2007 California Existing Building Code

California Code of Regulations
Title 24, Part 10

California Building Standards Commission

Based on 2006 International Existing Building Code®

EFFECTIVE
JANUARY 1, 2008
(For Errata and Supplements, see History Note Appendix)
## TABLE OF CONTENTS

**APPENDIX CHAPTER A1**  
SEISMIC STRENGTHENING PROVISIONS  
FOR UNREINFORCED MASONRY  
BEARING WALL BUILDINGS ............ 3

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A100</td>
<td>3</td>
</tr>
<tr>
<td>A101</td>
<td>3</td>
</tr>
<tr>
<td>A102</td>
<td>3</td>
</tr>
<tr>
<td>A103</td>
<td>3</td>
</tr>
<tr>
<td>A104</td>
<td>4</td>
</tr>
<tr>
<td>A105</td>
<td>5</td>
</tr>
<tr>
<td>A106</td>
<td>5</td>
</tr>
<tr>
<td>A107</td>
<td>7</td>
</tr>
<tr>
<td>A108</td>
<td>8</td>
</tr>
<tr>
<td>A109</td>
<td>8</td>
</tr>
<tr>
<td>A110</td>
<td>8</td>
</tr>
<tr>
<td>A111</td>
<td>9</td>
</tr>
<tr>
<td>A112</td>
<td>10</td>
</tr>
<tr>
<td>A113</td>
<td>11</td>
</tr>
<tr>
<td>A114</td>
<td>12</td>
</tr>
</tbody>
</table>

**REFERENCED STANDARDS** .................. 19

**HISTORY NOTE APPENDIX** .................. 27
APPENDIX CHAPTER A1 – SEISMIC STRENGTHENING PROVISIONS
FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

<table>
<thead>
<tr>
<th>Adopting Agency</th>
<th>BSC</th>
<th>HCD</th>
<th>DSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopt Entire Chapter</td>
<td>1</td>
<td>2</td>
<td>1AC AC SS</td>
</tr>
<tr>
<td>Adopt Entire Chapter as amended (amended sections listed below)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Adopt only those sections that are listed below</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Chapter / Section | Codes |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A100</td>
<td>CA</td>
</tr>
<tr>
<td>A103 – BUILDING CODE</td>
<td>CA</td>
</tr>
</tbody>
</table>

NOTES:
1. For essential services buildings, refer to Part 1, Chapter 4, Articles 1, 2 and 3, Title 24, C.C.R., for administrative regulations of the Division of the State Architect-Structural Safety Section.
2. For private schools, refer to Education Code section 39160-76, and Health and Safety Code section 18941.5.
3. For historical buildings, refer to Part 8, Title 24, C.C.R.
4. For application and enforcement authority, refer to Part 2, Chapter 1, sections 101, 102 and 108, Title 24, C.C.R.
5. For local jurisdiction exemption program, refer to Health and Safety Code section 18941.6.
SEISMIC STRENGTHENING PROVISIONS
FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

SECTION A 100
APPLICATION

A 100.1 Vesting authority. When adopted by a state agency, the provisions of these regulations shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.

Following is a list of the state agencies that adopt building standards, the specific scope of application of the agency responsible for enforcement, and the specific statutory authority of each agency to adopt and enforce such provisions of building standards of this code, unless otherwise stated.

1. BSC—California Building Standards Commission.
   Application—Existing buildings as specified in Section A 102 having at least one unreinforced masonry bearing wall, with the exception of buildings subject to building standards pursuant to Health and Safety Code, commencing with Section 17910.

   Enforcing Agency—State or local agency specified by the applicable provisions of the law.

   Authority Cited—Health and Safety Code Section 18934.6.

   Reference—Health and Safety Code Sections 18901 through 18949; and 50558 and 50559.

2. HCD 1—The Department of Housing and Community Development.
   Application—Hotels, motels, lodging houses, apartment houses, dwellings, employee housing and factory-built housing.

   Enforcing Agency—The local building department or the Department of Housing and Community Development.

   Authority Cited—Health and Safety Code Sections 17040, 17921, 17922, 19990.


3. HCD 2—The Department of Housing and Community Development.
   Application—Permanent buildings and permanent accessory buildings or structures constructed within mobilehome parks and special occupancy parks.

   Enforcing Agency—The local building department or the Department of Housing and Community Development.

   Authority Cited—Health and Safety Code Sections 18300, 18620, 18640, 18865, 18873 and 18873.2.

2007 CALIFORNIA EXISTING BUILDING CODE
CROSSWALL. A new or existing wall that meets the requirements of Section A111.3 and the definition of Section A111.3. A crosswall is not a shear wall.

CROSSWALL SHEAR CAPACITY. The unit shear value times the length of the crosswall, \( v_{Le} \).

DIAPHRAGM EDGE. The intersection of the horizontal diaphragm and a shear wall.

DIAPHRAGM SHEAR CAPACITY. The unit shear value times the depth of the diaphragm, \( v_{Le} \).

NORMAL WALL. A wall perpendicular to the direction of seismic forces.

OPEN FRONT. An exterior building wall line without vertical elements of the lateral-force-resisting system in one or more stories.

POINTING. The partial reconstruction of the bed joints of an unreinforced masonry wall as defined in UBC Standard 21-8.

RIGID DIAPHRAGM. A diaphragm of reinforced concrete construction supported by concrete beams and columns or by structural steel beams and columns.

UNREINFORCED MASONRY. Includes burned clay, concrete or sand-tile brick; hollow clay or concrete block; plain concrete; and hollow clay tile. These materials shall comply with the requirements of Section A106 as applicable.

UNREINFORCED MASONRY BEARING WALL. A URM wall that provides the vertical support for the reaction of floor or roof-framing members.

UNREINFORCED MASONRY (URM) WALL. A masonry wall that relies on the tensile strength of masonry units, mortar and grout in resisting design loads, and in which the area of reinforcement is less than 25 percent of the minimum ratio required by the building code for reinforced masonry.

YIELD STORY DRIFT. The lateral displacement of one level relative to the level above or below at which yield stress is first developed in a frame member.

SECTION A104 SYMBOLS AND NOTATIONS

For the purpose of this chapter, the following notations supplement the applicable symbols and notations in the building code.

- \( f'_{m} \) = Compressive strength of masonry.
- \( f_{sp} \) = Tensile-splitting strength of masonry.
- \( F_{ex} \) = Force applied to a wall at level \( x \), pounds (N).
- \( H \) = Least clear height of opening on either side of a pier, inches \( (10^{-3}) \) m.
- \( h/t \) = Height-to-thickness ratio of URM wall. Height, \( h \), is measured between wall anchorage levels and/or slab-on-grade.
- \( L \) = Span of diaphragm between shear walls, or span between shear wall and open front, feet (m).
- \( L_{c} \) = Length of crosswall, feet (m).
- \( P \) = Applied force as determined by standard test method of ASTM C 496 or ASTM E 519, pounds (N).
- \( P_{D} \) = Superimposed dead load at the location under consideration, pounds (kN). For determination of the rocking shear capacity, dead load at the top of the pier under consideration shall be used.
- \( P_{D+L} \) = Press resulting from the dead plus actual live load in place at the time of testing, pounds per square inch (kPa).
- \( P_{w} \) = Weight of wall, pounds (N).
- \( R \) = Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE 7, where \( R = 1.5 \).
- \( S_{DS} \) = Design spectral acceleration at short period, in g units.
- \( S_{DI} \) = Design spectral acceleration at 1-second period, in g units.
- \( v_{a} \) = Shear strength of any URM pier, \( v_{n}A/1.5 \) pounds (N).
- \( v_{c} \) = Unit shear capacity value for a crosswall sheathed with any of the materials given in Table A1-D or A1-E, pounds per foot (N/m).
- \( v_{n} \) = Shear strength of unreinforced masonry, pounds per square inch (kPa).
- \( V_{a} \) = The shear strength of any URM pier or wall, pounds (N).
- \( V_{c} \) = Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, \( v_{Le} \) pounds (N).
- \( V_{cb} \) = Total shear capacity of crosswalls in the direction of analysis immediately below the diaphragm level being investigated, \( v_{Le} \) pounds (N).
- \( V_{p} \) = Shear force assigned to a pier on the basis of its relative shear rigidity, pounds (N).
- \( V_{r} \) = Pier rocking shear capacity of any URM wall or wall pier, pounds (N).
The following construction documents and confirmation of existing conditions shall be in accordance with the California Building Code, except as modified by this chapter.

**A105.4 Structural observation, testing and inspection.** Structural observation, in accordance with Section 1709 of the California Building Code, shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. Structural observation shall include visual observation of work for conformance with the approved construction documents and confirmation of existing conditions assumed during design.

Structural testing and inspection for new construction materials shall be in accordance with the California Building Code, except as modified by this chapter.

