

CHAPTER 22A STEEL

Adopt and/or codify chapter as amended below:

PROPOSED ADOPTION	DSA-SS	DSA-SS/CC	Comments
Adopt entire chapter without amendments			
Adopt entire chapter as amended	X	-	
Adopt only those sections listed below			

(All existing amendments that are not revised below shall continue without any change)

DRAFT INITIAL EXPRESS TERMS

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SECTION 2201A GENERAL

2201A.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201A.1.1 Application. *The scope of application of Chapter 22A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state- owned or state-leased essential services buildings.*
2. *(Reserved for OSHPD)*

Exception: [Reserved for OSHPD]

2201A.1.2 Identification of amendments. DSA-SS adopts this chapter and all amendments.

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

1. Division of the State Architect-Structural Safety: [DSA-SS] For applications listed in Section 1.9.2.1.
2. [Reserved for OSHPD]

SECTION 2202A DEFINITIONS

2202A.1 Definitions. The following terms are defined in Chapter 2.

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SECTION 2204A CONNECTIONS

2204A.1 Welding. The details of design, workmanship and technique for welding and qualification of welding personnel shall be in accordance with the specifications listed in Sections 2205A, 2206A, 2207A, 2208A, 2210A and 2211A. For *Special inspection* of welding, see Section 1705A.2.

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2204A.4 ~~2204A.2.2~~ Column base plate. When shear and / or tensile forces are intended to be transferred between column base plates and anchor bolts, provision shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs and / or welded shear transfer plates or other means acceptable

to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than 1/8 inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.

SECTION 2205A STRUCTURAL STEEL

2205A.1 General. The design, fabrication and erection of structural steel elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exception: **[Reserved for OSHPD]**

2205A.2 Seismic Design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2205A.2.1 or 2205A.2.2.

~~**2205A.2.1 Seismic Design Category A, B or C.** Not permitted by DSA-SS.~~

2205A.2.1 Structural steel seismic force-resisting system. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems shall be in accordance with the provisions of Section 2205A.2.1.1 or 2205A.2.1.2, as applicable.

~~**2205A.2.1.1 Seismic Design Category B or C.** Not permitted by DSA. Structures assigned to Seismic Design Category B or C shall be of any construction permitted in Section 2205. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1 is used for the design of structural steel structures assigned to Seismic Design Category B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341.~~

Exception: The response modification coefficient, R, designated for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1 shall be permitted for systems

~~designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.~~

2205A.2.1.2 Seismic Design Category D, E or F. Structures assigned to *Seismic Design Category* D, E or F shall be designed and detailed in accordance with AISC 341, ~~except as permitted in ASCE 7, Table 15.4-1.~~

2205A.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting system other than those covered in Section 2205A.2.1, including struts, collectors, chords and foundation elements shall be in accordance with AISC 341, ~~where either of following applies:~~

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

2205A.3 Modifications to AISC 341. [DSA-SS]

2205A.3.1 Section A4. *Replace Section A4.1 item (3) as follows:*

(3) Locations and dimensions of protected zones, including provision by the owner or owner's' designated representative for construction to permanently mark and maintain the protection.

2205A.3.2 2205A.3.1 Section D1. *Add Section D1.6 as follows:*

6. Diaphragm bracing systems. *The required strength of diagonal bracing members used as the diaphragm shall be determined from either of the following:*

(1) *The load effect resulting from the diaphragm analysis per the applicable building code provided the members satisfy all of the following requirements:*

1. *Diagonal bracing members comply with Section D1.1 for moderately ductile members.*
2. *Each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance.*
3. *Diagonal bracing members shall not support gravity loads other than self-weight.*
4. *The slenderness ratio (KL/r) of diagonal bracing members shall not exceed $4\sqrt{E/F_y}$, except tension-only bracing.*

(2) *The load effect required for collectors using the load combinations stipulated in the applicable building code.*

2205A.3.3 ~~2205A.3.2~~ Section D2. *Modify Section D2.6c(b)(ii) as follows:*

(ii) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

2205A.3.4 ~~2205A.3.3~~ Section D2. *Add Section D2.9 as follows:*

9. Diaphragm bracing systems. *The required strength of the connections of diagonal bracing members used as the diaphragm shall be the load effect required for collectors using the load combinations stipulated in the applicable building code.*

