

**CHAPTER 21A  
MASONRY**

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**

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**SECTION 2103A  
MASONRY CONSTRUCTION MATERIALS**

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**2103A.3 Grout.** Grout shall comply with Article 2.2 of TMS 602/ACI 530.1/ASCE 6.

~~**2103A.13.1 Water.** Water content shall be adjusted to provide proper workability and to enable proper placement under existing field conditions, without segregation.~~

~~**2103A.13.2 Selecting Proportions.** Proportions of ingredients and any additives shall be based on laboratory or field experience with the grout ingredients and the masonry units to be used. Coarse grout proportioned by weight shall contain not less than 564 pounds of cementitious material per cubic yard (335 kg / m<sup>3</sup>).~~

~~**2103A.3.3 2103A.13.3 Aggregate.** Coarse grout shall be used in grout spaces between wythes of 2 inches (51 mm) or more in width as determined in accordance with TMS 602 Table 7, footnote 3, and in all grouted filled-cells of hollow unit masonry construction.~~

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**2103A.15 Additives and Admixtures.**

**2103A.15.1 General.** ~~Additives and admixtures to mortar or grout shall not be used unless approved by the enforcement agency.~~

**2103A.15.2 Antifreeze compounds.** ~~Antifreeze liquids, chloride salts or other such substances shall not be used in mortar or grout.~~

**2103A.5 2103A.15.3 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.~~

**SECTION 2104A  
CONSTRUCTION**

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**2104A.1.3.1.2 2104A.5.1.2 Reinforced hollow-unit masonry.**

**2104A.1.3.1.2.1 2104A.5.1.2.1 General.** Reinforced hollow-unit masonry is that type of construction made with hollow-masonry units in which cells are continuously filled with grout, and in which reinforcement is embedded. All cells shall be solidly filled with grout in reinforced hollow-unit masonry, ~~except as provided in Section 2114A.1.~~

**Exception:** ~~(Relocated from 2013 CBC 2114A.1) 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.~~

Construction shall be one of the two following methods: The low-lift method where the maximum height of construction laid before grouting is 4 feet (1220 mm), or the high-lift method where the full height of construction between horizontal cold joints is grouted in one operation. General requirements for construction shall be as follows:

1. Bond shall be provided by lapping units in successive vertical courses. 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.
2. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear grout space dimension unobstructed, continuous vertical cell measuring of not less than 2 inches by 3 inches (51 mm by 76 mm), except the minimum cell dimension for high-lift grout shall be 3 inches (76 mm), as determined in accordance with TMS 602 Table 7, footnote 3.
3. Grout shall be a workable mix suitable for placing without segregation and shall be thoroughly mixed. Grout shall be placed by pumping or an approved alternate method and shall be placed before initial set or hardening occurs. Grout shall be consolidated by mechanical vibration during placing and reconsolidated after excess moisture has been absorbed, but before workability is lost.
4. All reinforcement and wire ties shall be embedded in the grout. The space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter.
5. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above steel for each grout pour. The depth of the bond beam channel below the top of the unit shall be a minimum of 1 1/2 inches (38 mm) and the width shall be 3 inches (76 mm) minimum.

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**SECTION 2105A**  
**QUALITY ASSURANCE**

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**2105A.2 Compressive Strength,  $f'_m$ .** *The specified compressive strength,  $f'_m$ , assumed in design shall be ~~2,000 psi (13.79MPa)~~ ~~4,500 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 ~~2105A.4~~ ~~2105A.5~~ ~~[DSA-SS]~~.*

**Exception: ~~[DSA-SS]~~** *Subject to the approval of the enforcement agency, higher values of  $f'_m$  may be used in the design of reinforced grouted masonry and reinforced hollow-unit masonry. The approval shall be based on prism test results submitted by the architect or engineer which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength and stiffness. The design shall take into account the mortar joint depth. In no case shall the  $f'_m$  assumed in design exceed 3,000 psi (20.7 MPa).*

*Where an  $f'_m$  greater than ~~2,000 psi (13.79 MPa)~~ ~~4,500 psi (10.34 MPa)~~ is approved, the architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract specifications. Compliance with the requirements for the specified ~~compressive strength of constructed masonry  $f'_m$  shall be provided using prism test method in accordance with Section 2105A.2.2.1 or 2105A.2.2.2~~ ~~and core shear testing in accordance with Section 2105A.4.~~ Substantiation for the specified compressive strength prior to the start of construction shall be obtained ~~by using prism test method in accordance with Section 2105A.2.2.2.2.~~ ~~and Section 2105A.3.~~ ~~Testing of the constructed masonry shall also be provided in accordance with Section 2105A.5.~~*

**2105A.3 ~~2105A.2.2.1.4~~ Mortar and grout tests.** *These tests are to establish whether the masonry components meet the specified component strengths.*

At the beginning of all masonry work, at least one test sample of the mortar ~~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 ASTM C270 Table 1 and ASTM C476/TMS 602 Section 2.2 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.

**Exceptions:**

**1.** 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.

**2. [DSA-SS]** Mortar sampling and testing shall be as follows: At the beginning of all masonry work, mortar test samples 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 Annex 4 and 5 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 approved preblended mortars in conformance with ASTM C270.

**2105A.4 Masonry core testing. [OSHPD 1 & 4]** Not less than two cores shall be taken from each building for each 5,000 square feet (465 m<sup>2</sup>) 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 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.

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. The sShear test shall test both joints between the grout core and the outside wythes or face shell of the masonry One half of the number of 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. 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 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 the core 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 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  $f'_m$  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.

~~**2105A.5 Masonry core testing. [DSA-SS]** Not less than two cores shall be taken from each building for each 5,000 square feet (465 m<sup>2</sup>) 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. Cores shall be a minimum of 33/4 inches (76mm) in diameter and shall be taken in such a manner as to exclude masonry unit webs and reinforcing steel. 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. The inspector of record shall observe the coring of the masonry walls.~~

~~Visual examination of all cores shall be made by a laboratory acceptable to the building official and the condition of the cores reported as required by the California Administrative Code. All cores taken shall be tested in shear. 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. The average unit shear on the cross section of all the cores shall not be less than  $2.5\sqrt{f'_m}$  psi.~~

~~All cores shall be submitted to the laboratory, acceptable to the building official, for examination, regardless of whether the outside wythe or face shells separated during the cutting operation. The laboratory shall report the location where each core was taken, the findings of their visual examination of each core, and the results of the shear tests.~~

## SECTION 2106A

## SEISMIC DESIGN

**2106A.1 Seismic design requirements for masonry.** Masonry structures and components shall comply with the requirements in Chapter 7 of TMS 402/ACI 530/ASCE 5 depending on the structure's *Seismic Design Category*.

**2106A.1.1 Modifications to TMS 402 / ACI 530 / ASCE 5.** Modify TMS 402 / ACI 530 / ASCE 5 Section 7.4.4 4-18 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**. **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 Section 2107A and 2108A 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.**

**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" in diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.

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

**4. Anchor Bolts.** Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be 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.

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**(All existing amendments, except where section is deleted in the model code, 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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