeding 12 in. (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred, *but before plasticity is lost.*

2115.5.7 TMS 602, Article 3.5 F.1 Grout key. *Replace TMS 602, Article 3.5 F.1 as follows:*

1. Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of $1^1/_2$ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of $^1/_2$ inch (12.7 mm) below the mortar joint.

2115.6 TMS 602, Article 3.5 Grout placement. *Add the following to TMS 602, Article 3.5:*

3.5 I. *Additional grouting requirements:*

1. Grout shall be placed by pumping or an approved alternate method before initial set of hardening occurs.

2. Grout shall be placed so that all spaces to be grouted do not contain voids.

3. 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.

2115.7 Compressive strength, f'_m. *The minimum specified compressive strength, f'_m, in the design shall be not less than 2,000 psi (13.79 MPa) for all structural concrete masonry construction and 1,500 psi (10.34 MPa) for all structural clay masonry construction using materials and details of construction required herein. The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.*

2115.8 Additional testing requirements.

2115.8.1 Mortar and grout tests. TMS 602, Article 1.4 B Compressive Strength Determination. *Modify TMS 602, Article 1.4 B as follows by adding:*

5. Additional testing requirements:

a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on three successive working days and at least at one-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C270 with a valid evaluation report.

b. 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. The grout shall meet the minimum strength requirement given in ASTM C476/TMS 602 Section 2.2, or greater as specified.

c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.

d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

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

2115.8.2 Masonry core testing. *Not less than two cores shall be taken from each building for each 5,000 square feet (465 m^2) 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 $3^3/_4$ inches (96 mm) in nominal diameter; and

2104*A*.1.1 Support on wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.13.

2104*A*.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.

2104A.1.3 Reinforced grouted masonry.

2104A.1.3.1 TMS 602, Article 3.2 F Cleanouts. *Replace TMS 602, Article 3.2 F with the following:*

3.2 F. *Cleanouts* - Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds *the height limits given in Section 2104A.1.3.5 Item 3.*

1. *Cleanout openings in hollow unit masonry shall be provided in every cell at the bottom of each pour of grout. Alternatively, if the course at the bottom of the pour is constructed entirely of inverted double open-end bond beam units, cleanout openings need only be provided for access to every reinforced cell at the bottom of each pour of grout.*
2. *Cleanouts in multi-wythe masonry shall be provided for each pour by leaving out every other unit in the bottom wythe of the section being poured or by cleanout openings in the foundation.*
3. *The foundation or other horizontal construction joints at the cleanouts shall be cleaned of all loose material and mortar droppings before each pour. The cleanouts shall be sealed after inspection and before grouting.*

2104A.1.3.2 TMS 602, Article 3.3 B Placing mortar and units. *Modify TMS 602, Article 3.3 B.2.c as follows:*

c. Remove masonry protrusions extending *greater than* $^1/_4$ inch (*6.4* mm) into cells or cavities to be grouted.

2104A.1.3.3 TMS 602, Article 3.4 B Reinforcement. *Modify TMS 602, Article 3.4 B.1 and Article 3.4 B.3 as follows:*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances. *Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.*
3. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_4$ inch (6.4 mm) for fine grout and $^1/_2$ inch (12.7 mm) for coarse grout, *and the space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter,* except where cross webs of hollow units are used as supports for horizontal reinforcement. *Reinforcement and embedded items shall be solidly embedded in grout.*

2104A.1.3.4 TMS 602, Article 3.4 D Anchor bolts. *Replace TMS 602, Article 3.4 D.3 and add Articles 3.4 D.5 and 3.4 D.6 as follows:*

3. *Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $^1/_2$ inch (12.7 mm) of grout between the bolt circumference and the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $^1/_4$ inch (6.4 mm) when using fine grout and at least $^1/_2$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.*
5. *Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $^1/_2$-inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, $^3/_4$-inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, $^7/_8$-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.*
6. *Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*

2104A.1.3.5 TMS 602, Article 3.5 C Grout pour height. *Add to TMS 602, Article 3.5 C the following:*

1. *For grout pours not greater than 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry, the top of grout pour shall be at the top of constructed masonry, or within 8 inches (200 mm) of the top of the constructed masonry. Grout pours not terminated at the top of constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.e.* ***[OSHPD 1 & 4]*** *After construction of each grout lift height of wall, column, pier or beam, masonry cells or cavities shall be inspected prior to placement of grout.*
2. *Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to approval of the enforcement agency.*
3. *Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to the following:*
    a. *Grouting shall be done in a continuous pour in lifts not exceeding 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry.*

b. An approved admixture of a type that reduces early water loss and produces an expansive action shall be used.

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

d. For multiple grout lifts within a grout pour, each grout lift height of wall, column, pier or beam shall be inspected before placement of additional units.

e. Cleanout openings shall be provided at the bottom of each pour of grout.

2104A.1.3.6 TMS 602, Article 3.5 D Grout lift height. *Modify TMS 602, Article 3.5 D as follows:*

3. In no case shall lifts exceed 4 feet (1219 mm) in height.

Exception: *The 4 feet (1219 mm) maximum lift height may be increased to 5 feet 4 inches (1625.6 mm) for 10-inch (254 mm) nominal and larger hollow-unit masonry.*

2104A.1.3.7 TMS 602, Article 3.5 E Consolidation. *Modify TMS 602, Article 3.5 E.1.b as follows:*

b. Consolidate pours exceeding 12 inch (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred, *but before plasticity is lost.*

2104A.1.3.8 TMS 602, Article 3.5 F.1 Grout key. *Replace TMS 602, Article 3.5 F.1 as follows:*

1. Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of $1^1/_2$ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of $^1/_2$ inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above reinforcing steel for each grout pour.

2104A.1.3.9 TMS 602, Article 3.5 Grout placement. *Add the following to TMS 602, Article 3.5:*

3.5 I. *Additional grouting requirements:*

1. Grout shall be placed by pumping or an approved alternate method before initial set of hardening occurs.

2. Grout shall be placed so that all spaces to be grouted do not contain voids.

3. 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.

2104A.1.3.10 Reinforced grouted multi-wythe masonry.

2104A.1.3.10.1 General. *Reinforced grouted multi-wythe masonry is that form of composite construction made with clay or shale brick or made with solid concrete building brick in which interior spaces of masonry are filled by pouring grout around reinforcement therein as the work progresses.*

2104A.1.3.10.2 TMS 402, Section 5.1.4.2.2 Masonry headers. *Replace TMS 402, Section 5.1.4.2.2 as follows:*

5.1.4.2.2 *Masonry headers shall not project into the grout space and shall not be permitted to bond wythes of masonry.*

2104A.1.3.10.3 TMS 602, Article 3.3 B.5 Placing masonry units – Solid units. *Add the following to TMS 602, Article 3.3 B.5:*

d. Toothing of masonry walls is prohibited. Racking is to be held to a minimum.

2104A.1.3.10.4 TMS 602, Article 3.4 C.2 Wall ties. *Replace TMS 602, Article 3.4 C.2 as follows:*

2. The two wythes shall be bonded together with wall ties. Ties shall not be less than No. 9 (W1.7) wire in the form of rectangles 4 inches (102 mm) wide and 2 inches (51 mm) in length less than the overall wall thickness. Kinks, water drips or deformations shall not be permitted in the ties. One wythe of the wall shall be built up not more than 16 inches (406 mm) ahead of the other wythe. Ties shall be laid not to exceed 24 inches (610 mm) on center horizontally and 16 inches (406 mm) on center vertically for running bond, and not more than 24 inches (610 mm) on center horizontally and 12 inches (305 mm) on center vertically for stack bond.

2104A.1.3.10.5 TMS 602, Article 3.5 B Confinement. *Add the following to TMS 602, Article 3.5 B:*

1. Vertical grout barriers or dams of solid masonry shall be built across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall be spaced not more than 30 feet (9144 mm) apart.

2104A.1.3.10.6 TMS 602, Article 3.5 C Grout pour height. *Add the following to TMS 602, Article 3.5 C:*

4. The minimum clear width of grout space for multi-wythe masonry for pours not exceeding 4 feet (1.2 m) shall be $2^1/_2$ inches (64 mm). The clear width of grout space for pours exceeding 4 feet (1.2 m) shall be a minimum of $3^1/_2$ inches (89 mm).

2104A.1.3.11 Reinforced hollow-unit masonry.

