

CHAPTER 19A CONCRETE

Adopt and/or codify chapter as amended below:

PROPOSED ADOPTION	DSA-SS	DSA-SS/CC	Comments
Adopt entire chapter			
Adopt entire chapter as amended (amended sections listed below)	X	-	
Adopt only those sections listed below			

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

DRAFT INITIAL EXPRESS TERMS

Italics are used for text within Sections 1903A through 1905A of this code to indicate provisions that differ from ACI 318. State of California amendments in these sections are shown in italics and underlined.

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SECTION 1901A GENERAL

1901A.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

1901A.1.1 Application. *The scope of application of Chapter 19A is as follows:*

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

2. **(Reserved for OSHPD)**

1901A.1.2 Amendments in this chapter. *DSA adopts this chapter and all amendments.*

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

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

2. **[Reserved for OSHPD]**

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1901A.5 Construction documents. The *construction documents* for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for post-tensioning tendons.
11. For structures assigned to *Seismic Design Category D, E or F*, a statement if slab on grade is designed as a structural diaphragm.
12. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1901A.6 Special inspections and tests. Special inspections and tests of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17A and Section 1910A.

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SECTION 1903A

SPECIFICATIONS FOR TESTS AND MATERIALS

1903A.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

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1903A.2 Special Inspections. *Where required, special inspections and tests shall be in accordance with Chapter 17A and Section 1910A.1913A.*

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1903A.4 Flat wall insulating concrete form (ICF) systems. *Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E 2634.*

1903A.4 Reporting Requirements – *Modify ACI 318 Section 3.2.1 by adding the following:*

Each component (a) through (g), when present, as a percentage of total cementitious materials shall be reported for each mix design.

1903A.5 1903A.6 Aggregates - *Modify ACI 318 Section 3.3.2 26.4.1.2.1(a).(1) as follows: by adding the following:*

Aggregate size limitations waiver shall be approved by the enforcement agency.

Evidence that the aggregate used is not reactive in the presence of alkalis may be required by the enforcement agency. If new aggregate sources are to be used or if past experience indicates problems with existing aggregate sources, test the aggregate for potential alkali-silica reactivity in accordance with to ASTM C 1260 or C 1293 to determine the potential alkali-silica reactivity of the aggregate. If the results indicate an expansion greater than 0.10 percent at 16 days age with ASTM C 1260, or an expansion greater than 0.04 percent at 12 months age with ASTM C 1293, provide mitigation with one of the cementitious material systems noted below such that an expansion of less than 0.10 percent at 16 days age is obtained with ASTM C 1567:

- 1. Low alkali portland cement containing not more than 0.6 percent total alkali when calculated as sodium oxide, as determined by the method given in ASTM C 114.*
- 2. Blended hydraulic cement, Type IS or IP, conforming to ASTM C 595, except that Type IS cement shall not contain less than 40 percent slag cement.*
- 3. