

**45-DAY EXPRESS TERMS
FOR
BUILDING STANDARDS
OF THE
STATE HISTORICAL BUILDING SAFETY BOARD
REGARDING PROPOSED CHANGES TO
CALIFORNIA HISTORICAL BUILDING CODE
CALIFORNIA CODE OF REGULATIONS, TITLE 24, PART 8**

**Amendments to
Chapter 8-7, Structural Regulations
Chapter 8-8, Archaic Materials and Methods of Construction**

LEGEND FOR EXPRESS TERMS

1. Existing California code language being modified: All such language appears in plain text.
2. New California code language: All such language appears underlined.
3. Repealed text: All such language appears in ~~strikeout~~.

EXPRESS TERMS

**CHAPTER 8-7
STRUCTURAL REGULATIONS**

**SECTION 8-701
PURPOSE, INTENT AND SCOPE**

8-701.1 Purpose. The purpose of the CHBC is to provide alternative regulations to the regular code for the structural safety of buildings or structures designated as qualified historical buildings or structures. The CHBC requires enforcing agencies to accept any reasonably equivalent alternatives to regular code when dealing with qualified historical buildings or structures.

8-701.2 Intent. The intent of ~~the CHBC~~ this chapter is to encourage the preservation of qualified historical buildings or structures while providing a reasonable level of structural safety for occupants and the public at large through the application of the CHBC standards for a minimum level of building performance with the objective of preventing partial or total structural collapse such that the overall risk of life-threatening injury as a result of structural collapse is low.

8-701.3 Application. The alternative structural regulations provided by Section 8-705 are to be applied in conjunction with regular code whenever a structural upgrade or reconstruction is undertaken for qualified historical buildings or properties.

**SECTION 8-702
GENERAL**

8-702.1 The CHBC shall not be construed to allow the enforcing agency to approve or permit a lower level of safety of structural design and construction than that which is reasonably equivalent to the regular code provisions in occupancies which are critical to the safety and welfare of the public at large, including, but not limited to, public and private schools, hospitals, municipal police and fire stations and essential services facilities.

8-702.2 Nothing in these regulations shall prevent voluntary and partial seismic upgrades when it is demonstrated that such upgrades will improve life safety and when a full upgrade would not otherwise be required.

SECTION 8-703 STRUCTURAL SURVEY

8-703.1 Scope. When a structure, or portion of a structure is to be evaluated for structural capacity under the CHBC, it shall be surveyed for structural conditions by an architect or engineer knowledgeable in historical structures. The survey shall evaluate deterioration or signs of distress. The survey shall determine the details of the structural framing and the system for resistance of gravity and lateral loads. Details, reinforcement and anchorage of structural systems and veneers shall be determined and documented where these members are relied on for seismic lateral resistance.

8-703.2 Evaluation. The results of the survey shall be utilized for evaluating the structural capacity and for designing modifications to the structural system to reach compliance with this code.

8-703.3 Historical Records. Past historical records of the structure or similar structures may be used in the evaluation, including the effects of subsequent alterations.

SECTION 8-704 NON-HISTORICAL ADDITIONS AND NON-HISTORICAL ALTERATIONS

8-704.1 New non-historical additions and non-historical alterations which are structurally separated from an existing historical building or structure shall comply with regular code requirements.

8-704.2 New non-historical additions which impose vertical or lateral loads on an existing structure shall not be permitted unless the affected part of the supporting structure is evaluated and strengthened, if necessary, to meet regular code requirements.

Note: For use of archaic materials, see Chapter 8-8.

SECTION 8-705 STRUCTURAL REGULATIONS

8-705.1 Gravity Loads. The capacity of the structure to resist gravity loads shall be evaluated and the structure strengthened as necessary. The evaluation shall include all parts of the load path. Where no distress is evident, and a complete load path is present, the structure may be assumed adequate by having withstood the test of time if anticipated dead and live loads will not exceed those historically present.

8-705.2 Wind and Seismic Loads. The ability of the structure to resist wind and seismic loads shall be evaluated. Wind loads shall be considered when appropriate, but need not exceed 75% of the wind loads prescribed by the regular code. The evaluation shall be based on the requirements of Section 8-706.

8-705.2.1 Any un-safe conditions in the lateral-load-resisting system shall be corrected, or alternative resistance shall be provided. Additional resistance shall be provided to meet the minimum requirements of ~~this code~~ the CHBC. The strengthening measures selected shall fulfill the intent to prevent partial or total structural collapse and protect occupants from life-threatening injury. The evaluation of structural members and structural systems for seismic loads shall consider the inelastic performance of structural members and their ability to maintain load-carrying capacity during extreme seismic loadings greater than prescribed by the CHBC.

8-705.2.2 The architect or engineer shall consider additional measures with minimal loss of, and impact to historical materials which will reduce damage and needed repairs in future earthquakes to better

preserve the historical structure in perpetuity. These additional measures shall be presented to the owner for consideration as part of the rehabilitation or restoration.

SECTION 8-706 LATERAL LOAD SEISMIC REGULATIONS

8-706.1 Lateral Loads Seismic Forces. The forces used to evaluate the structure for resistance to wind and seismic loads need not exceed 0.75 times the seismic forces prescribed by the ~~1995 Edition of the California Building Code (CBC)~~ regular code requirements. Furthermore, the seismic base shear need not exceed 0.40W for structures with Occupancy Category III & IV and 0.30W for structures with Occupancy Category I or II. Near fault increases in ground motion (maximum considered earthquake ground motion of 0.2 second spectral response greater than 150% at 5% damping) shall be considered for historic structures within Occupancy Categories I, II or III only when the fundamental period of the building exceeds 0.5 seconds. The seismic forces may be computed based on the R_w , R values tabulated in the regular code for similar lateral-force-resisting-systems including consideration of the structural detailing of the members. All deviations of the detailing provisions of the lateral force resisting systems shall be evaluated for stability and the ability to maintain load-carrying capacity at increased lateral loads.

8-706.1.1 When a building is to be strengthened with the addition of a new lateral force resisting system, the R value of the new system can be used when the new lateral force resisting system resists at least 75% of the building's base shear.

8-706.1.2 Un-reinforced masonry bearing wall buildings shall comply with ~~Appendix Chapter 4 of the Uniform Code for Building Conservation (UCBC), 1994 edition~~ Appendix A, Chapter A1 of the International Existing Building Code, (IEBC), 2006 edition, and as modified by ~~this code~~ the CHBC. Reasonably equivalent Alternative standards may be used on a case-by-case basis when approved by the authority having jurisdiction.

8-706.1.3 All deviations of the detailing provisions of the lateral-force-resisting systems shall be evaluated for stability and the ability to maintain load-carrying capacity at increased lateral loads.

8-706.2 Existing Building Performance. The seismic resistance may be based upon the ultimate capacity of the structure to perform giving due consideration to ductility and reserve strength of the lateral-force resisting-system and materials while maintaining a reasonable factor of safety. Broad judgment may be exercised regarding the strength and performance of materials not recognized by regular code requirements. (See Chapter 8-8, Archaic Materials and Methods of Construction.)

8-706.2.1 All structural materials or members that do not comply with detailing and proportioning requirements of the regular code shall be evaluated for potential seismic performance and the consequence of non-compliance. All members which might fail and lead to possible collapse, or ~~threaten life-safety~~ life threatening injury when subjected to seismic demands in excess of those prescribed in Section 8-706.1, shall be judged unacceptable and appropriate structural strengthening shall be developed. Anchorages for veneers and decorative ornamentation shall be included in this evaluation.

8-706.3 Load Path. A complete and continuous load path, including connections, from every part or portion of the structure to the ground shall be provided for the required forces. It shall be verified that the structure is adequately tied together to perform as a unit when subjected to earthquake forces.

8-706.4 Parapets. Parapets and exterior decoration shall be investigated for conformance with regular code requirements for anchorage and ability to resist prescribed seismic forces. An exception to regular code requirements shall be permitted for those parapets and decorations which are judged not to be a hazard to life safety.

8-706.5 Non-structural Features. Non-structural features of a historical structure, such as exterior veneer, cornices and decorations, which might fall and create a life-safety hazard in an earthquake, shall

be ~~investigated~~ evaluated. Their ability to resist seismic forces shall be verified, or the feature shall be strengthened with improved anchorage when appropriate.

8-706.5.1 Partitions and ceilings of corridors and stairways serving an occupant load of 30 or more shall be investigated to determine their ability to remain in place when the building is subjected to earthquake forces.

CHAPTER 8-8 ARCHAIC MATERIALS AND METHODS OF CONSTRUCTION

SECTION 8-801 PURPOSE, INTENT AND SCOPE

8-801.1 Purpose. The purpose of the CHBC is to provide regulations for the use of historical methods and materials of construction that are at variance with regular code requirements or are not otherwise codified, in buildings or structures designated as qualified historical buildings or ~~properties~~ structures. The CHBC requires enforcing agencies to accept any reasonably equivalent alternatives to regular code when dealing with qualified historical buildings or ~~properties~~ structures.

8-801.2 Intent. It is the intent of the CHBC to provide for the use of historical methods and materials of construction that are at variance with specific code requirements or are not otherwise codified.

8-801.3 Scope. Any construction type or material that is, or was, part of the historical fabric of a structure, is covered by this chapter. Archaic materials and methods of construction present in a historical structure may remain or be reinstalled or be installed with new materials of the same class to match existing conditions.

SECTION 8-802 GENERAL ENGINEERING APPROACHES

~~Allowable stresses or u~~Ultimate strengths for archaic materials shall be assigned based upon similar conventional codified materials, or on tests as hereinafter indicated. The archaic materials and methods of construction shall be thoroughly investigated for their details of construction in accordance with Section 8-703. Testing shall be performed when applicable to evaluate existing conditions. The architect or structural engineer in responsible charge of the project shall assign allowable stresses or ultimate strength values to archaic materials. Such assigned allowable stresses, or ultimate strength values, shall not be greater than those provided for in the following sections without adequate testing, and shall be subject to the concurrence of the enforcing agency.

SECTION 8-803 NONSTRUCTURAL ARCHAIC MATERIALS

Where nonstructural historical materials exist in uses which do not meet the requirements of the regular code, their continued use is allowed by this code, provided that any public health and life-safety hazards are mitigated subject to the concurrence of the enforcing agency.

SECTION 8-804 ALLOWABLE CONDITIONS FOR SPECIFIC MATERIALS

Archaic materials which exist and are to remain in qualified historical buildings or structures shall be evaluated for their condition and for loads required by this code. The structural survey required in Section 8-703 of ~~this code~~ the CHBC shall document existing conditions, reinforcement, anchorage, deterioration

and other factors pertinent to establishing allowable and ultimate stresses and adequacy of the archaic materials. The remaining portion of this chapter provides additional specific requirements for commonly encountered archaic materials.

SECTION 8-805 MASONRY

Note: For adobe, see Section 8-806.

8-805.1 Existing Solid Masonry. Existing solid masonry walls of any type, except adobe, may be allowed, without testing, a maximum ~~value of three~~ ultimate strength of nine pounds per square inch (~~20.7~~ 62.1 kPa) in shear where there is a qualifying statement by the architect or engineer that an inspection has been made, that mortar joints are filled and that both brick and mortar are reasonably good. The allowable shear stress above applies to un-reinforced masonry, except adobe, where the maximum ratio of un-supported height or length to thickness does not exceed ~~42~~ 13, and where minimum quality mortar is used or exists. Wall height or length is measured to supporting or resisting elements that are at least twice as stiff as the tributary wall. Stiffness is based on the gross section. Allowable shear stress may be increased by the addition of 10 percent of the axial direct stress due to the weight of the wall directly above. Higher quality mortar may provide a greater shear value and shall be tested in accordance with ~~UBC Standard 21-6 as referenced in the 1997 UBC~~ Appendix A, Chapter A1 of the International Existing Building Code (IEBC) 2006 edition, and as modified by the CHBC.

8-805.2 Stone Masonry.

8-805.2.1 Solid-backed Stone Masonry. Stone masonry solidly backed with brick masonry shall be treated as solid brick masonry as described in Section 8-805.1 and in the ~~UCBC 2006 IEBC~~ provided representative testing and inspection verifies solid collar joints between stone and brick and that a reasonable number of stones lap with the brick wythes as headers or that steel anchors are present. Solid stone masonry where the wythes of stone effectively overlap to provide the equivalent header courses may also be treated as solid brick masonry.

8-805.2.2 Independent Wythe Stone Masonry. Stone masonry with independent face wythes may be treated as solid brick masonry as described in Section 8-805.1 and the ~~UCBC IEBC~~, provided representative testing and inspection verify that the core is essentially solid in the masonry wall and that steel ties are epoxied in drilled holes between outer stone wythes at floors, roof and at not-to-exceed 4 feet (1219 mm) on center in each direction, between floors and roof. A reinforced concrete bond beam or equivalent structural element shall be provided at the top of all stone masonry walls.

8-805.2.3 Testing of Stone Masonry. Testing of stone masonry shall be similar to ~~UBC Standard 21-6,~~ as referenced in the 1997 UBC the 2006 IEBC requirements for brick masonry, except that representative stones which are not interlocked shall be pulled outward from the wall and shear area appropriately calculated after the test.

8-805.3 Reconstructed Walls. Totally reconstructed walls utilizing original brick or masonry, constructed similar to original, shall be constructed in accordance with regular code. Repairs or infills may be constructed in a similar manner to the original walls without conforming to regular code.

SECTION 8-806 ADOBE

8-806.1 General. Unburned clay masonry may be constructed, reconstructed, stabilized, or rehabilitated subject to this chapter. When undertaking a mandatory or voluntary retrofit, the following provisions should be considered. Alternate approaches which provide an equivalent or greater level of safety may be used, subject to the concurrence of the enforcing agency.

8-806.2 Moisture Protection. Provisions shall be ~~made in-place~~ to protect adobe structures from ~~moisture and deterioration due to moisture penetration.~~ ~~The un-reinforced a~~Adobe shall be maintained in reasonably good condition. Particular attention shall be given to moisture content of adobe walls. Un-maintained or ~~un-stabilized~~walls or ruins shall be evaluated for safety based on their condition and stability. Additional ~~safety~~ protection measures may be ~~required~~ appropriate subject to the concurrence of the enforcing agency.

8-806.3 Requirements-Height to Thickness Ratio: Unreinforced new or existing adobe walls that meet these ~~requirements~~ criteria need not be evaluated for out of plane failure. ~~Existing sod or rammed earth walls shall be considered similar to the extent these provisions apply.~~ Where existing dimensions do not meet these conditions, additional strengthening measures, such as a bond beam, may be ~~required~~ appropriate. ~~Existing sod or rammed earth walls shall be considered similar to the extent these provisions apply.~~

1. One-story adobe load-bearing walls shall not exceed a height-to-thickness ratio of 6.

2. Two-story adobe buildings or structures' height-to-thickness wall ratio shall not exceed 5 at the ground floor and 6 at the second floor, and shall be measured at floor-to-floor height when the second floor and attic ceiling/roof are connected to the wall as described below.

~~3.~~ **8-806.4 Non Load-bearing Adobe.** Non-load-bearing adobe partitions and gable end walls shall be evaluated for stability and anchored against out-of-plane failure if necessary.

~~4.~~ **8-806.5 Bond Beam.** ~~Where required,~~ A bond beam or equivalent structural element shall be provided at the top of all adobe walls, and at the second floor for two-story buildings or structures ~~at the second floor.~~ The size and configuration of the ~~bond beam~~ structural element shall be designed sufficient in each case to meet the requirements of the existing conditions and provide an effective brace for the wall, to tie the building together and to connect the wall to the floor or roof.

~~8-806.4~~ **8-806.6 Repair or Reconstruction.** Repair or reconstruction of wall area may utilize unstabilized brick or adobe masonry designed to be compatible with the constituents of the existing adobe materials.

~~8-806.5~~ **8-806.7 Shear Values.** Existing adobe may be allowed a maximum ultimate value strength of ~~four~~ twelve pounds per square inch (~~27.6~~ 82.7 kPa) for shear, ~~with no increase for lateral forces.~~

~~8-806.6~~ **8-806.8 Mortar.** Mortar may be of the same soil composition as that used in the existing wall, or in new walls as necessary to be compatible with the adobe brick.

SECTION 8-807 WOOD

8-807.1 Existing Wood Diaphragms or Walls. Existing wood diaphragms or walls of straight or diagonal sheathing shall be assigned shear resistance values appropriate with the fasteners and materials functioning in conjunction with the sheathing. The structural survey shall determine fastener details and spacings and verify a load path through floor construction. Shear values of Tables 8-8-A and 8-8-B of the CHBC may be used.

8-807.2 Wood Lath and Plaster. Wood lath and plaster walls and ceilings may be utilized using the shear values referenced in Section 8-807.1.

8-807.3 Existing Wood Framing. Existing wood framing members may be assigned allowable stresses consistent with codes in effect at the time of construction. Existing or new replacement wood framing may be of archaic types originally used if properly researched, such as balloon and single wall. Wood joints such as dovetail and mortise and tenon types may be used structurally, provided they are well

made. Lumber selected for use and type need not bear grade marks, and greater or lesser species such as low-level pine and fir, boxwood and indigenous hardwoods and other variations may be used for specific conditions where they were or would have been used.

Wood fasteners such as square or cut nails may be used with a maximum increase of 50% over wire nails for shear.

SECTION 8-808 CONCRETE

8-808.1 Materials. Natural cement concrete, unreinforced rubble concrete, and similar materials may be utilized wherever that material is used historically. Concrete of low strength and with less reinforcement than required by the regular code may remain in place. The architect or engineer shall assign appropriate values of strength based on testing of samples of the materials. Bond and development lengths shall be determined based on historical information or tests.

8-808.2 Detailing. The architect or engineer shall carefully evaluate all detailing provisions of the regular code which are not met and shall consider the implications of these variations on the ultimate performance of the structure, giving due consideration to ductility and reserve strength.

SECTION 8-809 STEEL AND IRON

The hand-built, untested use of wrought or black iron, the use of cast iron or grey iron, and the myriad of joining methods that are not specifically allowed by code may be used wherever applicable and wherever they have proven their worth under the considerable span of years involved with most historical buildings or structures. Uplift capacity should be evaluated and strengthened where necessary. Fixed conditions or mid-height lateral loads on cast iron columns that could cause failure should be taken into account. Existing structural wrought, forged steel or grey iron may be assigned the maximum working stress prevalent at the time of original construction.

SECTION 8-810 HOLLOW CLAY TILE

The historical performance of hollow clay tile in past earthquakes shall be carefully considered in evaluating walls of hollow clay tile construction. Hollow clay tile bearing walls shall be evaluated and strengthened as appropriate for lateral loads and their ability to maintain support of gravity loads. Suitable protective measures shall be provided to prevent blockage of exit stairways, stairway enclosures, exit ways and public ways as a result of an earthquake.

SECTION 8-811 VENEERS

8-811.1 Terra Cotta and Stone. Terra Cotta, cast stone and natural stone veneers shall be investigated for the presence of suitable anchorage. Steel anchors shall be investigated for deterioration or corrosion. New or supplemental anchorage shall be provided as appropriate.

8-811.2 Anchorage. Brick veneer with mechanical anchorage at spacing greater than required by regular code may remain provided the anchorages have not corroded. Nail strength in withdrawal in wood sheathing may be utilized to its capacity in accordance with code values.

SECTION 8-812 GLASS AND GLAZING

8-812.1 Glazing Subject to Human Impact. Historical glazing material located in areas subject to

human impact may be approved subject to the concurrence of the enforcing agency when alternative protective measures are provided. These measures may include, but not be limited to, additional glazing panels, protective film, protective guards or systems, and devices or signs which would provide adequate public safety.

8-812.2 Glazing in Fire-rated Systems. See Section 8-402.3.

TABLE 8-8-A—ALLOWABLE STRENGTH VALUES FOR EXISTING MATERIALS

EXISTING MATERIALS OR CONFIGURATIONS OF MATERIALS ¹	ALLOWABLE VALUES
	x14.594 for N/m
1. Horizontal diaphragms ²	
1.1 Roofs with straight sheathing and roofing applied directly to the sheathing	400 300 lbs. Per foot for seismic shear
1.2 Roofs with diagonal sheathing and roofing applied directly to the sheathing	250 750 lbs. Per foot for seismic shear
1.3 Floors with straight tongue-and-groove sheathing	400 300 lbs. Per foot for seismic shear
1.4 Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular	500 1500 lbs. Per foot for seismic shear
1.5 Floors with diagonal sheathing and finished	600 1800 lbs. Per foot for seismic shear
2. Crosswalls ^{2,3}	
2.1 Plaster on wood or metal lath	Per side: 200 600 lbs. Per foot for seismic shear
2.2 Plaster on gypsum lath	475 550 lbs. Per foot for seismic shear
2.3 Gypsum wallboard, unblocked edges	75 200 lbs. Per foot for seismic shear
2.4 Gypsum wallboard, blocked edges	125 400 lbs. Per foot for seismic shear
Existing footings, wood framing, structural steel and reinforced steel	$f'_c = 1,500$ psi (10.34 MPa) unless otherwise shown by tests ⁴
3.1 Plain concrete footings	Allowable stress same as D.F. No. 1 ⁴
3.2 Douglas fir wood	$f_t = $ 18,000 40,000 lbs. Per square inch (124.1 M/mm ²) maximum
3.2 Reinforcing steel	$f_t = $ 20,000 33,000 lbs. Per square inch (137.9 N/mm ²) maximum ⁴
3.4 Structural steel	

¹Material must be sound and in good condition.

²A one-third increase in allowable stress is not allowed.

³Shear values of these materials may be combined, except the total combined value shall not exceed ~~300~~ ~~900~~ pounds per foot (4380 ~~13,140~~ N/m).

⁴Stresses given may be increased for combinations of loads as specified in the regular code.

**TABLE 8-8-B—ALLOWABLE STRENGTH VALUES OF NEW MATERIALS USED
IN CONJUNCTION WITH EXISTING CONSTRUCTION**

NEW MATERIALS OR CONFIGURATIONS OF MATERIALS	ALLOWABLE VALUES ¹
<p>1. Horizontal diaphragms²</p> <p>Plywood sheathing nailed 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</p> <p>Plywood sheathing nailed directly over existing diagonal sheathing with ends of plywood sheets bearing on joists or rafters</p> <p>1.3 Plywood sheathing nailed directly over existing straight or diagonal sheathing with ends of plywood sheets bearing on joists or rafters with edges of plywood located over new blocking and nailed to provide a minimum nail penetration into framing and blocking of 1¹/₂ inches (41 mm)</p>	<p>225 lbs. Per foot (3283 N/m)</p> <p>375 lbs. Per foot (5473 N/m)</p> <p>75 percent of the values specified in the regular code</p>
<p>1. Horizontal Diaphragms²</p> <p>1.1 <u>15/32 inch minimum plywood sheathing fastened 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 and fastened with minimum #6 x 1 1/4 inch wood screws or nails with helical threads 0.13 inch min. diameter and 1 1/4 inch min. length at 4 inch centers all panel edges and 12 inch centers each way in field.</u></p> <p>1.2 <u>Same plywood and attachments as 1.1 fastened directly over existing diagonal sheathing.</u></p> <p>1.3 <u>3/8 inch plywood sheathing fastened directly over existing straight or diagonal sheathing with ends and edges on centers of individual sheathing boards and fastened with #6 wood screws or nails with helical threads 0.13 inch minimum diameter and 1 1/4 inch min. length at 6 inch centers tall panel edges and 12 inch centers each way in field.</u></p>	<p>1,500 lbs. Per foot</p> <p>1,800 lbs. Per foot</p> <p>900 lbs. Per foot</p>
<p>2. Shear walls: (general procedure)</p> <p>Plywood sheathing applied directly over wood studs. No value shall be given to plywood applied over existing plaster or wood sheathing</p>	<p>100 percent of the value specified in the regular code for shear walls</p>
<p>3. Crosswalls: (special procedure only)</p> <p>Plywood sheathing applied directly over wood studs. No value shall be given to plywood applied over existing plaster or wood sheathing</p> <p>Drywall or plaster applied directly over wood studs</p> <p>Drywall or plaster applied to sheathing over existing wood studs</p>	<p>133 percent of the value specified in the regular code for shear walls</p> <p>100 percent of the values in the regular code.</p> <p>50 percent of the values specified in the regular code, reduced as noted.³ (UBC Table 25-1, Footnote 1)</p>
<p>4. Tension bolts</p> <p>a. Bolts extending entirely through unreinforced masonry walls secured with bearing plates on far side of a three-wythe-minimum wall with at least 30 square inches (19 350 mm²) of area^{4,5}</p> <p>b. Bolts All thread rod extending to the exterior face of the wall with a 2 1/2-inch (63.5 mm) round plate under the head and drilled at an angle of 22 1/2 degrees to the horizontal, installed as specified for shear bolts^{4,5,7,9} in adhesive⁹</p>	<p>4,800 5400 lbs. (8006 16,200 N) per bolt⁶</p> <p>900 2700 lbs. (4003 12,009 N) per bolt for two-wythe walls⁶</p> <p>1,200 3600 lbs. (5338 10,008 N) per bolt</p>
<p>5. Shear bolts</p> <p>Bolts embedded a minimum of 8 inches (203 mm) into unreinforced masonry walls and centered in a 2 1/2-inch-diameter (63.5 mm) hole filled with drypack or nonshrink grout. Through bolts with first 8 inches (203 mm) as noted above and embedded bolts <u>all thread rod</u> as noted in Item 4.2b^{5,7,9}</p>	<p>1/2 inch (12.7 mm) diameter = 350 1050 lbs. (4557 4671 N)⁶</p> <p>5/8 inch (15.9 mm) diameter = 500 1500 lbs. (2224 6672 N)⁶</p> <p>3/4 inch (19 mm) diameter = 750 2250 lbs. (3336 16,014 N)⁶</p>
<p>6. Infilled walls</p> <p>Reinforced masonry infilled openings in existing unreinforced masonry walls. Provide keys or dowels to match reinforcing</p>	<p>Same as values specified for unreinforced masonry walls.</p>
<p>7. Reinforced masonry</p> <p>Masonry piers and walls reinforced per the regular code</p>	<p>Same as values specified in the regular code⁸.</p>
<p>8. Reinforced concrete</p> <p>Concrete footings, walls and piers reinforced as specified in the regular code and designed for tributary loads</p>	<p>Same values as specified in the regular code⁸.</p>

¹A one-third increase in allowable stress is not allowed, except as noted. Values are for strength level loads as defined in regular code standards.

²Values and limitations are for nailed plywood. Higher values may be used for other fastening systems such as wood screws or staples when approved by the enforcing authority. Values may be adjusted for other fasteners when approved by the enforcing authority.

³In addition to existing sheathing value.

⁴Bolts to be 1/2-inch (12.7 mm) minimum diameter.

⁵Drilling for bolts and dowels shall be done with an electric rotary drill. Impact tools shall not be used for drilling holes or tightening anchors and shear bolt nuts. Other bolt sizes, values and installation methods may be used provided a testing program is conducted in accordance with regular code standards. Bolt spacing shall not exceed 6 feet. (1830 mm) on center and shall not be less than 12 inches (305 mm) on center.

⁶Other masonry based on tests or other substantiated data.

⁷Embedded bolts to be tested as specified in regular code standards.

⁸Stresses given may be increased for combinations of loads as specified in the regular code.

⁹Adhesives shall be approved by the enforcing agency and installed in accordance with the manufacturer's recommendations. All drilling dust shall be removed from drilled holeS prior to installation.

Notation

Authority: Health and Safety Code section 18959.5

Reference(s): Health and Safety Code sections 18950 and 18959.5