**A106.1 General.** Materials permitted by this chapter, including their appropriate strength design values and those existing configurations of materials specified herein, may be used to meet the requirements of this chapter.

**A106.2 Existing materials.** Existing materials used as part of the required vertical-load-carrying or lateral-force-resisting system shall be in sound condition, or shall be repaired or removed and replaced with new materials. All other unreinforced masonry materials shall comply with the following requirements:

1. The lay-up of the masonry units shall comply with Section A106.3.2, and the quality of bond between the units has been verified to the satisfaction of the building official;
2. Concrete masonry units are verified to be load-bearing units complying with UBC Standard 21-4 or such other standard as is acceptable to the building official; and
3. The compressive strength of plain concrete walls shall be determined based on cores taken from each class of concrete wall. The location and number of tests shall be the same as those prescribed for tensile-splitting strength.
AL06.3.3 Location of tests.

In Equations (A1-2) and (A1-3), the shear tests shall be based on substantiating research data or engineering judgment, with the approval of the building official.

A106.3 Existing unreinforced masonry.

A106.3.1 General. Unreinforced masonry walls used to carry vertical loads or seismic forces parallel and perpendicular to the wall plane shall be tested as specified in this section. All masonry that does not meet the minimum standards established by this chapter shall be removed and replaced with new materials, or alternatively, shall have its structural functions replaced with new materials and shall be anchored to supporting elements.

A106.3.2 Lay-up of walls.

A106.3.2.1 Multiwythe solid brick. The facing and backing shall be bonded so that not less than 10 percent of the exposed face area is composed of solid headers extending not less than 4 inches (102 mm) into the backing. The clear distance between adjacent full-length headers shall not exceed 24 inches (610 mm) vertically or horizontally. Where the backing consists of two or more wythes, the headers shall extend not less than 4 inches (102 mm) into the most distant wythe, or the backing wythes shall be bonded together with separate headers with their area and spacing conforming to the foregoing. Wythes of walls not bonded as described above shall be considered veneer. Veneer wythes shall not be included in the effective thickness used in calculating the height-to-thickness ratio and the shear capacity of the wall.

Exception: Veneer wythes anchored as specified in the building code and made composite with backup masonry may be used for calculation of the effective thickness, where $S_D$ exceeds 0.3.

A106.3.2.2 Grouted or ungrouted hollow concrete or clay block and structural hollow clay tile. Grouted or ungrouted hollow concrete or clay block and structural hollow clay tile shall be laid in a running bond pattern.

A106.3.2.3 Other lay-up patterns. Lay-up patterns other than those specified in Sections A106.3.2.1 and A106.3.2.2 above are allowed if their performance can be justified.

A106.3.3 Testing of masonry.

A106.3.3.1 Mortar tests. The quality of mortar in all masonry walls shall be determined by performing in-place shear tests in accordance with the following:

1. The bed joints of the outer wythe of the masonry should be tested in shear by laterally displacing a single brick relative to the adjacent bricks in the same wythe. The head joint opposite the loaded end of the test brick should be carefully excavated and cleared. The brick adjacent to the loaded end of the test brick should be carefully removed by sawing or drilling and excavating to provide space for a hydraulic ram and steel loading blocks. Steel blocks, the size of the end of the brick, should be used on each end of the ram to distribute the load to the brick. The blocks should not contact the mortar joints. The load should be applied horizontally, in the plane of the wythe. The load recorded at first movement of the test brick as indicated by spalling of the face of the mortar bed joints is $V_{as}$ in Equation (A1-3).

2. Alternative procedures for testing shall be used where in-place testing is not practical because of crushing or other failure mode of the masonry unit (see Section A106.3.3.2).

A106.3.3.2 Alternative procedures for testing masonry. The tensile-splitting strength of existing masonry $f_{sp}$ or the prism strength of existing masonry $f'_m$ may be determined in accordance with one of the following procedures:

1. Wythes of solid masonry units shall be tested by sampling the masonry by drilled cores of not less than 8 inches (203 mm) in diameter. A bed joint intersection with a head joint shall be in the center of the core. The tensile-splitting strength of these cores should be determined by the standard test method of ASTM C 496. The core should be placed in the test apparatus with the bed joint 45 degrees from the horizontal. The tensile-splitting strength should be determined by the following equation:

$$f_{sp} = \frac{2P}{\pi a_n}$$

(Equation A1-1)

2. Hollow unit masonry constructed of through-the-wall units shall be tested by sampling the masonry by a sawn square prism of not less than 18 inches square (11 613 mm$^2$). The tensile-splitting strength should be determined by the standard test method of ASTM E 519. The diagonal of the prism should be placed in a vertical position. The tensile-splitting strength should be determined by the following equation:

$$f_{sp} = \frac{0.494P}{a_n}$$

(Equation A1-2)

3. An alternative to material testing is estimation of the $f'_m$ of the existing masonry. This alternative should be limited to recently constructed masonry. The determination of $f'_m$ requires that the unit correspond to a specification of the unit by an ASTM standard and classification of the mortar by type.

A106.3.3.3 Location of tests. The shear tests shall be taken at locations representative of the mortar conditions throughout the entire building, taking into account variations in workmanship at different building height levels, variations in weathering of the exterior surfaces, and variations in the condition of the interior surfaces due to deterioration caused by leaks and condensation of water and/or by the deleterious effects of other substances con-

2007 CALIFORNIA EXISTING BUILDING CODE
tained within the building. The exact test locations shall be determined at the building site by the engineer or architect in responsible charge of the structural design work. An accurate record of all such tests and their locations in the building shall be recorded, and these results shall be submitted to the building department for approval as part of the structural analysis.

**A106.3.3.4 Number of tests.** The minimum number of tests per class shall be as follows:

1. At each of both the first and top stories, not less than two tests per wall or line of wall elements providing a common line of resistance to lateral forces.

2. At each of all other stories, not less than one test per wall or line of wall elements providing a common line of resistance to lateral forces.

3. In any case, not less than one test per 1,500 square feet (139.4 m²) of wall surface and not less than a total of eight tests.

**A106.3.3.5 Minimum quality of mortar.**

1. Mortar shear test values, \( v_m \), in pounds per square inch (kPa) shall be obtained for each in-place shear test in accordance with the following equation:

\[
v_m = (V_{net}/A_h) - P_D + t \quad \text{(Equation A1-3)}
\]

2. Individual unreinforced masonry walls with \( v_m \) consistently less than 30 pounds per square inch (207 kPa) shall be entirely pointed prior to retesting.

3. The mortar shear strength, \( v_m \), is the value in pounds per square inch (kPa) that is exceeded by 80 percent of the mortar shear test values, \( v_{mr} \).

4. Unreinforced masonry with mortar shear strength, \( v_m \), less than 30 pounds per square inch (207 kPa) shall be removed, pointed and retested or shall have its structural function replaced, and shall be anchored to supporting elements in accordance with Sections A106.3.1 and A113.8. When existing mortar in any wythe is pointed to increase its shear strength and is retested, the condition of the mortar in the adjacent bed joints of the inner wythe or wythes and the opposite outer wythe shall be examined for extent of deterioration. The shear strength of any wall class shall be no greater than that of the weakest wythe of that class.

**A106.3.3.6 Minimum quality of masonry.**

1. The minimum average value of tensile-splitting strength determined by Equation (A1-1) or (A1-2) shall be 50 pounds per square inch (344.7 kPa). The minimum value of \( f_m \) determined by categorization of the masonry units and mortar should be 1,000 pounds per square inch (6895 kPa).

2. Individual unreinforced masonry walls with average tensile-splitting strength of less than 50 pounds per square inch (344.7 kPa) shall be entirely pointed prior to retesting.

3. Hollow unit unreinforced masonry walls with estimated prism compressive strength of less than 1,000 pounds per square inch (6895 kPa) shall be grouted to increase the average net area compressive strength.

**A106.3.3.7 Collar joints.** The collar joints shall be inspected at the test locations during each in-place shear test, and estimates of the percentage of adjacent wythe surfaces that are covered with mortar shall be reported along with the results of the in-place shear tests.

**A106.3.3.8 Unreinforced masonry classes.** Existing unreinforced masonry shall be categorized into one or more classes based on shear strength, quality of construction, state of repair, deterioration and weathering. A class shall be characterized by the allowable masonry shear stress determined in accordance with Section A108.2. Classes shall be defined for whole walls, not for small areas of masonry within a wall.

**A106.3.3.9 Pointing.** Deteriorated mortar joints in unreinforced masonry walls shall be pointed according to UBC Standard 21-8. Nothing shall prevent pointing of any deteriorated masonry wall joints before the tests are made, except as required in Section A107.1.

**SECTION A107 QUALITY CONTROL**

**A107.1 Pointing.** Preparation and mortar pointing shall be performed with special inspection.

**Exception:** At the discretion of the building official, incidental pointing may be performed without special inspection.