2104A.1.3.11.1 TMS 602, Article 2.3 A & 2.3 B Masonry unit materials. *Add the following to TMS 602, Articles 2.3 A and 2.3 B:*

1. *The depth of the bond beam channel below the top of the unit in reinforced hollow-unit masonry shall be $1^1/_2$ inches (38 mm) minimum and the width shall be 3 inches (76 mm) minimum.*

2104A.1.3.11.2 TMS 602, Article 3.5 B Confinement. *Add the following to TMS 602, Article 3.5 B:*

1. *All cells shall be solidly filled with grout in reinforced hollow-unit masonry **[OSHPD 1 & 4]** and shall be constructed using single or double open-end units, except single open-end units shall be used at wall intersections, corners and similar conditions.*

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

2. *Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear grout space dimension of not less than that given in Section 2103A.3.1.*

SECTION 2105*A*
QUALITY ASSURANCE

2105*A*.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*A* and TMS 602 *and Sections 2105A.2 through 2105A.4.*

2105A.2 Compressive strength, f'_m.

[OSHPD 1 & 4] *The minimum specified compressive strength, f'_m, in the design shall be 1,500 psi (10.34 MPa) for all structural masonry construction using materials and details of construction required herein. Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.*

[DSA-SS] *The minimum specified compressive strength, f'_m, in the design shall be 2,000 psi (13.79 MPa) for all structural concrete masonry construction and 1,500 psi (10.34 MPa) for all structural clay masonry construction using materials and details of construction required herein. Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.*

Exception: *Where values of f'_m greater than 2000 psi (13.79 MPa) are used in the design of reinforced grouted multi-wythe masonry and reinforced hollow-unit masonry, they shall be based on prism test results in accordance with TMS 602, Article 1.4 B.3 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.*

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 documents. Verification of compliance with the requirements for the specified strength of masonry during construction shall be provided using prism test method in accordance with TMS 602, Article 1.4 B.3. Verification of compliance with the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in accordance with TMS 602, Article 1.4 B.3.

2105A.3 Mortar and grout tests. TMS 602, Article 1.4 B Compressive Strength Determination. *Modify TMS 602, Article 1.4 B as follows by adding:*

5. Additional testing requirements:

*a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at least at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. **[DSA-SS]** Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C270 with a valid evaluation report.*

b. 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 C476/TMS 602, Section 2.2, or greater as specified.

c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.

d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

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

2105A.4 Masonry core testing. *Not less than two cores shall be taken from each building for each 5,000 square feet (465 m^2) 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 $3^3/_4$ inches in 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 void 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 test both joints between the grout core and the outside wythes or face shell of the masonry 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 non-absorbent 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, the findings of their visual examination of each core, identify which cores were selected for shear testing, and the results of the shear tests.

Exceptions:

1. *Core sampling and testing is not required for nonbearing nonshear masonry walls, not exceeding a total wall height of 12 feet above top of 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 (13.79 MPa).*
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-lieu of core sampling and testing.* ***[OSHPD 1 & 4]*** *Infrared thermographic surveys or other nondestructive test procedures shall also include core tests with a minimum of two cores taken from each building for each 10,000 square feet (930* m^2*) of the wall.*

SECTION 2106*A*
SEISMIC DESIGN

2106*A*.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.

2106A.1.1 TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b). *Replace TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b) as follows:*

a. *Ties shall be at least* $^3/_8$ *inch (10 mm) 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.*
b. *The spacing of column ties shall be as follows: not greater than 8 bar diameters, 24 tie diameters, or one half the least dimension of the column, or 8 inches (203 mm) for the full column height.*

2106A.1.2 TMS 402, Chapter 5. *Add TMS 402, Section 5.6 as follows:*

5.6 – Lateral Support of Members

5.6.1 – 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.

2106A.1.3 TMS 402, Sections 7.4.4.1 and 7.4.5.1. *Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:*

7.4.4.1 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. Where stack bond is used in reinforced hollow-unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on 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 for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement..*

7.4.4.1.1 *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.*

7.4.4.1.2 *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.*

7.4.4.1.3 *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.

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

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

SECTION 2107*A*
ALLOWABLE STRESS DESIGN

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

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

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

$l_d = 0.002 d_b f_s$ **(Equation 21*A*-1)**

For SI: $l_d = 0.29 d_b f_s$

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

d_b = Diameter of reinforcement, inches (mm)

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

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

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

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

2107A.4 TMS 402, Section 8.3.4.4 Walls. *Modify TMS 402, Section 8.3.4.4 as follows by adding:*

8.3.4.4.1 *The minimum thickness of walls is given in this section. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.*

8.3.4.4.2 *The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio nor be less than the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.*

8.3.4.4.3 *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 hairpins.*

TABLE 8.3.4.4
MINIMUM THICKNESS OF MASONRY WALLS[1, 2]

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

1. *For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.*
2. *In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.*
3. *Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.*

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

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

2107A.6 Masonry Compressive Strength.

[OSHPD 1 & 4] *The specified compressive strength of structural masonry, f'_m, shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.*

[DSA-SS] *The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.*

SECTION 2108*A*
STRENGTH DESIGN OF MASONRY

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

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

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

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

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

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

2108A.4 TMS 402, Section 9.1.9.1.1. *Modify TMS 402, Section 9.1.9.1.1 as follows:*

9.1.9.1.1 Masonry compressive strength.

[OSHPD 1 & 4] The *specified* compressive strength of *structural* masonry, f'_m, shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength values in this chapter shall not exceed *3,000* psi *(20.7 MPa)* for concrete masonry and shall not exceed *4,500* psi (*31.03* MPa) for clay masonry.

[DSA-SS] *The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.*

SECTION 2109*A*
EMPIRICAL DESIGN OF ADOBE MASONRY

Not permitted by OSHPD and DSA.

SECTION 2110*A*
GLASS UNIT MASONRY

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

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

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

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $^3/_4$ hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways and ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404.6, Exception 2.

SECTION 2111*A*
MASONRY FIREPLACES

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

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

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

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

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

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

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 22 – STEEL

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

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	**X**			**X**	**X**								**X**										
Adopt entire chapter as amended (amended sections listed below)									**X**		**X**	**X**			**X**								
Adopt only those sections that are listed below																							
Chapter / Section																							
2201.1.1									X		X	X			X								
2201.1.2									X		X	X			X								
2201.1.3									X														
2201.1.4									X		X	X			X								
2204.1.1											X	X			X								
2204.4											X	X			X								
2205.1											X	X			X								
2205.2.1.2											X	X			X								
2205.3											X	X			X								
2205.4											X	X			X								
2206.2.1											X	X			X								
2207.4											X	X			X								
2207.6											X	X			X								
2208.1											X	X			X								
2210.1											X	X			X								
2210.1.1.2											X	X			X								
2210.2											X	X			X								
2211.1.1.2											X	X			X								
2211.1.3											X	X			X								
2211.2											X	X			X								
2212									X														
2213											X	X			X								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

tions 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 Steel storage racks. The design, testing and utilization of steel 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 steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.2 Steel cantilevered storage racks. The design, testing and utilization of steel 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 steel cantilevered storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.3 Certification. For rack storage structures that are 8 feet (2438 mm) in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a certificate of compliance shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

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.

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**												**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								
2303.1.3.1								X	X	X	X	X		X	X								
2303.1.4.1								X	X	X	X	X		X	X								
2303.2 – 2303.2.9			X																				
2303.4.1.4.1*, Exception 3*								X	X	X	X	X		X	X								
2303.4.3.1								X	X	X	X	X		X	X								
2304.3.1.1				X																			
2304.3.4								X	X	X	X	X		X	X								
2304.4.1								X	X	X	X	X			X								
2304.10.2.1								X		X	X	X		X	X								
2304.12.1.1.1																					X		
2304.12.1.2, *Exception*								X		X	X	X		X	X								
2304.12.1.4.1								X		X	X	X		X	X								
2304.12.8																					X		
2304.12.9																					X		
2305.1.2								X	X	X	X	X		X	X								
2308.2.7								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.

CHAPTER 23

WOOD

User notes:

About this chapter: *Chapter 23 provides minimum requirements for the design of buildings and structures that use wood and wood-based products. The chapter is organized around three design methodologies: allowable stress design (ASD), load and resistance factor design (LRFD) and conventional light-frame construction. In addition it allows the use of the American Wood Council Wood Frame Construction Manual for a limited range of structures. Included in the chapter are references to design and manufacturing standards for various wood and wood-based products; general construction requirements; design criteria for lateral force-resisting systems and specific requirements for the application of the three design methods.*

Code development reminder: *Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

SECTION 2301
GENERAL

2301.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of wood members and their fasteners.

