

CHAPTER 21
MASONRY

PROPOSED ADOPTION	DSA-SS	DSA-SS/CC	Comments
Adopt entire chapter without amendments			
Adopt entire chapter with amendments listed below	-	X	
Adopt only those sections listed below			
<i>2101.1.1</i>		X	
<i>2101.1.2</i>		X	
<i>2101.1.3</i>		X	
<i>2101.1.4</i>		X	
<i>2114</i>		X	
<i>2114.1</i>		X	
<i>2114.2</i>		X	
<i>2114.3</i>		X	
<i>2114.4</i>		X	
<i>2114.5</i>		X	
<i>2114.6.1</i>		X	
<i>2114.7</i>		X	
<i>2114.8</i>		X	
<i>2114.9.1</i>		X	
<i>2114.9.2.1</i>		X	
<i>2114.9.3</i>		X	
<i>2114.10</i>		X	
<i>2114.11.1</i>		X	
<i>2114.11.2</i>		X	
<i>2114.12</i>		X	
<i>2114.13</i>		X	
<i>2114.14</i>		X	

Adopt and/or codify chapter as amended below:

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

DRAFT INITIAL EXPRESS TERMS

SECTION 2101

GENERAL

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

2101.1.1 Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC)

Community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC) as listed in Section 1.9.2.2.

2101.1.2 Amendments in this chapter. *DSA-SS/CC adopts this chapter and all amendments.*

Exception: *Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

[DSA-SS/CC] - *For community college buildings listed in Section 1.9.2.2.*

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 2114 for additional requirements.*

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SECTION 2114

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

2114.1 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).

2114.1.1 Prohibitions. *The following design, systems and materials are not permitted by DSA:*

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

2114.2 Mortar. *Type S mortar conforming to ASTM C 270 shall be used for glass unit masonry.*

2114.2 2114.3 Additives and Admixtures.

2114.2.1 2114.3.1 General. *Additives and admixtures to mortar or grout shall not be used unless approved by the enforcement agency.*

2114.2.2 2114.3.2 Antifreeze compounds. *Antifreeze liquids, chloride salts or other such substances shall not be used in mortar or grout.*

2114.2.3 2114.3.3 Air entrainment. *Air-entraining substances shall not be used in mortar or grout unless tests are conducted to determine compliance with the requirements of this code.*

2114.4 Tolerances. *The maximum thickness of the initial bed joint in fully grouted masonry walls shall not exceed 1 1/4 in. (31.7 mm).*

2114.5 Glass unit masonry. *All mortar for glass unit masonry contact surfaces shall be treated to ensure adhesion between mortar and glass.*

2114.3 2114.6 Grouted masonry.

2114.3.1 2114.6.1 General conditions. *Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than 1/4 inch (6.4 mm), mortar droppings and other foreign material.*

All cells shall be solidly filled with grout, except as provided in Section 2114.14.

Exception: ~~(Relocated from 2013 CBC 2114.13)~~ Reinforced hollow-unit masonry laid in running bond used for freestanding site walls fences and or interior nonbearing non-shear wall partitions may be ~~of hollow-unit masonry construction~~ grouted only in cells containing vertical and horizontal reinforcement.

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

The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour. At the time of laying, all masonry units shall be free of dust and dirt.

Grout pours greater than 12 inches (300 mm) in height shall be consolidated by mechanical vibration during placement to fill the grout space before loss of plasticity, and reconsolidated by mechanical vibration to minimize voids due to water loss. Grout pours less than 12 inches in height may be puddled.

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

The construction documents shall completely describe grouting procedures, subject to approval of DSA.

2114.4 2114.7 Aluminum equipment. 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.

2114.5 2114.8 Specified compressive strength. The specified compressive strength, f'_{m} , assumed in design shall be not less than 1,500 psi (10.34 MPa) for all masonry construction using materials and details of construction required herein. Testing of the constructed masonry shall be provided in accordance with Section 2114.6.2 2114.9.3.

In no case shall the f'_{m} assumed in design exceed 3,000 psi (20.68 MPa).