**A107.2 Masonry shear tests.** In-place masonry shear tests shall comply with Section A106.3.3.1. Testing of masonry for determination of tensile-splitting strength shall comply with Section A106.3.3.2.

**A107.3 Existing wall anchors.** Existing wall anchors used as all or part of the required tension anchors shall be tested in pull-out according to UBC Standard 21-7. The minimum number of anchors tested shall be four per floor, with two tests at walls with joists framing into the wall and two tests at walls with joists parallel to the wall, but not less than 10 percent of the total number of existing tension anchors at each level.

**A107.4 New bolts.** All new embedded bolts shall be subject to periodic special inspection in accordance with the building code, prior to placement of the bolt and grout or adhesive in the drilled hole. Five percent of all bolts that do not extend through the wall shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with UBC Standard 21-7. New bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

**Exception:** Special inspection in accordance with the building code may be provided during installation of new anchors in lieu of testing.
All new embedded bolts resisting tension forces or a combination of tension and shear forces shall be subject to periodic special inspection in accordance with the building code, prior to placement of the bolt and grout or adhesive in the drilled hole. Five percent of all bolts resisting tension forces shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with UBC Standard 21-7. New through-bolts need not be tested.

**SECTION A108**

**DESIGN STRENGTHS**

**A108.1 Values.**

1. Strength values for existing materials are given in Table A1-D and for new materials in Table A1-E.
2. Capacity reduction factors need not be used.
3. The use of new materials not specified herein shall be based on substantiating research data or engineering judgment, with the approval of the building official.

**A108.2 Masonry shear strength.** The unreinforced masonry shear strength, \( v' \), shall be determined for each masonry class from one of the following equations:

1. The unreinforced masonry shear strength, \( v' \), shall be determined by Equation (A1-4) when the mortar shear strength has been determined by Section A106.3.3.1.

\[
v' = 0.56v + \frac{0.75P_D}{A}
\]  
(Equation A1-4)

The mortar shear strength values, \( v_p \), shall be determined in accordance with Section 106.3.3.5 and shall not exceed 100 pounds per square inch (689.5 kPa) for the determination of \( v' \).

2. The unreinforced masonry shear, \( v' \), shall be determined by Equation (A1-5) when tensile-splitting strength has been determined in accordance with Section A106.3.3.2, Item 1 or 2.

\[
v' = 0.8f_p + 0.5\frac{P_D}{A}
\]  
(Equation A1-5)

3. When \( f_m' \) has been estimated by categorization of the units and mortar in accordance with Section 2105.2.2.1 of the California Building Code, the unreinforced masonry shear strength, \( v' \), shall not exceed 200 pounds per square inch (1380 kPa) or the lesser of the following:

a) \( 2.5\sqrt{f_m'} \)  
b) 200 psi or  
c) \( v + 0.75\frac{P_D}{A} \)  
(Equation A1-6)

For SI: 1 psi = 6.895 kPa.

where:

\( v = 62.5 \) psi (430 kPa) for running bond masonry not grouted solid.

\( v = 100 \) psi (690 kPa) for running bond masonry grouted solid.

\( v = 25 \) psi (170 kPa) for stack bond grouted solid.

**A108.3 Masonry compression.** Where any increase in dead plus live compression stress occurs, the compression stress in unreinforced masonry shall not exceed 300 pounds per square inch (2070 kPa).

**A108.4 Masonry tension.** Unreinforced masonry shall be assumed to have no tensile capacity.

**A108.5 Existing tension anchors.** The resistance values of the existing anchors shall be the average of the tension tests of existing anchors having the same wall thickness and joist orientation.

**A108.6 Foundations.** For existing foundations, new total dead loads may be increased over the existing dead load by 25 percent. New total dead load plus live load plus seismic forces may be increased over the existing dead load plus live load by 50 percent. Higher values may be justified only in conjunction with a geotechnical investigation.

**SECTION A109**

**ANALYSIS AND DESIGN PROCEDURE**

**A109.1 General.** The elements of buildings hereby required to be analyzed are specified in Table A1-A.

**A109.2 Selection of procedure.** Buildings with rigid diaphragms shall be analyzed by the general procedure of Section A110, which is based on the building code. Buildings with flexible diaphragms shall be analyzed by the general procedure or, when applicable, may be analyzed by the special procedure of Section A111.

**SECTION A110**

**GENERAL PROCEDURE**

**A110.1 Minimum design lateral forces.** Buildings shall be analyzed to resist minimum lateral forces assumed to act non-concurrently in the direction of each of the main axes of the structure in accordance with the following:

\[
V = 0.75 S_{b5} W
\]  
(Equation A1-7)

**A110.2 Lateral forces on elements of structures.** Parts and portions of a structure not covered in Sections A110.3 shall be analyzed and designed per the current building code, using force levels defined in Section A110.1.

**Exceptions:**

1. Unreinforced masonry walls for which height-to-thickness ratios do not exceed ratios set forth in Table A1-B need not be analyzed for out-of-plane loading. Unreinforced masonry walls that exceed the allowable \( h/t \) ratios of Table A1-B shall be braced according to Section A113.5.
2. Parapets complying with Section A113.6 need not be analyzed for out-of-plane loading.
3. Walls shall be anchored to floor and roof diaphragms in accordance with Section A113.1.

A110.3 In-plane loading of URM shear walls and frames. Vertical lateral-force-resisting elements shall be analyzed in accordance with Section A112.

A110.4 Redundancy and overstrength factors. Any redundancy or overstrength factors contained in the building code may be taken as unity. The vertical component of earthquake load \( E_v \) may be taken as zero.

**SECTION A111**

**SPECIAL PROCEDURE**

A111.1 Limits for the application of this procedure. The special procedures of this section may be applied only to buildings having the following characteristics:

1. **Flexible diaphragms at all levels above the base of the structure.**
2. **Vertical elements of the lateral-force-resisting system consisting predominantly of masonry or concrete shear walls.**
3. **Except for single-story buildings with an open front on one side only, a minimum of two lines of vertical elements of the lateral-force-resisting system parallel to each axis of the building (see Section A111.8 for open-front buildings).**

A111.2 Lateral forces on elements of structures. With the exception of the provisions in Sections A111.4 through A111.7, elements of structures shall comply with Sections A110.2 through A110.4.

A111.3 Crosswalls. Crosswalls shall meet the requirements of this section.

A111.3.1 Crosswall definition. A crosswall is a wood-framed wall sheathed with any of the materials described in Table A1-D or A1-E or other system as defined in Section A111.3.5. Crosswalls shall be spaced no more than 40 feet (12 192 mm) on center measured perpendicular to the direction of consideration, and shall be placed in each story of the building. Crosswalls shall extend the full story height between diaphragms.

**Exceptions:**
1. Crosswalls need not be provided at all levels when used in accordance with Section A111.4.2, Item 4.
2. Existing crosswalls need not be continuous below a wood diaphragm at or within 4 feet (1219 mm) of grade, provided:
   2.1 Shear connections and anchorage requirements of Section A111.5 are satisfied at all edges of the diaphragm.
   2.2 Crosswalls with total shear capacity of \( 0.5S_d \sum W_d \) interconnect the diaphragm to the foundation.
   2.3 The demand-capacity ratio of the diaphragm between the crosswalls that are continuous to their foundations does not exceed 2.5, calculated as follows:
   
   \[
   DCR = \frac{2.1S_d W_d + V_{cb}}{2v_u D} \quad \text{(Equation A1-8)}
   \]

A111.3.2 Crosswall shear capacity. Within any 40 feet (12 192 mm) measured along the span of the diaphragm, the sum of the crosswall shear capacities shall be at least 30 percent of the diaphragm shear capacity of the strongest diaphragm at or above the level under consideration.

A111.3.3 Existing crosswalls. Existing crosswalls shall have a maximum height-to-length ratio between openings of 1.5 to 1. Existing crosswall connections to diaphragms need not be investigated as long as the crosswall extends to the framing of the diaphragms above and below.

A111.3.4 New crosswalls. New crosswall connections to the diaphragm shall develop the crosswall shear capacity. New crosswalls shall have the capacity to resist an overturning moment equal to the crosswall shear capacity times the story height. Crosswall overturning moments need not be cumulative over more than two stories.

A111.3.5 Other crosswall systems. Other systems, such as moment-resisting frames, may be used as crosswalls provided that the yield story drift does not exceed 1 inch (25.4 mm) in any story.

A111.4 Wood diaphragms.

A111.4.1 Acceptable diaphragm span. A diaphragm is acceptable if the point \( L \times DCR \) on Figure A1-1 falls within Region 1, 2 or 3.