2205A.3.5 Section F1. *Add Section F1.4c as follows:*

4c. Multi-tiered Braced Frames: *Braced-frames configured with two or more tiers of bracing between diaphragm levels or locations of out-of-plane support shall comply with the additional requirements of section F2.4e.*

2205A.3.6 ~~2205A.3.4~~ Section F2. *Modify Section F2.3 Exception (2)(a) as follows:*

(a) *The maximum of the forces determined using load combination stipulated by the applicable building code including the amplified seismic load, applied to the building frame model in which all compression braces have been removed and those determined with no compression braces removed per D1.4a(2).*

2205A.3.7 ~~2205A.3.5~~ Section F2. *Modify Section F2.4a by adding the following:*

Where each framing bay on a line of resistance does not have opposing diagonal braces within the same column bay, then the collector forces along that line shall be designed considering the redistribution of seismic forces to other bays as a result of the post-buckled redistribution of loads using the analysis requirements of Section F2.3. The collector shall not be designed for a load less than that stipulated by the applicable building code.

The required strength of the collector need not exceed the forces determined using load combination stipulated by the applicable building code including the amplified seismic load, applied to the building model in which all compression braces have been removed.

2205A.3.8 Section F2. *Add Section F2.4e as follows:*

4c. Multi-tiered Braced Frames: *Braced-frames configured with two or more tiers of bracing between diaphragm levels or locations of out-of-plane support shall comply with the additional requirements of this section:*

- (1) Braces shall be used in symmetrical pairs at every tier level.*
- (2) Horizontal beams at intermediate tier levels for V- and inverted V-brace configurations shall have out-of-plane strength, stiffness, and beam-to-column connections adequate to resist torsional moments arising from brace buckling when braces are designed to buckle out-of-plane.*
- (3) Columns shall be restrained against rotation about their longitudinal axis at each intermediate tier level and shall resist out-of-plane bending moments due to second-order effects, geometric imperfections, and out-of-plane brace buckling.*

2205A.4 MODIFICATIONS TO AISC 341. [Reserved for OSHPD]

SECTION 2206A
COMPOSITE STRUCTURAL STEEL AND
CONCRETE STRUCTURES

2206A.1 General. Systems of structural steel elements acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 14.

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

2206A.2.1 Seismic requirements for composite structural steel and concrete construction. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1 is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341 *and shall be considered as an alternative system.*

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

- 1. Beams are provided with Reduced Beam Sections (RBS),*
- 2. Columns shall be Hollow Structural Sections (HSS) and completely filled with structural concrete having unit weight not less than 110 pounds per cubic foot (17 kN/m³). Concrete shall have 28-day compressive strength not less than 4,000 psi (28 MPa).*
- 2. ~~3.~~ Web extension to beam web two sided fillet weld welds are sized to develop expected strength of the beam web and shall not be less than a ¼ inch fillet weld, and*
- 4. ~~The high strength bolt design shall consider interaction between shear and tension as required by AISC 360, and~~*

3. 5. The built-up box column wall thickness shall not be less than 1.25" and the HSS column wall thickness shall not be less than ½ inch.

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SECTION 2207A
STEEL JOISTS

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2207A.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the *approved construction documents* and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207A.2. Steel joist placement plans shall include, at a minimum, the following:

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~~Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional.~~

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2207A.4.1 Design approval. [DSA-SS] Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.

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

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SECTION 2208A STEEL CABLE STRUCTURES

2208A.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

~~**2208.2 Seismic requirements for steel cable.** The design strength of steel cables shall be determined by the provisions of ASCE 19 except as modified by these provisions.~~

- ~~1. A load factor of 1.1 shall be applied to the prestress force included in T_3 and T_4 as defined in Section 3.12.~~
- ~~2. In Section 3.2.1, Item (c) shall be replaced with "1.5 T_3 " and Item (d) shall be replaced with "1.5 T_4 ."~~

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SECTION 2210A COLD-FORMED STEEL

2210A.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 also comply with Section 2211A. Where required, the seismic design of cold formed steel structures shall be in accordance with the additional provisions of Section 2210A.2.

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

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

2210A.1.1.2 Steel roof deck. Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0. *The base material thickness of steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: [DSA-SS] *For single-story open structures, the minimum deck thickness may be waived if the steel roof deck need not be used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

~~**2210A.1.1.3 Composite slabs on steel decks.** Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with ANSI/SDI-C.~~

2210A.1.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C.