2114.6 2114.9 Additional testing requirements.

2114.6.1 2114.9.1 Mortar and grout tests. At the beginning of all masonry work, at

least one test sample of the mortar ~~and grout~~ shall be taken on three successive working days and at least at one-week intervals thereafter. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. They shall meet the minimum strength requirement given in this code Sections 2103A.9 and 2103A.13 for mortar and grout. ~~respectively.~~ Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official. ~~or whenever in the judgment of the architect, structural engineer or the enforcement agency such tests are necessary to determine the quality of the material.~~ When the prism test method ~~of Section 2105A.2.2.2~~ is used during construction, the tests in this section are not required.

Test specimens for mortar and grout shall be made as set forth in ASTM C 1586 and ASTM C 1019.

Exception: For non-bearing non-shear masonry walls not exceeding total wall height of 12' above wall base, mortar test shall be permitted to be limited to those at the beginning of masonry work for each mix design.

2114.9.2 Prism test method.

~~2114.9.2.1 Number of prisms per test.~~ Prior to the start of construction, ~~three prisms shall be constructed and tested in accordance with ASTM C 1314. A set of three masonry prisms shall be built during construction in accordance with ASTM C 1314 for each 5,000 square feet (465 m²) of wall area, but not less than one set of three prisms for the project. Each set of prisms shall equal or exceed f 'm.~~

2114.6.2 2114.9.3 Masonry core testing. Not less than two cores shall be taken from each building for each 5,000 square feet (465 m²) ~~of the greater of the masonry wall area or the floor area or fraction thereof.~~ ~~The architect or structural engineer in responsible charge of the project or his/her representative or the inspector of record shall select the areas for sampling.~~ The inspector of record 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.

Cores samples shall comply with the following:

1. Cored no sooner than 7 days after grouting of the selected area;

2. ~~Be~~ Be a minimum of 3-3/4" in nominal diameter; and
3. Sampled shall be taken in such a manner as to exclude any masonry unit webs, mortar joint, or and 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.

~~If vertical reinforcing steel is placed such that cores will include reinforcing steel, core testing may be waived by the design professional in responsible charge, as approved by the enforcement agency.~~

~~Visual examination of all cores shall be made by an approved agency a laboratory acceptable to the building official and the condition of the cores reported as required by the California Administrative Code. One half of the number of All cores taken shall be tested in shear 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. The shear test shall test both joints between the grout core and the outside wythes or face shell of the masonry. Shear testing apparatus shall be of a design approved by 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 on the cross section of any three consecutive all the cores tested shall not be less than 2.5 $\sqrt{f'_m}$ psi.~~

~~All cores shall be submitted to an approved agency the laboratory, acceptable to the building official, for examination, regardless of whether even where the core specimens failed outside wythe or face shells separated during the cutting operation. The approved agency laboratory 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 non-bearing non-shear masonry walls, not exceeding total wall height of 12' above wall base, 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 equal to or less than 1500 psi (10.34 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.

2114.7 2114.10 Modifications to TMS 402/ACI 530/ASCE 5.

2114.7.1 ~~2114.10.1~~ Modify TMS 402/ACI 530/ASCE 5, Section 7.4.4.1.18 as follows:

1. Minimum reinforcement requirements for masonry walls. The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups and wire shall be permitted for joint reinforcement. Vertical wall reinforcement shall have dowels of equal size and equal 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/ACI 530/ASCE 5 ~~as modified by Sections 2107 and 2108~~ shall be considered as continuous reinforcement.

Horizontal reinforcing element bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

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

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

~~Joint reinforcement shall not be used as principal reinforcement in masonry designed by the strength design method.~~

Where joint reinforcement is used as shear reinforcement, the requirements of TMS 402 / ACI 530 / ASCE 5 Sections 9.3.3.2.3 and 9.3.3.7 shall apply for all design methods.

2. Minimum reinforcement for masonry columns. The spacing of

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

3. **Anchor bolts.** Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be 1/2-inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, 3/4-inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, 7/8-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25mm) diameter for 12-inch (304.8 mm) nominal masonry.

2114.8 ~~2114.11~~ Additional requirements for allowable stress design.

2114.8.1 ~~2114.11.1~~ TMS 402/ACI 530/ASCE 5 [DSA-SS/CG] Modify by adding Section 8.1.7 ~~2-1.8~~ as follows:

8.1.7 ~~2-1.8~~ – Walls and piers.

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

The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Also, no masonry wall shall exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 2114.8.1 ~~2114.11.1~~.

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

2114.8.2 ~~2114.11.2~~ TMS 402/ACI 530/ASCE 5, Section 2.1.7.7.1.1, lap splices. Modify the requirements of Section 2107.2.1 by adding the following:

Lap splices need not be greater than 72 bar diameters.

TABLE 2114.8.1 2114.11.1
MINIMUM THICKNESS OF MASONRY WALLS^{1,2} [DSA-SS/CG]

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR	NOMINAL MINIMUM THICKNESS
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

2114.9 2114.12 Glass unit masonry construction. ~~Masonry of glass blocks walls or panels shall be designed for seismic forces. permitted in non-load-bearing exterior or interior walls and shall conform to the requirements of Section 2115A. Stresses in glass block shall not be utilized. Glass block may be solid or hollow and may contain inserts.~~

2114.13 Nonbearing walls. ~~All nonbearing masonry walls shall be reinforced as specified in Section 2114.10.1.1. Fences and interior nonbearing nonshear walls may be of hollow-unit masonry construction grouted in cells containing vertical and horizontal reinforcement. Nonbearing walls maybe used to carry a superimposed load of not more than 200 pounds per linear foot (2.92 kN/m).~~

~~1. **Thickness.** Every nonbearing masonry wall shall be so constructed and have a sufficient thickness to withstand all vertical loads and horizontal loads, but in no case~~

~~shall the thickness of such walls be less than the values set forth in Table 2114.11.1. Plaster shall not be considered as contributing to the thickness of a wall in computing the height-to-thickness ratio.~~

~~2. **Anchorage.** All nonbearing walls shall be anchored as required by Section 1604.8.2 and ASCE 7 Chapter 13. Suspended ceilings or other nonstructural elements shall not be used to provide anchorage for masonry walls.~~

~~**2114.14 Masonry screen walls.** Masonry units may be used in nonbearing decorative screen walls. Units may be laid up in panels with units on edge with the open pattern of the unit exposed in the completed wall.~~

~~1. **Horizontal forces.** The panels shall be capable of spanning between supports to resist the horizontal forces specified in Chapter 16. Wind loads shall be based on gross projected area of the block.~~

~~2. **Mortar joints.** Horizontal and vertical joints shall not be less than 1/4 inch (6 mm) thick. All joints shall be completely filled with mortar and shall be "shoved joint" work. The units of a panel shall be so arranged that either the horizontal or the vertical joint containing reinforcing is continuous without offset. This continuous joint shall be reinforced with a minimum of 0.03 square inch (19 mm²) of reinforcing steel and maximum spacing of 16 in. on center. Reinforcement may be embedded in mortar.~~

~~3. **Reinforcement.** Joint reinforcement may be composed of two wires made with welded ladder or trussed wire cross ties. In calculating the resisting capacity of the system, compression and tension in the spaced wires may be utilized. Ladder wire reinforcement shall not be spliced and shall be the widest that the mortar joint will accommodate, allowing 1/2 inch (13 mm) of mortar cover.~~

~~4. **Size of panels.** The maximum size of panels shall be 144 square feet (13.4 m²), with the maximum dimension in either direction of 15 feet (4572 mm). The specified thickness of the units for exterior applications shall not be less than 37/8 in.~~

~~5. **Panel support.** Each panel shall be supported on all edges by a structural member of concrete, masonry or steel. Supports at the top and ends of the panel shall be by means of confinement of the masonry by at least 1 inch (25 mm) into and between the flanges of a steel channel. The space between the end of the panel and the web of the channel shall be filled with resilient material. The use of equivalent configuration in other steel section or in masonry or concrete is acceptable.~~