[HCD 1] *For limited-density owner-built rural dwellings, owner-produced or used materials and appliances may be utilized unless found not to be of sufficient strength or durability to perform the intended function; owner-produced or used lumber, or shakes and shingles may be utilized unless found to contain dry rot, excessive splitting or other defects obviously rendering the material unfit in strength or durability for the intended purpose.*

2301.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *The scope of application of Chapter 23 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, regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.*

   Exception: *For applications listed in Section 1.10.3 (Licensed Clinics), the provisions of this chapter without OSHPD amendments identified in accordance with Section 2301.1.2 shall apply.*

2301.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *DSA-SS, DSA-SS/CC and OSHPD adopt this chapter and all amendments.*

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

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

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

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

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

2301.1.3 Reference to other chapters.

2301.1.3.1 [DSA-SS and OSHPD 1 & 4] *Where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21 and 22, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A, respectively shall apply instead.*

2301.1.3.2 [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

2301.1.4 Prohibition. [DSA-SS & DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *The following design methods, systems and materials are not permitted by DSA and OSHPD:*

1. *Straight-sheathed horizontal lumber diaphragms.*
2. *Gypsum-based sheathing shear walls and portland cement plaster shear walls.*
3. *Shear wall foundation anchor bolt washers in accordance with exception to AWC SDPWS Section 4.3.6.4.3.*
4. *Wood structural panel shear walls and diaphragms using staples as fasteners.*
5. *Unblocked shear walls.*
6. *Any wood structural panel sheathing used for diaphragms and shear walls that are part of the seismic*

force-resisting system, not applied directly to framing members.

7. *Single and double diagonally sheathed lumber walls used to resist seismic forces.*
8. *Log structures in accordance with ICC 400.*
9. ***[OSHPD 1, 1R, 2, 4 & 5]*** *Cross-laminated timber used as part of the seismic force-resisting system, unless approved as an alternative system in accordance with Section 104.11.*
10. ***[DSA-SS, DSA-SS/CC]*** *Cross-laminated timber used as part of the vertical seismic force-resisting system, unless approved as an alternative system in accordance with Section 104.11.*

2301.2 Nominal sizes. For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions (see Section 2304.2).

SECTION 2302
DESIGN REQUIREMENTS

2302.1 General. The design of structural elements or systems, constructed partially or wholly of wood or wood-based products, shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305 and 2306.
2. Load and resistance factor design in accordance with Sections 2304, 2305 and 2307.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.
4. AWC WFCM in accordance with Section 2309.
5. The design and construction of log structures in accordance with the provisions of ICC 400.

SECTION 2303
MINIMUM STANDARDS AND QUALITY

2303.1 General. Structural sawn lumber; end-jointed lumber; prefabricated wood I-joists; structural glued-laminated timber; wood structural panels; fiberboard sheathing (where used structurally); hardboard siding (where used structurally); particleboard; preservative-treated wood; structural log members; structural composite lumber; round timber poles and piles; fire-retardant-treated wood; hardwood plywood; wood trusses; joist hangers; nails; and staples shall conform to the applicable provisions of this section.

2303.1.1 Sawn lumber. Sawn lumber used for load-supporting purposes, including end-jointed or edge-glued lumber, machine stress-rated or machine-evaluated lumber, shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20 or equivalent. Grading practices and identification shall comply with rules published by an agency approved in accordance with the procedures of DOC PS 20 or equivalent procedures.

2303.1.1.1 Certificate of inspection. In lieu of a grade *mark* on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section is permitted to be accepted for precut, remanufactured or rough-sawn lumber and for sizes larger than 3 inches (76 mm) nominal thickness.

2303.1.1.2 End-jointed lumber. Approved end-jointed lumber is permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required to have a fire-resistance rating shall have the designation "Heat Resistant Adhesive" or "HRA" included in its grade mark.

2303.1.2 Prefabricated wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D5055.

2303.1.3 Structural glued-laminated timber. Glued-laminated timbers shall be manufactured and identified as required in ANSI/APA 190.1 and ASTM D3737.

2303.1.3.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *The construction documents shall indicate the following:*

1. *Dry or wet service conditions.*
2. *Laminating combinations and stress requirements.*
3. *Species group.*
4. *Preservative material and retention, when preservative treatment is required.*
5. *Provisions for protection during shipping and field handling, such as sealing and wrapping in accordance with AITC 111.*

When mechanical reinforcement such as radial tension reinforcement is required, such reinforcement shall comply with AITC 404 and shall be detailed accordingly in the construction documents. Construction documents shall specify that the moisture content of laminations at the time of manufacture shall not exceed 12 percent for dry conditions of use.

The design of fasteners and connections shall comply with AITC 117, Section I, Item 6 (Connection Design), and NDS Appendix E.

2303.1.4 Structural glued cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.

2303.1.4.1 Additional requirements. [DSA-SS & DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *Requirements in Section 2303.1.3.1 shall apply to glued cross-laminated timber.*

2303.1.5 Wood structural panels. Wood structural panels, where used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for their type in DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Each panel or member shall be identified for grade, bond classification, and Performance Category by the trademarks of an approved testing and grading agency. The Performance Category value shall be used as the "nominal panel thickness" or "panel thickness" whenever

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

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 [a, b] (inches)		NUMBER OF TOENAILS INTO SUPPORTS[c]
	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
$3^1/_2$ × 0.162	20	12	2
$3^1/_2$ × 0.148	19	11	2
$3^1/_2$ × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
$2^3/_4$ × 0.148	10	6	2
$2^3/_4$ × 0.131	9	6	3
$2^3/_4$ × 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.

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.

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 predrilled 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 2304.10.8.

2304.10.1 Connection fire-resistance rating. 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 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 2304.10.2.

2304.10.2.1 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.* <

2304.10.3 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.

2304.10.4 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.

2304.10.5 Other fasteners. Clips, staples, glues and other approved methods of fastening are permitted where approved.

2304.10.6 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 2304.10.6.1 through 2304.10.6.4. 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.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 24 – GLASS AND GLAZING

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

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X		X	X	X																		
Adopt entire chapter as amended (amended sections listed below)								X	X	X	X	X		X	X								
Adopt only those sections that are listed below																							
Chapter / Section																							
2401.1.1								X	X	X	X	X		X	X								
2401.1.2								X	X														
2401.1.2, Exception 1										X	X	X		X	X								
2403.2.1								X	X	X	X	X		X	X								
Table 2403.2.1								X	X	X	X	X		X	X								
2410								X	X	X	X	X		X	X								
2410.1, Exception												X											
2410.1.2, Exception								X	X														
2411										X	X	X		X	X								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 28 – MECHANICAL 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																							
Adopt entire chapter as amended (amended sections listed below)			X																				
Adopt only those sections that are listed below																							
Chapter / Section																							
2802			X																				

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 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**																
Chapter / Section																							
3001.3			X																				
3001.4			X			X	X																
3001.5			X																				
3001.6			X																				
3002.4a – 3002.4.6a			X																				
3002.5			X																				
3002.6.1			X																				
3002.9			X																				
3002.10 – 3002.11			X																				
3003.1			X																				
3003.1.4			X																				
3003.1.5			X																				
3003.2			X																				
3003.2.1			X																				
3003.2.1.1			X																				
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																				
3008.1.4			X																				
3003.1.5			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.

space, elevator control space or elevator control room where all the following are met:

1. *The requirements of NFPA 13, Section 9.3.6.3.*
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 1020.2, 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 pro-

tected 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 708.6 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.*

Exceptions:

1. *Below grade* parking garage *floors* shall not be required to *be served by* fire service access elevators.
2. The elevator shall not be required to serve the top floor of a building where that floor is utilized only for equipment for building systems.

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 403.2.2.1 through 403.2.2.4.

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 footcandle (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.

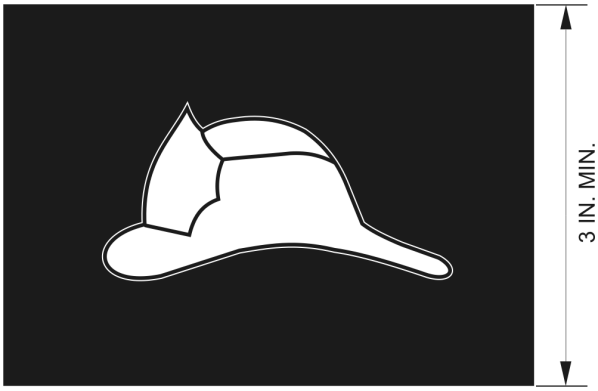
3007.6.3 Lobby doorways. Other than doors to the hoistway, elevator control room or elevator control space, each doorway to an enclosed fire service access elevator lobby shall be provided with a $^{3}/_{4}$-hour fire door assembly complying with Section 716. The fire door assembly shall comply with 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^2) 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 S.I. 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 e*levators *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 *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*, and 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 403.2.2.1 through 403.2.2.4.

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^2) 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 52 inches (760 mm by 1320 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 pro-

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			X																				
3103			X																				
3104			X																				
3104.2, *Exception 2*						X	X																
3105			X																				
3106			X																				
3109				†	†																		
3109.1								X	X														
3109.2, Note	X																						
3110			X																				
3111			X																				
3111.1.1, *Exception*				X	X			X	X														
3111.3.5 - 3111.3.5.2			X																				
3112.2				X																			
3112.3, *Exception*								X	X														
3113				†	†																		
3113.1				X	X			X	X														
3113.1.1								X	X														
3113.2, *Exception*								X	X														
3113.3, *Exception*								X	X														
3113.4*, Exception*								X	X														
3115			X							†	†	†	†	†	†								
3115.1, Exceptions				X	X			X	X														
3115.6, Exception								X	X														
3115.8.2								X	X														
3115.8.4.1 – 3115.8.4.3								X	X														
3115.8.5								X	X														
3115.9								X	X														

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS

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

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	**X**												**X**										
Adopt entire chapter as amended (amended sections listed below)			**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**		**X**	**X**								
Adopt only those sections that are listed below							**X**																**X**
Chapter/Section																							
AAMA 501.4-18								X	X	X	X	X		X	X								
AAMA 501.6-18								X	X	X	X	X		X	X								
AAMA TIR A8-16								X	X	X	X	X		X	X								
ACI 355.2-19								X	X	X	X	X		X	X								
ACI 355.4-19								X	X	X	X	X		X	X								
ACI 440.2R-08								X	X	X	X	X		X	X								
ACI 503.7-07								X	X	X	X	X		X	X								
ACI 506R-16								X	X	X	X	X		X	X								
ACI 506.2-13								X	X	†	†	†		†	†								
ACI 506.4R-94								†	†	X	X	X		X	X								
ACI 506.6T-17								†	†	X	X	X		X	X								
AISC 358-16/s1-18/s2-20								X	X														
ANSI/DASMA 103-2017				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	†	†	†		†	†								
ASME A17.1/CSA B44			X				X																
ASME A18.1-2014							X																
ASME BPE-2009			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 C618-15								†	†	X	X	X		X	X								
ASTM C618-19								X	X	†	†	†		†	†								
ASTM C635/C635M-*13a*								†	†	X	X	X		X	X								
ASTM C636/C636M-*17*								X	X														
ASTM C989-16e1								†	†	X	X	X		X	X								
ASTM C989-18a								X	X	†	†	†		†	†								
ASTM C1019-16								X	X	X	X	X		X	X								
ASTM C1249-18								X	X	X	X	X		X	X								
ASTM C1392-20								X	X	X	X	X		X	X								
ASTM C1394-20								X	X	X	X	X		X	X								
ASTM C1401-14								X	X	X	X	X		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 C1586-05 (2011)								X	X	X	X	X		X	X								
ASTM D1586-20								X	X	X	X	X		X	X								
ASTM D3966-07 (2013)								X	X	X	X	X		X	X								
ASTM D5778-20								X	X	X	X	X		X	X								
ASTM E108-*2020a*			X																				
ASTM E580/E580M-17								X	X	X	X	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																
ASTM F2374			X																				
AWS D1.1/D1.1M-15								X	X	X	X	X		X	X								
AWS D1.2/D1.2M-14								X	X	X	X	X		X	X								
AWS D1.3/D1.3M-08								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																
FEMA P-2082-1								†	†	X	X	X		X	X								
FM 1950-16								X	X	X	X	X		X	X								
FM 3011-99			X																				
FM 3260-00			X																				
FM 4430-80			X																				
*ICC-ES AC01-21**								X	X	X	X	X		X	X								
*ICC-ES AC58-21**								X	X	X	X	X		X	X								
*ICC-ES AC70-21**								X	X	X	X	X		X	X								
ICC-ES AC77			X																				
*ICC-ES AC106-21**								X	X	X	X	X		X	X								
*ICC-ES AC125-21**								X	X	X	X	X		X	X								
*ICC-ES AC156-21**								X	X	X	X	X		X	X								
*ICC-ES AC178-21**								X	X	X	X	X		X	X								
*ICC-ES AC193-21**								X	X	X	X	X		X	X								
*ICC-ES AC232-21**								X	X	X	X	X		X	X								
*ICC-ES AC308-21**								X	X	X	X	X		X	X								

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X												X										
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X								
Adopt only those sections that are listed below							X																X
Chapter / Section																							
ICC ES AC331			X																				
*ICC-ES AC358-21**								X	X	X	X	X		X	X								
*ICC-ES AC446-21**								X	X	X	X	X		X	X								
ISO 9001-15								X	X	X	X	X		X	X								
NFPA 10-*21*			X																				
NFPA 11-16																							X
NFPA 13-*22*			X																				
NFPA 13D-*22*			X																				
NFPA 13R-22			X																				
NFPA 14-19			X																				
NFPA 24-22			X																				X
NFPA 25-13CA			X																				X
NFPA 32-16			X																				
NFPA 37-18			X																				
NFPA 54-18			X																				
NFPA 72-22			X				X																X
NFPA 110-16																							X
NFPA 111-13																							X
NFPA 130-20			X																				
NFPA 409-*22*			X																				
NFPA 502-20			X																				
NFPA 1124-17			X																				
NFPA 2001-18			X																				
PCI MNL 120-17								X	X	X	X	X		X	X								
PTI DC35.1-14								X	X	X	X	X		X	X								
SFM 12-3			X																				
SFM 12-7-3			X																				
SFM 12-7A-1			X																				
SFM 12-7A-2			X																				
SFM 12-7A-3			X																				
SFM 12-7A-4			X																				
SFM 12-7A-4A			X																				
SFM 12-7A-5			X																				
SFM 12-8-100			X																				
SFM 12-10-1			X																				
SFM 12-10-2			X																				
SFM 12-10-3			X																				
UBC 15-2			X																				
UBC 15-3			X																				
UBC 15-4			X																				
UL 13-96			X																				
UL 38-99			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																							
UL 193-04			X																				
UL 199-95			X																				
UL 228-97			X																				
UL 260-04			X																				
UL 262-04			X																				
UL 268A-09			X																				
UL 312-04			X																				
UL 346-05			X																				
UL 464-03			X																				
UL 497B-04			X																				
UL 521-99			X																				
UL 539-00			X																				
UL 632-00			X																				
UL 753-04			X																				
UL 790 *Edition 9-2022*			X																				
UL 813-96			X																				
UL 857-13								†	†	X	X	X		X	X								
UL 864-2014			X																				

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 35

REFERENCED STANDARDS

User note:

About this chapter: The California Building Code *contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Chapter 1, Scope and Administration, Division 1, Sections 1.1.5 and 1.1.7, and in Chapter 1, Scope and Administration, Division II, Section 102.4, *as applicable.*

[DSA-SS, DSA-SS/CC & OSHPD 1 & 4] Reference to other chapters. *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A.*

AA

Aluminum Association
1400 Crystal Drive, Suite 430
Arlington, VA 22202

ADM—2020: Aluminum Design Manual
1604.3.5, 2002.1

ASM 35—00: Aluminum Sheet Metal Work in Building Construction (Fourth Edition)
2002.1

AAMA

American Architectural Manufacturers Association
1900 E Golf Road, Suite 1250
Schaumburg, IL 60173

711—20: Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
1404.4

714—19: Voluntary Specification for Liquid Applied Flashing Used to Create a Water-resistive Seal around Exterior Wall Openings in Buildings
1404.4

1402—09: Standard Specifications for Aluminum Siding, Soffit and Fascia
1403.5.1

2502—19: Comparative Analysis Procedure for Window and Door Products
1709.5

AAMA/WDMA/CSA 101/I.S.2/A440—17: North American Fenestration Standard/Specifications for Windows, Doors and Skylights
1709.5.1, 2405.5

501.4-18: Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts
[OSHPD 1 & 4] Section 7.2.5, *Replace "elastic design displacement" with "design story drifts associated with the design earthquake".*
2410.1