A111.4.2 Demand-capacity ratios. Demand-capacity ratios shall be calculated for the diaphragm at any level according to the following formulas:

1. For a diaphragm without qualifying crosswalls at levels immediately above or below:
   \[
   DCR = 2.1S_d W_d / (\Sigma v_u D) \quad \text{(Equation A1-9)}
   \]
2. For a diaphragm in a single-story building with qualifying crosswalls, or for a roof diaphragm coupled by crosswalls to the diaphragm directly below:
   \[
   DCR = 2.1S_d W_d / (\Sigma v_u D + V_{cb}) \quad \text{(Equation A1-10)}
   \]
3. For diaphragms in a multistory building with qualifying crosswalls in all levels:
   \[
   DCR = 2.1S_d \Sigma W_d / (\Sigma v_u D + V_{cb}) \quad \text{(Equation A1-11)}
   \]
   
   **DCR** shall be calculated at each level for the set of diaphragms at and above the level under consideration. In addition, the roof diaphragm shall also meet the requirements of Equation (A1-10).
4. For a roof diaphragm and the diaphragm directly below, if coupled by crosswalls:
   \[
   DCR = 2.1S_d W_d / (\Sigma v_u D) \quad \text{(Equation A1-12)}
   \]

A111.4.3 Chords. An analysis for diaphragm flexure need not be made, and chords need not be provided.
AII1.4.4 Collectors. An analysis of diaphragm collector forces shall be made for the transfer of diaphragm edge shears into vertical elements of the lateral-force-resisting system. Collector forces may be resisted by new or existing elements.

AII1.4.5 Diaphragm openings.

1. Diaphragm forces at corners of openings shall be investi­gated and shall be developed into the diaphragm by new or existing materials.

2. In addition to the demand-capacity ratios of Section AII1.4.2, the demand-capacity ratio of the portion of the diaphragm adjacent to an opening shall be calculated using the opening dimension as the span.

3. Where an opening occurs in the end quarter of the diaphragm, the calculation of \(v_d\) for the demand-capacity ratio shall be based on the net depth of the diaphragm.

AII1.5 Diaphragm shear transfer. Diaphragms shall be connected to shear walls with connections capable of developing the diaphragm-loading tributary to the shear wall given by the lesser of the following formulas:

\[
V = 1.2 S_D C_p W_d \quad (\text{Equation A1-13})
\]

using the \(C_p\) values in Table A1-C, or

\[
V = v_d D \quad (\text{Equation A1-14})
\]

AII1.6 Shear walls (In-plane loading).

AII1.6.1 Wall story force. The wall story force distributed to a shear wall at any diaphragm level shall be the lesser value calculated as:

\[
F_{wx} = 0.8 S_D (W_{wx} + W_d/2) \quad (\text{Equation A1-15})
\]

but need not exceed

\[
F_{wx} = 0.8 S_D W_{wx} + v_d D \quad (\text{Equation A1-16})
\]

AII1.6.2 Wall story shear. The wall story shear shall be the sum of the wall story forces at and above the level of consideration.

\[
V_{wx} = \Sigma F_{wx} \quad (\text{Equation A1-17})
\]

AII1.6.3 Shear wall analysis. Shear walls shall comply with Section A112.

AII1.6.4 Moment frames. Moment frames used in place of shear walls shall be designed as required by the building code, except that the forces shall be as specified in Section AII1.6.1, and the story drift ratio shall be limited to 0.015, except as further limited by Section A112.4.2.

AII1.7 Out-of-plane forces—unreinforced masonry walls.

AII1.7.1 Allowable unreinforced masonry wall height-to-thickness ratios. The provisions of Section A110.2 are applicable, except the allowable height-to-thickness ratios given in Table A1-B shall be determined from Figure A1-1 as follows:

1. In Region 1, height-to-thickness ratios for buildings with crosswalls may be used if qualifying crosswalls are present in all stories.

2. In Region 2, height-to-thickness ratios for buildings with crosswalls may be used whether or not qualifying crosswalls are present.

3. In Region 3, height-to-thickness ratios for "all other buildings" shall be used whether or not qualifying crosswalls are present.

AII1.7.2 Walls with diaphragms in different regions. When diaphragms above and below the wall under consideration have demand-capacity ratios in different regions of Figure A1-1, the lesser height-to-thickness ratio shall be used.

AII1.8 Open-front design procedure. A single-story building with an open front on one side and crosswalls parallel to the open front may be designed by the following procedure:

1. Effective diaphragm span, \(L_o\), for use in Figure A1-1 shall be determined in accordance with the following formula:

\[
L_o = 2 [(W_{wx}/W_d) L + L ] \quad (\text{Equation A1-18})
\]

2. Diaphragm demand-capacity ratio shall be calculated as:

\[
DCR = 2.12 S_D (W_d + W_{wx}) / (\{ v_d D \} + V_{wx}) \quad (\text{Equation A1-19})
\]

SECTION A112
ANALYSIS AND DESIGN

A112.1 General. The following requirements are applicable to both the general procedure and the special procedure for analyzing vertical elements of the lateral-force-resisting system.

A112.2 Existing unreinforced masonry walls.

A112.2.1 Flexural rigidity. Flexural components of deflec­tion may be neglected in determining the rigidity of an unreinforced masonry wall.

A112.2.2 Shear walls with openings. Wall piers shall be analyzed according to the following procedure, which is diagramed in Figure A1-2.

1. For any pier,

1.1. The pier shear capacity shall be calculated as:

\[
V_o = v_o A/1.5 \quad (\text{Equation A1-20})
\]

1.2. The pier rocking shear capacity shall be calculated as:

\[
V_r = 0.9 P_o D/H \quad (\text{Equation A1-21})
\]

2. The wall piers at any level are acceptable if they comply with one of the following modes of behavior:

2.1. Rocking controlled mode. When the pier rocking shear capacity is less than the pier shear capacity, i.e., \(V_r < V_o\) for each pier in a level, forces in the wall at that level, \(V_{wx}\), shall be distributed to each pier in proportion to \(P_o D/H\). For the wall at that level:

\[
0.7 V_{wx} < \Sigma V_r \quad (\text{Equation A1-22})
\]
2.2. Shear controlled mode. Where the pier shear capacity is less than the pier rocking capacity, i.e., \( V_p < V_a \) in at least one pier in a level, forces in the wall at the level, \( V_{sw} \), shall be distributed to each pier in proportion to \( D/H \).

For each pier at that level:

\[
V_p < V_a \quad \text{(Equation A1-23)}
\]

and

\[
V_p < V_r \quad \text{(Equation A1-24)}
\]

If \( V_p < V_a \) for each pier and \( V_p > V_r \) for one or more piers, such piers shall be omitted from the analysis, and the procedure shall be repeated for the remaining piers, unless the wall is strengthened and reanalyzed.

3. Masonry pier tension stress. Unreinforced masonry wall piers need not be analyzed for tension stress.

A112.2.3 Shear walls without openings. Shear walls without openings shall be analyzed the same as for walls with openings, except that \( V_r \) shall be calculated as follows:

\[
V_r = 0.9 (P_p + 0.5 P_w/H) D/H \quad \text{(Equation A1-25)}
\]

A112.3 Plywood-sheathed shear walls. Plywood-sheathed shear walls may be used to resist lateral forces for buildings with flexible diaphragms analyzed according to provisions of Section A111. Plywood-sheathed shear walls may not be used to share lateral forces with other materials along the same line of resistance.

A112.4 Combinations of vertical elements.

A112.4.1 Lateral-force distribution. Lateral forces shall be distributed among the vertical-resisting elements in proportion to their relative rigidities, except that moment-resisting frames shall comply with Section A112.4.2.

A112.4.2 Moment-resisting frames. Moment-resisting frames shall not be used with an unreinforced masonry wall in a single line of resistance unless the wall has piers that have adequate shear capacity to sustain rocking in accordance with Section A112.2.2. The frames shall be designed in accordance with the building code to carry 100 percent of the lateral forces transferable to that line of resistance, as determined from Equation (A1-7). The story drift ratio shall be limited to 0.0075.

SECTION A113
DETAILED SYSTEM DESIGN REQUIREMENTS

A113.1 Wall anchorage.

A113.1.1 Anchor locations. Unreinforced masonry walls shall be anchored at the roof and floor levels as required in Section A110.2. Ceilings of plaster or similar materials, when not attached directly to roof or floor framing and where abutting masonry walls, shall either be anchored to the walls at a maximum spacing of 6 feet (1829 mm), or be removed.

A113.1.2 Anchor requirements. Anchors shall consist of bolts installed through the wall as specified in Table A11-E, or an approved equivalent at a maximum anchor spacing of 6 feet (1829 mm). All wall anchors shall be secured to the joists to develop the required forces.