2210A.2 Seismic requirements for cold-formed steel structures. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100, ~~and ASCE 8.~~ ~~or, for cold-formed steel special-bolted moment frames, AISI S110.~~

SECTION 2211A COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2211A.1 General. The design and installation of structural and nonstructural members utilized in cold-formed steel light-frame construction where the specified minimum base steel

thickness is not greater than 0.1180 inches (2.997 mm) shall be in accordance with AISI S200 and Sections 2211A.2 through 2211A.7, or AISI S220, as applicable.

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2211A.3 Truss design. Cold-formed steel trusses shall be designed in accordance with AISI S214, Sections 2211A.3.1 through 2211A.3.4 and accepted engineering practice.

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.

2211A.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section B2.3 of AISI S214 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 B 6(a) or B 6(e) of AISI S214 where these methods are utilized to provide restraint/bracing.

2211A.3.2 Deferred submittals. ~~AISI S214 Section B4.2 shall be deleted.~~ *Not permitted by DSA-SS.*

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2211A.4 Structural wall stud design. Structural wall studs shall be designed in accordance with either AISI S211 or AISI S100.

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.

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2211A.6 Lateral design. Light-frame shear walls, diagonal strap bracing that is part of a structural wall and diaphragms used to resist wind, seismic and other in-plane lateral loads shall be designed in accordance with AISI S213.

Shear wall assemblies in accordance with ~~per~~ Section C2.2.3 of AISI S213 are not permitted within the seismic force-resisting system of buildings.

2211A.7 Prescriptive framing. *Not permitted by DSA-SS. ~~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.~~*

**SECTION 2212A [DSA-SS]
LIGHT MODULAR STEEL MOMENT FRAMES FOR
PUBLIC ELEMENTARY AND SECONDARY
SCHOOLS, AND COMMUNITY COLLEGES**

2212A.1 General.

2212A.1.1 Configuration. *Light modular steel moment frame buildings shall be constructed of factory-assembled modules comprising a single-story moment-resisting space frame supporting a floor and roof. Individual modules shall not exceed a width of 14 feet (4.25 m) nor a length of 72 feet (22 m). All connections of beams to corner columns shall be designed as moment-resisting in accordance with the criteria of Section 2212A.2. Modules may be stacked to form multistory structures not exceeding 35 feet or two stories in height. When stacked modules are evaluated separately, seismic forces on each module shall be distributed in accordance with Section 12.8.3 of ASCE 7, considering the modules in the stacked condition. See Section 2212A.2.5 of this code.*

2212A.1.2 Design, fabrication and erection. *The design, fabrication and erection of light modular steel moment frame buildings shall be in accordance with the AISC Specification for Structural Steel Buildings (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold Formed Structural Members*

(AISI/COS/ NASPEC), as applicable, and the requirements of this section. The maximum dead load of the roof and elevated floor shall not exceed 25 psf and 50 psf (1197 Pa and 2394 Pa), respectively. The maximum dead load of the exterior walls shall not exceed 45 psf (2155 Pa).

2212A.2 Seismic requirements. In addition to the other requirements of this code, the design, materials and workmanship of light modular steel moment frames shall comply with the requirements of this section. The response modification coefficient R shall be equal to $3/2$. C_d and Ω_0 shall be equal to 3.0.

2212A.2.1 Base materials. Beams, columns and connection materials shall be limited to those materials permitted under the AISC Specification for Structural Members (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold Formed Structural Members (AISI/COS/NASPEC).

2212A.2.2 Beam-to-column strength ratio. At each moment-resisting connection the following shall apply:

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

where:

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

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

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

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

Exceptions:

1. Beam-to-column connections at the floor level beams of first or second-story modules need not comply with this requirement.

2. *Beam-to-column strength ratios less than 1.4 are allowed if proven to be acceptable by analysis or testing.*

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

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

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

SECTION 2213A

TESTING AND FIELD VERIFICATION

2213A.1 Tests of High-strength Bolts, Nuts and Washers. *High-strength bolts, nuts and washers shall be sampled and tested by an approved independent testing laboratory for conformance with the requirements of applicable ASTM standards.*

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

(All existing amendments that are not revised above shall continue without any change)

NOTATION:

- *Authority: Health and Safety Code Section 130005(g) & 130021*
- *Reference: Health and Safety Code Section 1275, 129790, 129850 & 130005(g)*

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