501.6-18: Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System
2410.1

TIR A8-16: Structural Performance of Composite Thermal Barrier Framing Systems
2411.1

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331-3439

117—10: Specification for Tolerances for Concrete Construction and Materials
1901.7.1

216.1—14: Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Table 721.1(2), 722.1

318—19: Building Code Requirements for Structural Concrete
722.2.4.3, 1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, *Table 1705A.2.1*, *Table 1705A.3*, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11, 1810.3.11.1, 1810.3.12, 1810.3.13, *1810A.3.10.4*, 1901.2, 1901.3, *1901.3.4.4*, 1902.1, *1903A*, 1903.1, *1904A*, 1904.1, 1904.2, *1905A*, 1905.1, 1905.1.1, 1905.1.2, 1905.1.3, 1905.1.4, 1905.1.5, 1905.1.6, 1905.1.7, 1905.1.8, 1908.1, *1909.2*, *1909.3*, *1910A.5.4*, 2108.3, 2206.1

355.2—19: Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
1617A.1.19, *1901.3.2*

355.4—19: Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
1617A.1.19, *1901.3.3*

440.2R-08: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
1911.3, *1911A.3*

503.7—07: Specification for Crack Repair by Epoxy Injection
1911.2, *1911A.2*

506R—16: Guide to Shotcrete
1908.1, *1908A.1*

506.2—13: [DSA-SS, DSA-SS/CC] Guide to Shotcrete
1908A.1, *1908A.9*

506.4R—94: [OSHPD] Guide for the Evaluation of Shotcrete
1908.1, *1908A.1*

506.6T—17: [OSHPD] Visual Shotcrete Core Quality Evaluation
1908.1, *1908A.1*

550.5—18: Code Requirements for the Design of Precast Concrete Diaphragms for Earthquake Motions
Table 1705.3

ITG—7-09: Specification for Tolerances for Precast Concrete
1901.7.2

AISC

American Institute of Steel
130 East Randolph Street, Suite 2000
Chicago, IL 60601-6219

ANSI/AISC 341—16: Seismic Provisions for Structural Steel Buildings
1705.13.1.1, 1705.13.1.2, 1705.14.1.1, 1705.14.1.2, *1705A.2.1*, *1705A.2.5*, 1810.3.5.3.1, *2205A*, 2205.2.1.1, 2205.2.1.2, 2205.2.2, *2205.3*, *2206A*, 2206.2.1, *2212.2*

ANSI/AISC 358—16/s1—18: Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications, Including Supplement No. 1
1705*A*.2.1, *2205A*, 2205.2.1.1, 2205.2.1.2, *2205.4*, *2206A.2*, *2206.2.1*

ANSI/AISC 358—16/s1—18/*s2—20*: *[DSA-SS, DSA-SS/CC]* Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications, Including Supplement No. 1 *and No. 2*
1705A.2.1, *2205A*, 2205.2.1.1, 2205.2.1.2, *2206A.2*, *2212.3*

ANSI/AISC 360—16: Specification for Structural Steel Buildings
722.5.2.2.1, 1604.3.3, 1705.2.1, *1705A.2.1*, *Table 1705A.2.1*, *1705A.2.5*, 2202.1, 2203.1, *2204.4*, *2204A.4*, 2205.1, 2205.2.1.1, 2206.1, *2212.1.1*, *2212A.1.2*. *2212A.2.1*

APA—continued

APA S560—20: 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—18: Glulam in Residential Construction—Building—Construction Guide
2306.1

ASABE

American Society of Agricultural and Biological Engineers
2950 Niles Road
St. Joseph, MI 49085

EP 484.3 DEC2017: Diaphragm Design of Metal-clad, Wood-frame Rectangular Buildings
2306.1

EP 486.3 SEP2017: Shallow-post and Pier Foundation Design
2306.1

EP 559.1 AUG2010(R2019): 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

7—16 with Supplements 1, *2 and 3*: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
104.11, 202, Table 1504.2, *Table 1504.8*, *1510.7.1*, 1602.1, *1603A.1.5*, *1603A.2*, Table 1604.3, *1604.4*, *1604A.4*, 1604.5, Table 1604.5, 1604.8.2, 1604.9, 1605.1, 1605.1.1, 1605.2, 1606.3, 1607.9.1, 1607.9.1.1, 1607.9.1.2, 1607.10, 1607.14.1, 1607.17, 1608.1, 1608.2, Figure 1608.2(1), 1608.3, 1609.1.1, 1609.2, 1609.3, Figure 1609.3(5), Figure 1609.3(6), Figure 1609.3(7), Figure 1609.3(8), Figure 1609.3(9), Figure 1609.3(10), Figure 1609.3(11), Figure 1609.3(12), 1609.5.1, 1609.5.3, 1611.1, 1611.2, 1612.2, 1613.1, 1613.2.2, 1613.2.3, Table 1613.2.3(1), Table 1613.2.3(2), 1613.2.5, 1613.2.5.1, 1613.2.5.2, 1613.3, 1614.1, 1615.1, *1617*, *1617A*, 1705.13, 1705.13.1.1, 1705.13.1.2, 1705.13.4, 1705.14.1.1, 1705.14.1.2, 1705.14.2, 1705.14.3, 1705.14.4, 1709.5, 1709.5.3.1, 1802.1, 1803.5.12, *1803A.6*, 1806.1, *1807A.2.5*, *1811A.4*, 1808.3, 1808.3.1, 1809.13, 1810.3.1.1, 1810.3.6.1, 1810.3.8, 1810.3.9.2, 1810.3.9.4, 1810.3.9.4.1, 1810.3.9.4.2, 1810.3.11.2, 1810.3.12, 1811*A*.4, 1902.1, 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, *2210A.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, *3115.8.4.2*

8—02: 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, 1612.2, 1612.4, 2702.1.8, 3001.3

29—05: Standard Calculation Methods for Structural Fire Protection
722.1

32—01: Design and Construction of Frost Protected Shallow Foundations
1809.5

41—13: [OSHPD] 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

49—12: Wind Tunnel Testing for Buildings and Other Structures
1609.1.1

55—16: Tensile Membrane Structures
3102.2

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329USA

170—2017: Ventilation of Health Care Facilities
1020.6

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016

A17.1—2019/CSA B44—19: Safety Code for Elevators and Escalators
11B-407.1, 11B-407.1.1, 11B-407.4.9, 11B-408.1, 11B-409.1, 11B-411.1, 11B-810.9, 1607.11.1, 3001.4

> **A17.1—CSA B44: *the edition as referenced in*: *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* Safety Code for Elevators and Escalators**
907.3.3, 911.1.6, 1009.4.1, 3001.*3*, Table 3001.3, 3001.5, 3002.5, *3002.6.1,* 3003.2, 3007.1, 3008.1.4, 3008.7.1

A17.7—2007/CSA B44—07(R2017): Performance-based Safety Code for Elevators and Escalators
Table 3001.3, 3001.5, 3002.5

A18.1—2020: Safety Standard for Platform Lifts and Stairway Chairlifts
1110.9, Table 3001.3

A90.1—2015: Safety Standard for Belt Manlifts
Table 3001.3

B16.18—2018: Cast Copper Alloy Solder Joint Pressure Fittings
909.13.1

B16.22—2018: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
909.13.1

B20.1—2018: 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—2020: Process Piping
415.11.7

ASSP

American Society of Safety Professionals
520 N. Northwest Highway
Park Ridge, IL 60068

ANSI/ASSE Z359.1—2020: The Fall Protection Code
1015.6, 1015.7

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

A6/A6M—2017A: 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—2016A: Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware
2304.10.2.1, 2304.10.6

A227/A227M—17: Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs
1211.1.1

ASTM—continued

E90—2009(2016): Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
1206.2, 1206.2.1

E96/E96M—2016: Standard Test Methods for Water Vapor Transmission of Materials
202, 1202.3, 1404.3.1

E108—*2020a*: Standard Test Methods for Fire Tests of Roof Coverings
1505.1, 2603.6, 2610.2, 2610.3

E119—2018B: Standard Test Methods for Fire Tests of Building Construction and Materials
703.2.1.1, 703.2.1.3, 703.2.1.4, 703.2.1.5, 703.2.2, 703.4, 703.6, 704.12, 705.7, 705.8.5, 707.6, 712.1.13.2, 714.4.1, 714.5.1, 715.3, 715.4, 715.4.1, Table 716.1(1), Table 716.1(2), Table 716.1(3), 716.1.2.3, 716.2.5.1.1, 716.2.5.4, 716.3.2.1.1, 717.3.1, 717.5.2, 717.5.3, 717.6.1, 717.6.2, Table 721.1(1), 2103.1, 2603.5.1

E136—2019: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
703.3.1

E283—04(2012): Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences across the Specimen
202

E330/E330M—14: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
1709.5.2, 1709.5.2.1, 1709.5.3.1

E331—2000(2016): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
1402.2, 1403.2

E336—19a: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
1206.2

E492—2009(2016)E1: Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-ceiling Assemblies Using the Tapping Machine
1206.3

E580/E580M—17: Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions
1617.11.16, 1617A.1.21

E605/E605M—93(2015)e1: Test Method for Thickness and Density of Sprayed Fire-resistive Material (SFRM) Applied to Structural Members
1705.15

E648—2017A: Standard Test Method for Critical Radiant Flux of Floor-covering Systems Using a Radiant Heat Energy Source
406.2.4, 424.2, 804.2, 804.3, *804.4.1, 804.4.2*

E662—17a: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
804.4.1, 804.4.2

E681—09(2015): Test Methods for Concentration Limits of Flammability of Chemical Vapors and Gases
202

E736/E736M—2017: Test Method for Cohesion/Adhesion of Sprayed Fire-resistive Materials Applied to Structural Members
704.13.3.2, 1705.15.6

E814—2013A(2017): Test Method for Fire Tests of Penetration Firestop Systems
202, 714.4.1.2, 714.4.2, 714.5.1.2

E970—2017: Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source
720.3.1

E1007—19: Test Method f or Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
1206.3

E1300—2016: Practice for Determining Load Resistance of Glass in Buildings
2404.1, 2404.2, 2404.3.1, 2404.3.2, 2404.3.3, 2404.3.4, 2404.3.5

ASTM—continued

E1354—2017: Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
424.2, 602.4.1.1, 602.4.2.1, 602.4.3.1, 1402.5

E1592—2005(2017): Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
1504.4.2

E1602—2003(2017): Guide for Construction of Solid Fuel-burning Masonry Heaters
2112.2

E1886—2013A: Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
1609.2, 1709.5.3.1

E1966—2015: Standard Test Method for Fire-resistive Joint Systems
202, 715.3.1, 1709.5.3.1

E1996—2017: Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
1609.2, 1609.2.2, 1709.5.3.1

E2072—14: Standard Specification for Photoluminescent (Phosphorescent) Safety Markings
1025.4

E2174—2018: Standard Practice for On-site Inspection of Installed Fire Stops
1705.18.1

E2178—13: Standard Test Method for Air Permeance of Building Materials
202

E2273—2018: Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
1407.4.1, 2510.6.2

E2307—15BE1: Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using the Intermediate-scale, Multistory Test Apparatus
715.4

E2353—2016: Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards and Balustrades
2407.1.2

E2392 / E2392M—10(2016): Standard Guide for Design of Earthen Wall Building Systems
2109.2.4.8.9.2

E2393—10a(2015): Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
1705.18.2

E2404—2017: Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facing and Veneers to Assess Surface Burning Characteristics
803.5.2, 803.12, 1402.5

E2556/E2556M—2010(2016): Standard Specification for Vapor Permeable Flexible Sheet Water-resistive Barriers Intended for Mechanical Attachment
1403.2, 2510.6.1

E2568—2017A: Standard Specification for PB Exterior Insulation and Finish Systems
1407.2

E2570/E2570M—07(2014)e1: Standard Test Method for Evaluating Water-resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) for EIFS with Drainage
1407.4.1.1, 1705.17.1

E2573—2017: Standard Practice for Specimen Preparation and Mounting of Site-fabricated Stretch Systems to Assess Surface Burning Characteristics
803.10

E2579—2015: Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics
803.11

ICC—continued

ICC-ES AC 178—21*: 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—21*: Acceptance Criteria for Mechanical Anchors in Concrete Elements
1617A.1.19, 1901.3.2

ICC-ES AC 232—21*: Acceptance Criteria for Anchor Channels in Concrete Elements
1617A.1.19, 1901.3.2

ICC-ES AC 308—21*: 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—21*: Acceptance Criteria for Helical Foundation Systems and Devices
1810A.3.1.5.1, 1810.3.1.5.1

ICC-ES AC 446—21*: Acceptance Criteria for Headed Cast-in Specialty Inserts in Concrete
1617A.1.19, 1901.3.2

ICC 1100—18: Standard for Spray-applied Foam Plastic Insulation
2603.1.1

SBCCI SSTD 11—97: Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles
1504.3.1.1, 1504.3.1.2, 1504.3.1.3

** Refers to International Building Code, 2021 as a reference standard.*

ISO

International Organization for Standardization
Chemin de Blandonnet 8
CP 401 1214 Vernier
Geneva, Switzerland

ISO 668—2013: Series 1 Freight Containers—Classifications, Dimensions and Ratings
Table 3115.8.5.3

ISO 1496-1—2013: Series 1 Freight Containers—Specification and Testing - Part 1: General Cargo Containers for General Purposes
3115.8, Table 3115.8.5.3

ISO 6346—1995: Freight Containers—Code, Identification and Marking with Amendment 3 - 2012
3115.3

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.14.3

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte, NC 28217

ANSI MH29.1—2012: Safety Requirements for Industrial Scissors Lifts
Table 3001.3

ANSI/MH16.1—12: Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks
Table 1705.13.7

NAAMM

National Association of Architectural Metal Manufacturers
800 Roosevelt Road, Bldg. C, Suite 312
Glen Ellyn, IL 60137

FP 1001—07: Guide Specifications for Design of Metal Flag Poles
1609.1.1

NCMA

National Concrete Masonry Association
13750 Sunrise Valley
Herndon, VA 20171

TEK 5—8B(2005): Details for Concrete Masonry Fire Walls
Table 721.1(2)

NEHRP

Building Seismic Safety Council
National Institute of Building Sciences
1090 Vermont Avenue NW
Suite 700
Washington, DC 20005

FEMA P-2082—1: Recommended Seismic Provisions for New Building and Other Structures, Volume 1, September 2020
1617A.1.3

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

04—21: Standard for Integrated Fire Protection and Life Safety System Testing
901.6.2.1, 901.6.2.2

10—2018: Standard for Portable Fire Extinguishers
906.2, Table 906.3(1), Table 906.3(2), 906.3.2, 906.3.4

11—16: Standard for Low-, Medium, and High Expansion Foam
904.7, *3109F*

12—15: Standard on Carbon Dioxide Extinguishing Systems
904.8, 904.13

12A—18: Standard on Halon 1301 Fire Extinguishing Systems
904.9

13—*22*: Standard for Installation of Sprinkler Systems *as amended**
403.3.3, 712.1.3.1, 903.3.1.1, 903.3.2, 903.3.8.2, 903.3.8.5, 904.13, 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 6.4.3.1.1* as follows:

6.4.3.1.1* *Pipe joints shall not be located under foundation footings. The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

2. Where allowed in accordance with Section 6.4.3.1.
3. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

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NFPA—continued

Revise Section 9.2.1.16 as follows:

9.2.1.16 *Exterior columns under 10 ft^2 (0.93m^2) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.*

Revise Section 9.2.3.1* as follows:

9.2.3.1* *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.9.2.3.1 of Annex

Revise Section 9.2.3.2

9.2.3.2 *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^3 (4.5 m^3) 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^2 (5.1 m^2).

Delete language to section 9.2.3.3 and reserve section number.
9.2.3.3 Reserved.

Delete Sections 9.3.6.1 and 9.3.6.2

9.3.6.1* Reserved.

9.3.6.2 ***Reserved.***

Revise Section 9.3.6.3 as follows:

9.3.6.3 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.

(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 Section 9.3.6.1.1 as follows:

9.3.6.1.1 *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 9.3.19.1* as follows:

9.3.19.1* *Unless the requirements of 9.2.3.1 or 9.2.3.2 are met, sprinklers shall be installed under exterior roofs, canopies, porte-cochere, balconies, decks or similar projections exceeding 4 ft (1.2 m) in width.*

Revise Annex Section A9.3.19.2 as follows:

A9.3.19.2 *The presence of planters, newspaper machines and similar items, should not be considered storage.*

Add Section 9.3.19.3 as follows:

9.3.19.3 *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.

NFPA—continued

Add new Sections 16.9.3.1.3.4 and 16.9.3.1.3.5 as follows:

16.9.3.1.3.4 *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.*

16.9.3.1.3.5 *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 16.9.10.5, 16.9.10.5.1, 16.9.10.5.1.1, 16.9.10.5.1.2, 16.9.10.5.1.3, 16.9.10.5.1.4, 16.9.10.5.2 as follows:

16.9.10.5 Sectional Valves.

16.9.10.5.1 *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.*

16.9.10.5.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

16.9.10.5.1.2 *Sectional control valves shall be indicating valves in accordance with Section 16.9.3.2.*

16.9.10.5.1.3 *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.*

16.9.10.5.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

16.9.10.5.2 *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 17.2.2.9.1 as follows:

17.2.2.9.1 *Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic design Categories C, D, E and F.*

Revise Section 18.5.11.4 as follows:

18.5.11.4 *Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.*

Replace Section 18.5.12.5 as follows:

18.5.12.5 *Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.*

Replace Section 18.5.12.6.1 as follows:

18.5.12.6.1 *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 18.5.9. Calculations shall be submitted to the authority having jurisdiction.*

Revise Section 18.5.12.7.4 as follows:

18.5.12.7.4 *Concrete anchors when identified in 18.5.11.11 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 18.6.1(3) as follows:

18.6.1*(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 19.2.3.1.5.2(9) as follows:

19.2.3.1.5.2(9) *Exterior columns under 10 ft^2 (0.93m^2) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system.*

Revise Section 19.2.3.2.3.1 as follows:

19.2.3.2.3.1 *Where listed quick-response sprinklers, excluding extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 19.2.3.2.3.1 when all of the following conditions are satisfied:*

(1) Wet pipe system
(2) Light hazard occupancy

NFPA—continued

Add new Section 6.2.2.1 as follows:

6.2.2.1 *Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.*

Add new Section 6.2.4 as follows:

6.2.4 *Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multipurpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.*

Revise Section 8.3.4 as follows:

8.3.4* Sprinklers shall not be required in *detached* garages, open attached porches, carports *with no habitable space above,* and similar structures.

Add *new* Sections *8.3.11 and 8.3.11.1* as follows:

8.3.11 Solar photovoltaic panel structures

8.3.11.1 *Sprinklers shall be permitted to be omitted from the following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

13R—*22*: Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies, *as amended**

903.3.1.2, 903.3.5.2, 903.4

****NFPA 13R, Amended Sections as follows:***

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.

Add new Sections 6.6.10 and 6.10.1 as follows:

6.6.10 Solar photovoltaic panel structures

6.6.10.1 *Sprinklers shall be permitted to be omitted from the following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

Revise Section 11.4 as follows:

11.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

(1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

(2) NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 2013 California Edition and Title 19, California Code of Regulations, Chapter 5.

(3) Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, California Code of Regulations, Chapter 5, shall be affixed to each system riser.

14—19: Standard for the Installation of Standpipe and Hose System, *as amended**

905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

****NFPA 14, Amended Sections as follows:***

Replace Section 6.3.7.1

6.3.7.1 *System water supply valves, isolation control valves and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:*

(1) Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) a central station, proprietary or remote supervising station, or

(b) a local signaling service that initiates an audible signal at a constantly attended location.

NFPA—continued

(2) Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) Locking the valves in the open position, or

(b) Sealing of valves and an approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

16—19: Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems
904.7, 904.13

17—21: Standard for Dry Chemical Extinguishing Systems
904.6, 904.13

17A—21: Standard for Wet Chemical Extinguishing Systems
904.5, 904.13

20—19: Standard for the Installation of Stationary Pumps for Fire Protection
412.2.4.1, 913.1, 913.2, 913.2.1, 913.5

24—22: Standard for Installation of Private Fire Service Mains and Their Appurtenances, as amended*
3109F

NFPA 24, Amended Sections as follows:

Amend Section 4.2.1 as follows:

Section 4.2.1. Installation work shall be done by fully experienced and responsible *contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.*

Revise Section 4.2.2 as follows:

4.2.2 *Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from* the authority having jurisdiction.

Add Section 4.2.2.1 as follows:

4.2.2.1 *As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.*

Revise Section 5.9.5.1 as follows:

5.9.5.1 Fire department connections shall be on the street side of buildings and *as approved by the authority having jurisdiction.*

Add Sections 6.6.1.1, 6.6.1.2, 6.6.1.3 and 6.6.1.4 as follows:

6.6.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

6.6.1.2 *Sectional control valves shall be indicating valves in accordance with NFPA 13, Section 6.7.1.3.*

6.6.1.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

6.6.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

Revise Section 10.4.3.1.1 as follows:

10.4.3.1.1 Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

1. Where allowed in accordance with 10.4.3.2.

2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

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—21: Flammable and Combustible Liquids Code
415.6.1, 415.6.2, 507.8.1.1.1, 507.8.1.1.2

30A—21: Code for Motor Fuel Dispensing Facilities and Repair Garages
406.2.9.2

NFPA—continued

Amend Section 5.4.1.1 to read as follows:

5.4.1.1 Enclosed stations shall be provided with a fire command center in accordance with *Section 911.1.1 through 911.5 of the California Building Code.*

Amend Section 5.4.4.1 to read as follows:

5.4.4.1* An automatic sprinkler protection system shall be provided *where required by Section 903 of the California Building Code.*

Delete Section 5.4.4.2.

Amend Section 5.4.5.1 to read as follows:

5.4.5.1* Class I standpipes shall be installed *where required by Chapter 9 of the California Building Code* in accordance with NFPA 14 except as modified herein.

Amend Section 7.3.2.1 to read as follows:

7.3.2.1 The fan inlet airflow hot temperature shall be determined by an engineering analysis, however, this temperature shall not be less than *482*°C (*250*°F). *Ventilation fans and related components shall be capable of withstanding the maximum anticipated plus/minus pressure transients induced by train operations.*

Add Section 7.6.1.1 to read as follows:

7.6.1.1 *Ventilation of stations shall not terminate at grade on any vehicle roadway.*

Amend Section 7.7.1 to read as follows:

7.7.1 Operation of the emergency ventilation system components shall be *capable of automatic and manual initiation in accordance with 909.12.3 of the California Building Code.*

Amend Section 7.8.1 to read as follows:

7.8.1 The design of the power for the emergency ventilation system shall comply with the requirements of Article 700 of *the California Electrical Code and Section 909 of the California Building Code.*

170—18: Standard for Fire Safety and Emergency Symbols

1025.2.6.1

211—19: Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances

2112.5

221—21: Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls

706.2, Table 716.1(2)

252—17: Standard Methods of Fire Tests of Door Assemblies

Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.1.2, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

253—19: Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

406.2.4, 424.2, 804.2, 804.3

257—17: Standard for Fire Test for Window and Glass Block Assemblies

Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4

259—18: Standard Test Method for Potential Heat of Building Materials

2603.4.1.10, 2603.5.3

265—19: Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

803.5.1, 803.5.1.1

268—19: Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source

1405.1.1.1, 1405.1.1.1.1, 1405.1.1.1.2, 2603.5.7

275—17: Standard Method of Fire Tests for the Evaluation of Thermal Barriers

508.4.4.1, 509.4.1.1, 1406.10.2, 1408.10.2, 2603.4

276—19: Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components

1508.1, 2603.3, 2603.4.1.5

285—19: Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components

718.2.6, 1402.5, 1406.10.3, 1408.10.4, 1511.6.2, 2603.5.5

NFPA—continued

286—15: Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
402.6.4.4, 424.2, 803.1.1, 803.1.1.1, 803.11, 803.12, 803.13, 1406.10.2, 1408.10.3, 2603.7, 2603.9, 2604.2.4, 2614.4, 3105.3

288—17: Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal in Fire-resistance-rated Floor Systems
712.1.13.1

289—19: Standard Method of Fire Test for Individual Fuel Packages
402.6.2, 402.6.4.5, 424.2, 806.4

409—*22*: Standard for Aircraft Hangars
412.3.6, Table 412.3.6, 412.3.6.1, 412.5.5

418—16: Standard for Heliports
412.7.4

484—19: Standard for Combustible Metals
426.1

502—20*: *Standard for Road Tunnels, Bridges, and Other Limited Access Highways
429

652—19: Standard on the Fundamentals of Combustible Dust
426.1

654—20: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids
426.1

655—17: Standard for the Prevention of Sulfur Fires and Explosions
426.1

664—20: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
426.1

701—19: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
410.2.6, 424.2, 806.4, 3102.3, 3102.3.1, 3102.6.1.1, 3105.3

704—17: Standard System for the Identification of the Hazards of Materials for Emergency Response
202, 415.5.2

750—19: Standard on Water Mist Fire Protection Systems
202, 904.11.1.1, 904.13

1124—17: Code for the Manufacture, Transportation and Storage *and Retail Sales* **of Fireworks and Pyrotechnic Articles**
415.6.4.1

2001—18: Standard on Clean Agent Fire Extinguishing Systems, *as amended
904.10

NFPA 2001, Amended Sections as follows:

Add Sections 4.3.5.1.1 and 4.3.5.2.1 to read as follows:

4.3.5.1.1 *Alarms signals from the fire extinguishing system shall not interfere with the building fire alarm signal.*

4.3.5.2.1 *The lens on visual appliances shall be "red" in color.*

Exception: *Other lens colors are permitted where approved by the enforcing agency.*

2010—20: Standard for Fixed Aerosol Fire-extinguishing Systems
904.12

PCI

Precast Prestressed Concrete Institute
8770 West Bryn Mawr, Suite 1150
Chicago, IL 60631-3517

PCI 124—18: Specification for Fire Resistance of Precast Prestressed Concrete
722.1, 722.2.3.1

PCI 128—19: Specification for Glass Fiber Reinforced Concrete Panels
1903.3

MNL 120—17: PCI Design Handbook 8th Edition
1905A.1.1, 1905A.1.2

UL—continued

346—05: Waterflow Indicators for Fire Protective Signaling Systems

464—03: Audible Signal Appliances—with Revisions through October 10, 2003

497B—04: Protectors for Data Communication and Fire Alarm Circuits

521—99: Heat Detectors for Fire Protective Signaling Systems—with Revisions through July 20, 2005

539—00: Single- and Multiple-Station Heat Detectors—with Revisions through August 15, 2005

555—2006: Fire Dampers—with Revisions through October 2016
717.3.1

555C—2014: Ceiling Dampers—with Revisions through May 2017
717.3.1

555S—2014: Smoke Dampers—with Revisions through October 2016
717.3.1

580—2006: Test for Uplift Resistance of Roof Assemblies—with Revisions through October 2018
1504.4.1, 1504.4.2

632—00: Electrically Actuated Transmitters

641—2010: Type L Low-temperature Venting Systems—with Revisions through April 2018
2113.11.1.4

710B—2011: Recirculating Systems—with Revisions through August 2014
904.13

723—2018: Test for Surface Burning Characteristics of Building Materials
202, 402.6.4.4, 406.7.2, 720.1, 720.4, 803.1.2, 803.5.2, 803.10, 803.11, 803.12, 803.13, 806.7, 1402.5, 1403.12.1, 1406.9, 1406.10.1, 1408.9, 1408.10.1, 1511.6.2, 1511.6.3, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2603.5.5, 2603.7, 2604.2.4, 2606.4, 2612.3, 2614.3, 3105.3

723S—2006: Drop-Out Ceilings Installed Beneath Automatic Sprinklers
2606.7.4

753—04: Alarm Accessories for Automatic Water Supply Valves for Fire Protection Service

790 *Edition 9—2022*: Standard Test Methods for Fire Tests of Roof Coverings
1505.1, 2603.6, 2610.2, 2610.3

793—2008: Automatically Operated Roof Vents for Smoke and Heat—with Revisions through March 2017
910.3.1

813—96: Commercial Audio Equipment—with Revisions through December 7, 1999

857—13: Busways
1705A.14.3.1

864—2014: Control Units and Accessories for Fire Alarm Systems *as amended**—**with Revisions through March 2018**
909.12

Amend No. 55.1 as follows:

RETARD-RESET-RESTART PERIOD – MAXIMUM 30 SECONDS —*No alarm obtained from control unit. Maximum permissible time is 30 seconds.*

Amend Section 55.2.2 as follows:

Where an alarm verification feature is provided, the maximum retard-reset-restart period before an alarm signal can be confirmed and indicated at the control unit, including any control unit reset time and the power-up time for the detector to become operational for alarm, shall not exceed 30 seconds. (The balance of the section text is to remain unchanged).

Add Section 55.2.9 as follows:

Smoke detectors connected to an alarm verification feature shall not be used as releasing devices.

Exception: *Smoke detectors which operate their releasing function immediately upon alarm actuation independent of alarm verification feature.*

Amend Section 89.1.10 as follows:

The existing text of this section is to remain as printed with one editorial amendment as follows:

THE TOTAL DELAY (CONTROL UNIT PLUS SMOKE DETECTORS) SHALL NOT EXCEED 30 SECONDS.

(The balance of the section text is to remain unchanged).

UL—continued

924—2016: Safety Emergency Lighting and Power Equipment—with Revisions through May 2018
1013.5

1040—1996: Fire Test of Insulated Wall Construction—with Revisions through April 2017
1406.10.2, 2603.9

1256—02: Fire Test of Roof Deck Construction—with Revisions through August 2018
1508.1, 2603.3, 2603.4.1.5

1479—2015: Fire Tests of Penetration Firestops
202, 714.4.1.2, 714.4.2, 714.5.1.2, 714.5.4

1482—2011: Solid-fuel Type Room Heaters—with Revisions through August 2015
2112.2, 2112.5

1489—2016: Fire Resistant Pipe Protection Systems Carrying Combustible Liquids
403.4.8.2

1703—2002: Flat-plate Photovoltaic Modules and Panels—with Revisions through September 2018
1507.17.5, 3111.3.1

1715—97: Fire Test of Interior Finish Material—with Revisions through April 2017
1406.10.2, 2603.9, 2614.4

1741—2010: Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources—with Revisions through February 2018
3111.3.1

1777—2007: Chimney Liners—with Revisions through April 2014
2113.11.1, 2113.19

1784—2015: Air Leakage Tests of Door Assemblies
405.4.3, 710.5.2.2, 710.5.2.2.1, 716.2.1.4, 716.2.9.1, 716.2.9.3, 3006.3, 3007.6.3, 3008.6.3

1897—2015: Uplift Tests for Roof Covering Systems
1504.4.1, 1504.4.3

1975—06: Fire Tests for Foamed Plastics Used for Decorative Purposes
402.6.2, 402.6.4.5, 424.2

1994—2015: Luminous Egress Path Marking Systems
411.6, 1008.2.1, 1025.2.1, 1025.2.3, 1025.2.4, 1025.2.5, 1025.4

2034—2017: Single- and Multiple-station Carbon Monoxide Alarms—with Revisions through September 2018
915.4.2, 915.4.4

2075—2013: Standard for Gas and Vapor Detectors and Sensors—with Revisions through December 2017
915.5.1, 915.5.3

2079—2015: Tests for Fire Resistance of Building Joint Systems
202, 715.3.1, 715.8

2196—2017: Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables
909.20.7.1, 913.2.2, 2702.3, 3007.8.1, 3008.8.2

2200—2012: Stationary Engine Generator Assemblies—with Revisions through October 2015
2702.1.1

2202—2009: Electric Vehicle (EV) Charging System Equipment—with Revisions through February 2018
406.2.7

2594—2016: Electric Vehicle Supply Equipment
406.2.7

2703—2014: Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-plate Photovoltaic Modules and Panels—with Revisions through December 2019
1505.9

7103—19: Outline of Investigation for Building-Integrated Photovoltaic Roof Coverings
Table 1504.2, 1507.16.6

61730-1—2017: Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction
1507.16.6, 1507.17.5, *1511.9*, 3111.3.1

61730-2—2017: Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing
1507.16.6, 1507.17.5, *1511.9*, 3111.3.1

E

F

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HISTORY NOTE APPENDIX

2022 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* 2019 Triennial Edition, effective January 1, 2020.

1. (BSC 05/21, CEC 03/21, HCD 05/21, DSA/AC 01/21, DSA-SS/CC 05/21, SFM 04/21, OSHPD 04/21 and OSHPD 06/21)—Adoption by reference of the 2021 *International Building Code* with necessary amendments to become the 2022 *California Building Code*, and repeal of the 2018 edition of the *International Building Code*; effective on January 1, 2023.
2. Erratum to correct editorial errors in Matrix Adoption Tables and miscellaneous corrections throughout chapters 1, 2, 4, 5, 7, 7A, 9, 10, 12, 14, 16, 17, 18A, 19, 19A, 21A, 27, and 35, effective January 1, 2023.
3. 2022 Intervening Cycle update (DSA-SS/CC 03/22, OSHPD 03/22, SFM 02/22)—Adoption of amendments to the 2022 *California Building Code.* Effective on July 1, 2024.

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Significant Changes to the California Building Code, 2022 Edition	Search #5521S22
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