A113.1.3 Minimum wall anchorage. Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as 0.95 times the tributary weight or 200 pounds per linear foot (2920 N/m), whichever is greater, acting normal to the wall at the level of the floor or roof. Existing wall anchors, if used, must meet the requirements of this chapter or must be upgraded.

A113.1.4 Anchors at corners. At the roof and floor levels, both shear and tension anchors shall be provided within 2 feet (610 mm) horizontally from the inside of the corners of the walls.

A113.2 Diaphragm shear transfer. Bolts transmitting shear forces shall have a maximum bolt spacing of 6 feet (1829 mm) and shall have nuts installed over malleable iron or plate washers when bearing on wood, and heavy-cut washers when bearing on steel.

A113.3 Collectors. Collector elements shall be provided that are capable of transferring the seismic forces originating in other portions of the building to the element providing the resistance to those forces.

A113.4 Ties and continuity. Ties and continuity shall conform to the requirements of the building code.

A113.5 Wall bracing.

A113.5.1 General. Where a wall height-to-thickness ratio exceeds the specified limits, the wall may be laterally supported by vertical bracing members per Section A113.5.2 or by reducing the wall height by bracing per Section A113.5.3.

A113.5.2 Vertical bracing members. Vertical bracing members shall be attached to floor and roof construction for their design loads independently of required wall anchors. Horizontal spacing of vertical bracing members shall not exceed one-half of the unsupported height of the wall or 10 feet (3048 mm). Deflection of such bracing members at design loads shall not exceed one-tenth of the wall thickness.

A113.5.3 Intermediate wall bracing. The wall height may be reduced by bracing elements connected to the floor or roof. Horizontal spacing of the bracing elements and wall anchors shall be as required by design, but shall not exceed 6 feet (1829 mm) on center. Bracing elements shall be detailed to minimize the horizontal displacement of the wall by the vertical displacement of the floor or roof.

A113.6 Parapets. Parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions.

The maximum height of an unbraced unreinforced masonry parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table A1-F. If the required parapet height exceeds this maximum height, a bracing system designed for the forces determined in accordance with the building code.

2007 CALIFORNIA EXISTING BUILDING CODE
shall support the top of the parapet. Parapet corrective work must be performed in conjunction with the installation of tension roof anchors.

The minimum height of a parapet above any wall anchor shall be 12 inches (305 mm).

**Exception:** If a reinforced concrete beam is provided at the top of the wall, the minimum height above the wall anchor may be 6 inches (152 mm).

### A113.7 Veneer.

1. Veneer shall be anchored with approved anchor ties conforming to the required design capacity specified in the building code and shall be placed at a maximum spacing of 24 inches (610 mm) with a maximum supported area of 4 square feet (0.372 m²).

**Exception:** Existing anchor ties for attaching brick veneer to brick backing may be acceptable, provided the ties are in good condition and conform to the following minimum size and material requirements.

Existing veneer anchor ties may be considered adequate if they are of corrugated galvanized iron strips not less than 1 inch (25.4 mm) in width, 8 inches (203 mm) in length and 1/16 inch (1.6 mm) in thickness, or the equivalent.

2. The location and condition of existing veneer anchor ties shall be verified as follows:

   2.1. An approved testing laboratory shall verify the location and spacing of the ties and shall submit a report to the building official for approval as part of the structural analysis.

   2.2. The veneer in a selected area shall be removed to expose a representative sample of ties (not less than four) for inspection by the building official.

### A113.8 Nonstructural masonry walls.

Unreinforced masonry walls that carry no design vertical or lateral loads and that are not required by the design to be part of the lateral-force resisting system shall be adequately anchored to new or existing supporting elements. The anchors and elements shall be designed for the out-of-plane forces specified in the building code. The height- or length-to-thickness ratio between such supporting elements for such walls shall not exceed nine.

### A113.9 Truss and beam supports.

Where trusses and beams other than rafters or joists are supported on masonry, independent secondary columns shall be installed to support vertical loads of the roof or floor members.

**Exception:** Secondary supports are not required where $S_D$ is less than 0.3g.

### A113.10 Adjacent buildings.

Where elements of adjacent buildings do not have a separation of at least 5 inches (127 mm), the allowable height-to-thickness ratios for "all other buildings" per Table A1-B shall be used in the direction of consideration.
### TABLE A1-A—ELEMENTS REGULATED BY THIS CHAPTER

<table>
<thead>
<tr>
<th>BUILDING ELEMENTS</th>
<th>$S_m$</th>
<th>(0.067 &lt; S_m &lt; 0.133)</th>
<th>(0.133 &lt; S_m &lt; 0.20)</th>
<th>(0.20 &lt; S_m &lt; 0.30)</th>
<th>(S_m &gt; 0.30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parapets</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Walls, anchorage</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Walls, h/t ratios</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Walls, in-plane shear</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Diaphragms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diaphragms, shear transfer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diaphragms, demand-capacity ratios</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Applies only to buildings designed according to the general procedures of Section A110.

b. Applies only to buildings designed according to the special procedures of Section A111.

### TABLE A1-B—ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS

<table>
<thead>
<tr>
<th>WALL TYPES</th>
<th>(0.13 &lt; S_m &lt; 0.25)</th>
<th>(0.25 &lt; S_m &lt; 0.4)</th>
<th>(S_m \geq 0.4), BUILDINGS WITH CROSSWALLS(^a)</th>
<th>(S_m &gt; 0.4) ALL OTHER BUILDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls of one-story buildings</td>
<td>20</td>
<td>16</td>
<td>16(^b,c)</td>
<td>13</td>
</tr>
<tr>
<td>First-story wall of multistory building</td>
<td>20</td>
<td>18</td>
<td>16(^c)</td>
<td>15</td>
</tr>
<tr>
<td>Walls in top story of multistory building</td>
<td>14</td>
<td>14</td>
<td>14(^b,c)</td>
<td>9</td>
</tr>
<tr>
<td>All other walls</td>
<td>20</td>
<td>16</td>
<td>16(^c)</td>
<td>13</td>
</tr>
</tbody>
</table>

a. Applies to the special procedures of Section A111 only. See Section A111.7 for other restrictions.
b. This value of height-to-thickness ratio may be used only where mortar shear tests establish a tested mortar shear strength, \(v_t\), of not less than 100 pounds per square inch (690 kPa). This value may also be used where the tested mortar shear strength is not less than 60 pounds per square inch (414 kPa), and where a visual examination of the collar joint indicates not less than 50-percent mortar coverage.
c. Where a visual examination of the collar joint indicates not less than 50-percent mortar coverage, and the tested mortar shear strength, \(v_t\), is greater than 30 pounds per square inch (207 kPa) but less than 60 pounds per square inch (414 kPa), the allowable height-to-thickness ratio may be determined by linear interpolation between the larger and smaller ratios in direct proportion to the tested mortar shear strength.

### TABLE A1-C—HORIZONTAL FORCE FACTOR, \(C_p\)

<table>
<thead>
<tr>
<th>CONFIGURATION OF MATERIALS</th>
<th>(C_p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roofs with straight or diagonal sheathing and roofing applied directly to the sheathing, or floors with straight tongue-and-groove sheathing.</td>
<td>0.50</td>
</tr>
<tr>
<td>Diaphragms with double or multiple layers of boards with edges offset, and blocked plywood systems.</td>
<td>0.75</td>
</tr>
<tr>
<td>Diaphragms of metal deck without topping: Minimal welding or mechanical attachment.</td>
<td>0.6</td>
</tr>
<tr>
<td>Welded or mechanically attached for seismic resistance.</td>
<td>0.68</td>
</tr>
<tr>
<td>EXISTING MATERIALS OR CONFIGURATION OF MATERIALS</td>
<td>STRENGTH VALUES</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Horizontal diaphragms</td>
<td>× 14.594 for N/m</td>
</tr>
<tr>
<td>Roofs with straight sheathing and roofing applied directly to the sheathing.</td>
<td>300 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Roofs with diagonal sheathing and roofing applied directly to the sheathing.</td>
<td>750 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Floors with straight tongue-and-groove sheathing.</td>
<td>300 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular.</td>
<td>1,500 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Floors with diagonal sheathing and finished wood flooring.</td>
<td>1,800 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Metal deck welded with minimal welding.</td>
<td>1,800 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Metal deck welded for seismic resistance.</td>
<td>3,000 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Crosswalls</td>
<td></td>
</tr>
<tr>
<td>Plaster on wood or metal lath.</td>
<td>600 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Plaster on gypsum lath.</td>
<td>550 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Gypsum wallboard, unblocked edges.</td>
<td>200 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Gypsum wallboard, blocked edges.</td>
<td>400 lbs. per ft. for seismic shear</td>
</tr>
<tr>
<td>Existing footing, wood framing, structural steel, reinforcing steel</td>
<td></td>
</tr>
<tr>
<td>Plain concrete footings.</td>
<td>$f'_c = 1,500$ psi (10.34 MPa) unless otherwise shown by tests</td>
</tr>
<tr>
<td>Douglas fir wood.</td>
<td>Same as D.F. No. 1</td>
</tr>
<tr>
<td>Reinforcing steel.</td>
<td>$F_y = 40,000$ psi (124.1 N/mm²) maximum</td>
</tr>
<tr>
<td>Structural steel.</td>
<td>$F_y = 33,000$ psi (137.9 N/mm²) maximum</td>
</tr>
</tbody>
</table>

- **a.** Material must be sound and in good condition.
- **b.** Shear values of these materials may be combined, except the total combined value should not exceed 900 pounds per foot (4380 N/m).
- **c.** Minimum 22-gage steel deck with welds to supports satisfying the standards of the Steel Deck Institute.
- **d.** Minimum 22-gage steel deck with $\frac{3}{4}$" plug welds at an average spacing not exceeding 8 inches (203 mm) and with sidelap welds appropriate for the deck span.
TABLE A1-E—STRENGTH VALUES OF NEW MATERIALS USED IN CONJUNCTION WITH EXISTING CONSTRUCTION

<table>
<thead>
<tr>
<th>NEW MATERIALS OR CONFIGURATION OF MATERIALS</th>
<th>STRENGTH VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal diaphragms: plywood sheathing applied directly over existing straight sheathing with ends of plywood sheets bearing on joists or rafters and edges of plywood located on center of individual sheathing boards.</td>
<td>675 lbs. per ft.</td>
</tr>
<tr>
<td>Crosswalls: drywall or plaster applied directly over wood studs.</td>
<td>1.2 times the value specified in the current building code.</td>
</tr>
<tr>
<td>Drywall or plaster applied directly over wood studs.</td>
<td>The value specified in the current building code.</td>
</tr>
<tr>
<td>Drywall or plaster applied to sheathing over existing wood studs.</td>
<td>50 percent of the value specified in the current building code.</td>
</tr>
<tr>
<td>Tension bolts:(^a) bolts extending entirely through unreinforced masonry wall secured with bearing plates on far side of a three-wythe- minimum wall with at least 30 square inches of area.(^b,c)</td>
<td>5,400 lbs. per bolt 2,700 lbs. for two-wythe walls</td>
</tr>
<tr>
<td>Shear bolts:(^a) bolts embedded a minimum of 8 inches into unreinforced masonry walls; bolts should be centered in 2(\frac{1}{2})-inch-diameter holes with dry-pack or nonshrink grout around the circumference of the bolt.</td>
<td>The value for plain masonry specified for solid masonry in the current building code; no value larger than those given for (\frac{1}{2})-inch bolts should be used.</td>
</tr>
<tr>
<td>Combined tension and shear bolts:(^a) Through-bolts—bolts meeting the requirements for shear and for tension bolts.</td>
<td>Tension—same as for tension bolts  Shear—same as for shear bolts</td>
</tr>
<tr>
<td>Embedded bolts—bolts extending to the exterior face of the wall with a 2(\frac{1}{2})-inch round plate under the head and drilled at an angle of 22(\frac{1}{2}) degrees to the horizontal; installed as specified for shear bolts.(^a,b,c)</td>
<td>Tension—3,600 lbs. per bolt  Shear—same as for shear bolts</td>
</tr>
<tr>
<td>Infilled walls: reinforced masonry infilled openings in existing unreinforced masonry walls; provide keys or dowels to match reinforcing.</td>
<td>Same as values specified for unreinforced masonry walls</td>
</tr>
<tr>
<td>Reinforced masonry: masonry piers and walls reinforced per the current building code.</td>
<td>The value specified in the current building code for strength design.</td>
</tr>
<tr>
<td>Reinforced concrete: concrete footings, walls and piers reinforced as specified in the current building code.</td>
<td>The value specified in the current building code for strength design.</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm\(^2\), 1 pound = 4.4 N.
\(^a\) Embedded bolts to be tested as specified in Section A107.4.
\(^b\) Bolts to be \(\frac{1}{2}\)-inch (12.7 mm) minimum in diameter.
\(^c\) Drilling for bolts and dowels shall be done with an electric rotary drill; impact tools should not be used for drilling holes or tightening anchors and shear bolt nuts.
\(^d\) No load factors or capacity reduction factor shall be used.
\(^e\) Other bolt sizes, values and installation methods may be used, provided a testing program is conducted in accordance with UBC Standard 21-7. The usable value shall be determined by multiplying the calculated allowable value, as determined by UBC Standard 21-7, by 3.0, and the usable value shall be limited to a maximum of 1.5 times the value given in the table. Bolt spacing shall not exceed 6 foot (1829 mm) on center and shall not be less than 12 inches (305 mm) on center.

### TABLE A1-F—MAXIMUM ALLOWABLE HEIGHT-TO-THICKNESS RATIOS FOR PARAPETS

<table>
<thead>
<tr>
<th>Maximum allowable height-to-thickness ratios</th>
<th>$S_{p1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.13_g &lt; S_{p1} &lt; 0.25_g$</td>
<td>2.5</td>
</tr>
<tr>
<td>$0.25_g &lt; S_{p1} &lt; 0.4_g$</td>
<td>2.5</td>
</tr>
<tr>
<td>$S_{p1} \geq 0.4_g$</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### TABLE A1-G—MAXIMUM HEIGHT-TO-THICKNESS RATIOS FOR ADOBE OR STONE WALLS

<table>
<thead>
<tr>
<th>One-story buildings</th>
<th>$S_{p1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.13_g &lt; S_{p1} &lt; 0.25_g$</td>
<td>12</td>
</tr>
<tr>
<td>$0.25_g &lt; S_{p1} &lt; 0.4_g$</td>
<td>10</td>
</tr>
<tr>
<td>$S_{p1} \geq 0.4_g$</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Two-story buildings</th>
<th>$S_{p1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>First story</td>
<td>14</td>
</tr>
<tr>
<td>Second story</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>
1. Region of demand-capacity ratios where crosswalls may be used to increase $h/t$ ratios.
2. Region of demand-capacity ratios where $h/t$ ratios of "buildings with crosswalls" may be used, whether or not crosswalls are present.
3. Region of demand-capacity ratios where $h/t$ ratios of "all other buildings" shall be used, whether or not crosswalls are present.

**FIGURE A1-1**

ACCEPTABLE DIAPHRAGM SPAN
$V_a =$ Allowable shear strength of a pier.
$V_p =$ Shear force assigned to a pier on the basis of a relative shear rigidity analysis.
$V_r =$ Rocking shear capacity of pier.
$V_{tot} =$ Total shear force resisted by the wall.
$\Sigma V_r =$ Rocking shear capacity of all piers in the wall.

**FIGURE A1-2**
ANALYSIS OF URM WALL IN-PLANE SHEAR FORCES
REFERENCE STANDARDS

UNIFORM BUILDING CODE STANDARD 21-4
HOLLOW AND SOLID LOAD-BEARING
CONCRETE MASONRY UNITS

Based on Standard Specification C 90-95 of the ASTM International.
Extracted, with permission, from the Annual Book of ASTM Standards, copyright
ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428

Note: See Appendix Chapter 1, Section A106, California Existing Building Code

Section 21.401 — Scope
This standard covers solid (units with 75 percent or more net area) and hollow load-bearing concrete masonry units made from portland cement, water and mineral aggregates with or without the inclusion of other materials.

Section 21.402 — Classification
21.402.1 Types. Two types of concrete masonry units in each of two grades are covered as follows:

21.402.1.1 Type I, moisture-controlled units. Units designated as Type I shall conform to all requirements of this standard including the moisture content requirements of Table 21-4-A.

21.402.1.2 Type II, nonmoisture-controlled units. Units designated as Type II shall conform to all requirements of this standard except the moisture content requirements of Table 21-4-A.

21.402.2 Grades. Concrete masonry units manufactured in accordance with this standard shall conform to two grades as follows:

21.402.2.1 Grade N. Units having a weight classification of 85 pcf (1360 kg/m³) or greater, for general use such as in exterior walls below and above grade that may or may not be exposed to moisture penetration or the weather and for interior walls and backup.

21.402.2.2 Grade S. Units having a weight classification of less than 85 pcf (1360 kg/m³), for uses limited to above-grade installation in exterior walls with weather-protective coatings and in walls not exposed to the weather.

Section 21.403 — Materials
21.403.1 Cementitious materials. Materials shall conform to the following applicable standards:

1. Portland Cement—ASTM C 150 modified as follows:
   - Limitation on insoluble residue—1.5 percent maximum.
   - Limitation on air content of mortar, Volume percent—22 percent maximum.
   - Limitation on loss on ignition—7 percent maximum.
   - Limestone with a minimum 85 percent calcium carbonate (CaCO₃) content may be added to the cement, provided the requirements of ASTM C 150 as modified above are met.


21.403.2 Other constituents and aggregates. Air-entraining agents, coloring pigments, integral water repellents, finely ground silica, aggregates, and other constituents, shall be previously established as suitable for use in concrete or shall be shown by test or experience to not be detrimental to the durability of the concrete.

Section 21.404 — Physical Requirements
At the time of delivery to the work site, the units shall conform to the physical requirements prescribed in Table 21-4-B. The moisture content of Type I concrete masonry units at time of delivery shall conform to the requirements prescribed in Table 21-4-A.

At the time of delivery to the purchaser, the linear shrinkage of Type II units shall not exceed 0.065 percent.

Section 21.405 — Minimum Face-shell and Web Thicknesses
Face-shell (FST) and web (WT) thicknesses shall conform to the requirements listed in Table 21-4-C.

Section 21.406 — Permissible Variations in Dimensions
21.406.1 Precision units. For precision units, no overall dimension (width, height and length) shall differ by more than \( \frac{1}{8} \) inch (3.2 mm) from the specified standard dimensions.

21.406.2 Particular feature units. For particular feature units, dimensions shall be in accordance with the following:

1. For molded face units, no overall dimension (width, height and length) shall differ by more than \( \frac{1}{8} \) inch (3.2 mm) from the specified standard dimension. Dimensions of molded features (ribs, scores, hex-shapes, patterns, etc.) shall be within \( \frac{1}{16} \) inch (1.6 mm) of the specified standard dimensions and shall be within \( \frac{1}{16} \) inch (1.6 mm) of the specified placement of the unit.

2. For split-faced units, all non-split overall dimensions (width, height and length) shall differ by no more than \( \frac{1}{8} \) inch (3.2 mm) from the specified standard dimension.
inch (3.2 mm) from the specified standard dimensions. On faces that are split, overall dimensions will vary. Local suppliers should be consulted to determine dimensional tolerances achievable.

3. For slumped units, no overall height dimension shall differ by more than 1/8 inch (3.2 mm) from the specified standard dimension. On faces that are slumped, overall dimensions will vary. Local suppliers should be consulted to determine dimension tolerances achievable.

Note: Standard dimensions of units are the manufacturer’s designated dimensions. Nominal dimensions of modular size units, except slumped units, are equal to the standard dimensions plus 3/8 inch (9.5 mm), the thickness of one standard mortar joint. Slumped units are equal to the standard dimensions plus 1/2 inch (13 mm), the thickness of one standard mortar joint. Nominal dimensions of nonmodular size units usually exceed the standard dimensions by 1/4 inch to 1/2 inch (3.2 mm to 6.4 mm).

Section 21.407 — Visual Inspection

All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Units may have minor cracks incidental to the usual method of manufacture, or minor chipping resulting from customary methods of handling in shipment and delivery.

Units that are intended to serve as a base for plaster or stucco shall have a sufficiently rough surface to afford a good bond.

Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks or other imperfections when viewed from 20 feet (6100 mm), except that not more than 5 percent of a shipment may have slight cracks or small chips not larger than 1 inch (25.4 mm).

Section 21.408 — Methods of Sampling and Testing

The purchaser or authorized representative shall be accorded proper facilities to inspect and sample the units at the place of manufacture from the lots ready for delivery.

Sample and test units in accordance with ASTM C 140.

Total linear drying shrinkage shall be based on tests of concrete masonry units made with the same materials, concrete mix design, manufacturing process and curing method, conducted in accordance with ASTM C 426 and not more than 24 months prior to delivery.

Section 21.409 — Rejection

If the samples tested from a shipment fail to conform to the specified requirements, the manufacturer may sort it, and new specimens shall be selected by the purchaser from the retained lot and tested at the expense of the manufacturer. If the second set of specimens fails to conform to the specified requirements, the entire lot shall be rejected.

### TABLE 21-4-A

<table>
<thead>
<tr>
<th>LINEAR SHRINKAGE, PERCENT</th>
<th>Humid 1</th>
<th>Intermediate 2</th>
<th>Arid 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03 or less</td>
<td>45</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>From 0.03 to 0.045</td>
<td>40</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>0.045 to 0.065, max.</td>
<td>30</td>
<td>30</td>
<td>25</td>
</tr>
</tbody>
</table>

1 Average annual relative humidity above 75 percent.
2 Average annual relative humidity 50 to 75 percent.
3 Average annual relative humidity less than 50 percent.

### TABLE 21-4-B

<table>
<thead>
<tr>
<th>COMPRESSION STRENGTH, MIN, psi (MPa)</th>
<th>WATER ABSORPTION, MAX, lb./ft. (kg/m) (Average of 3 Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Net Area</td>
<td>Weight Classification—Oven-dry Weight of Concrete, lb./ft. (kg/m)</td>
</tr>
<tr>
<td>Average of 3 Units</td>
<td>Individual Unit</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1900 (13.1)</td>
<td>1700 (11.7)</td>
</tr>
</tbody>
</table>
### TABLE 21-4-C
MINIMUM THICKNESS OF FACE-SHELLS AND WEBS

<table>
<thead>
<tr>
<th>NOMINAL WIDTH (W) OF UNIT (inches)</th>
<th>FACE-SHELL THICKNESS (FST) MIN., (inches)</th>
<th>WEB THICKNESS (WT)</th>
<th>Equivalent Web Thickness, Min., In./Lin. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x 28.4 for mm</td>
<td></td>
<td>x 83 for mm/lin. m</td>
</tr>
<tr>
<td>3 and 4</td>
<td>3/4</td>
<td>3/4</td>
<td>1 3/8</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2 1/4</td>
</tr>
<tr>
<td>8</td>
<td>1 1/4</td>
<td>1</td>
<td>2 1/4</td>
</tr>
<tr>
<td>10</td>
<td>1 3/8</td>
<td>1 1/8</td>
<td>2 1/2</td>
</tr>
<tr>
<td>12</td>
<td>1 1/2</td>
<td>1 1/8</td>
<td>2 1/2</td>
</tr>
<tr>
<td></td>
<td>1 1/4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Average of measurements on three units taken at the thinnest point.
2. Sum of the measured thickness of all webs in the unit, multiplied by 12 (305 when using metric), and divided by the length of the unit. In the case of open-ended units where the open-ended portion is solid grouted, the length of that open-ended portion shall be deducted from the overall length of the unit.
3. This face-shell thickness (FST) is applicable where allowable design load is reduced in proportion to the reduction in thicknesses shown, except that allowable design load on solid-grouted units shall not be reduced.
4. For split-faced units, a maximum of 10 percent of a shipment may have face-shell thicknesses less than those shown, but in no case less than 3/4 inch (19 mm).
UNIFORM BUILDING CODE STANDARD 21-6
IN-PLACE MASONRY SHEAR TESTS

See Appendix Chapter 1, Sections A1 06.3.3 and A1 07.2, Uniform Code for Building Conservation
Note: See Appendix Chapter A1, Section A104, California Existing Building Code.

SECTION 21.601 — SCOPE
This standard applies when the Uniform Code for Building Conservation (California Existing Building Code) requires in-place testing of the quality of masonry mortar.

SECTION 21.602 — PREPARATION OF SAMPLE
The bed joints of the outer wythe of the masonry shall be tested in shear by laterally displacing a single brick relative to the adjacent bricks in the same wythe. The head joint opposite the loaded end of the test brick shall be carefully excavated and cleared. The brick adjacent to the loaded end of the test brick shall be carefully removed by sawing or drilling and excavating to provide space for a hydraulic ram and steel loading blocks.

SECTION 21.603 — APPLICATION OF LOAD AND DETERMINATION OF RESULTS
Steel blocks, the size of the end of the brick, shall be used on each end of the ram to distribute the load to the brick. The blocks shall not contact the mortar joints. The load shall be applied horizontally, in the plane of the wythe, until either a crack can be seen or slip occurs. The strength of the mortar shall be calculated by dividing the load at the first cracking or movement of the test brick by the nominal gross area of the sum of the two bed joints.

UNIFORM BUILDING CODE STANDARD 21-7
TESTS OF ANCHORS IN UNREINFORCED MASONRY WALLS

See Appendix Chapter 1, Section A1 07.3 and A1 07.4, Uniform Code for Building Conservation
Note: See Appendix Chapter A1, Section A105, A107.3, A107.4 and Table A1-E, California Existing Building Code.

SECTION 21.701 — SCOPE
Shear and tension anchors in existing masonry construction shall be tested in accordance with this standard when required by the Uniform Code for Building Conservation (California Existing Building Code).

SECTION 21.702 — DIRECT TENSION TESTING OF EXISTING ANCHORS AND NEW BOLTS
The test apparatus shall be supported by the masonry wall. The distance between the anchor and the test apparatus support shall not be less than one half the wall thickness for existing anchors and 75 percent of the embedment for new embedded bolts. Existing wall anchors shall be given a preload of 300 pounds (1335 N) prior to establishing a datum for recording elongation. The tension test load reported shall be recorded at 1/8 inch (3.2 mm) relative movement of the existing anchor and the adjacent masonry surface. New embedded tension bolts shall be subject to a direct tension load of not less than 2.5 times the design load but not less than 1,500 pounds (6672 N) for five minutes (10 percent deviation).

SECTION 21.703 — TORQUE TESTING OF NEW BOLTS
Bolts embedded in unreinforced masonry walls shall be tested using a torque-calibrated wrench to the following minimum torques:

- 1/2-inch-diameter (13 mm) bolts—40 foot pounds (54.2 N·m)
- 5/8-inch-diameter (16 mm) bolts—50 foot pounds (67.8 N·m)
- 3/4-inch-diameter (19 mm) bolts—60 foot pounds (81.3 N·m)

SECTION 21.704 — PREQUALIFICATION TEST FOR BOLTS AND OTHER TYPES OF ANCHORS
This section is applicable when it is desired to use tension or shear values for anchors greater than those permitted by Table A-1-E of the Uniform Code for Building Conservation (California Existing Building Code). The direct-tension test procedure set forth in Section 2 1.702 for existing anchors may be used to determine the allowable tension values for new embedded or through bolts, except that no preload is required. Bolts shall be installed in the same manner and using the same materials as will be used in the actual construction. A minimum of five tests for each bolt size and type shall be performed for each class of masonry in which they are proposed to be used. The allowable tension values for such anchors shall be the lesser of the average ultimate load divided by a factor of safety of 5.0 or the average load of which 1/8 inch (3.2 mm) elongation occurs for each size and type of bolt and class of masonry.

Shear bolts may be similarly prequalified. The test procedure shall comply with ASTM E 488-90 or another approved procedure. The allowable values determined in this manner may exceed those set forth in Table A-1-E of the Uniform Code for Building Conservation (California Existing Building Code).

SECTION 21.705 — REPORTS
Results of all tests shall be reported. The report shall include the test results as related to anchor size and type, orientation of loading, details of the anchor installation and embedment, wall thickness, and joist orientation.
UNIFORM BUILDING CODE STANDARD 21-8
POINTING OF UNREINFORCED MASONRY WALLS

See Appendix Chapter 1, Section A1 06.3.3.2, Uniform Code for Building Conservation
Note: See Appendix Chapter A1, Section A103 and A106.3.3.9, California Existing Building Code.

SECTION 21.801 — SCOPE
Pointing of deteriorated mortar joints when required by the Uniform Code for Building Conservation (California Existing Building Code) shall be in accordance with this standard.

SECTION 21.802 — JOINT PREPARATION
The old or deteriorated mortar joint shall be cut out, by means of a-toothing chisel or nonimpact power tool, to a uniform depth of 3/4 inch (19 mm) until sound mortar is reached. Care shall be taken not to damage the brick edges. After cutting is complete, all loose material shall be removed with a brush, air or water stream.

SECTION 21.803 — MORTAR PREPARATION
The mortar mix shall be Type N or Type S proportioned as required by the construction specifications. The pointing mortar shall be pre-hydrated by first thoroughly mixing all ingredients dry and then mixing again, adding only enough water to produce a damp unworkable mix which will retain its form when pressed into a ball. The mortar shall be kept in a damp condition for one and one-half hours; then sufficient water shall be added to bring it to a consistency that is somewhat drier than conventional masonry mortar.

SECTION 21.804 — PACKING
The joint into which the mortar is to be packed shall be damp but without freestanding water. The mortar shall be tightly packed into the joint in layers not exceeding 1/4 inch (6.4 mm) in depth until it is filled; then it shall be tooled to a smooth surface to match the original profile.
REFERENCED STANDARDS

UNIFORM BUILDING CODE STANDARD 21-13
HYDRATED LIME FOR MASONRY PURPOSES


Extracted, with permission, from the Annual Book of ASTM Standards, copyright
ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428

See Section 2102.2, Item 3, Uniform Building Code
Note: See Referenced Standard UBC 21-4

Section 21.1301 — Scope
This standard covers four types of hydrated lime. Types N and S are suitable for use in mortar, in the scratch and brown coats of cement plaster, for stucco, and for addition to portland-cement concrete. Types NA and SA are air-entrained hydrated limes that are suitable for use in any of the above uses where the inherent properties of lime and air entrainment are desired. The four types of lime sold under this specification shall be designated as follows:

- **Type N**—Normal hydrated lime for masonry purposes.
- **Type S**—Special hydrated lime for masonry purposes.
- **Type NA**—Normal air-entraining hydrated lime for masonry purposes.
- **Type SA**—Special air-entraining hydrated lime for masonry purposes.

Note: Type S, special hydrated lime, and Type SA, special air-entraining hydrated lime, are differentiated from Type N, normal hydrated lime, and Type NA, normal air-entraining hydrated lime, principally by their ability to develop high, early plasticity and higher water retentivity and by a limitation on their unhydrated oxide content.

Section 21.1302 — Definition

**HYDRATED LIME.** The hydrated lime covered by Type N or S in this standard shall contain no additives for the purpose of entraining air. The air content of cement-lime mortars made with Type N or S shall not exceed 7 percent. Types NA and SA shall contain an air-entraining additive as specified by Section 21.1305. The air content of cement-lime mortars made with Type NA or SA shall have a minimum of 7 percent and a maximum of 14 percent.

Section 21.1303 — Additions
Types NA and SA hydrated lime covered by this standard shall contain additives for the purpose of entraining air.

Section 21.1304 — Manufacturer’s Statement
Where required, the nature, amount and identity of the air-entraining agent used and of any processing addition that may have been used shall be provided, as well as test data showing compliance of such air-entraining addition.

Section 21.1305 — Chemical Requirements

**Composition**
Hydrated lime for masonry purposes shall conform to the requirements as to chemical composition set forth in Table 21-13-A.

Section 21.1306 — Residue, Popping and Pitting
The four types of hydrated lime for masonry purposes shall conform to one of the following requirements:

1. The residue retained on a No. 30 (600 μm) sieve shall not be more than 0.5 percent, or
2. If the residue retained on a No. 30 (600 μm) sieve is over 0.5 percent, the lime shall show no pops and pits when tested.

Section 21.1307 — Plasticity
The putty made from Type S, special hydrate, or Type SA, special air-entraining hydrate, shall have a plasticity figure of not less than 200 within 30 minutes after mixing with water, when tested.

Section 21.1308 — Water Retention
Hydrated lime mortar made with Type N, normal hydrated lime, or Type NA, normal air-entraining hydrated lime, after suction for 60 seconds, shall have a water-retention value of not less than 75 percent when tested in a standard mortar made from the dry hydrate or from putty made from the hydrate which has been soaked for a period of 16 to 24 hours.

Hydrated lime mortar made with Type S, special hydrated lime, or Type SA, special air-entraining hydrated lime, after suction for 60 seconds, shall have a water-retention value of not less than 85 percent when tested in a standard mortar made from the dry hydrate.

Section 21.1309 — Special Marking
When Type NA or SA air-entraining hydrated lime is delivered in packages, the type under this standard and the words “air-entraining” shall be plainly indicated thereon or, in case of bulk shipments, so indicated on shipping notices.
Section 21.1310 — Quality Control

Every 90 days, each lime producer shall retain an approved agency to obtain a random sample from a local point of supply in the market area served by the producer.

The agency shall test the lime for compliance with the physical requirements of Sections 21.1306, 21.1307 and 21.1308.

Upon request of the building official, the producer shall furnish (at no cost) test results to the building official, architect, structural engineer, general contractor and masonry contractor.

<table>
<thead>
<tr>
<th>TABLE 21–13–A—CHEMICAL REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDRATE TYPES</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Calcium and magnesium oxides (nonvolatile basis), min. percent</td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Calcium and magnesium oxides (nonvolatile basis), min. percent</td>
</tr>
<tr>
<td>Carbon dioxide (as-received basis), max. percent</td>
</tr>
<tr>
<td>If sample is taken at place of manufacture</td>
</tr>
<tr>
<td>Unhydrated oxides (as-received basis), max. percent</td>
</tr>
</tbody>
</table>
HISTORY NOTE APPENDIX
CALIFORNIA EXISTING BUILDING CODE

(Title 24, Part 10, California Code of Regulations)

For prior history, see the History Note Appendix to the California Code for Building Conservation, 2001 Triennial Edition, effective November 1, 2002.

1. The 2007 Triennial Edition, California Existing Building Code, was filed with the Secretary of State on February 15, 2007. The California Building Standards Commission established January 1, 2008, as the effective date.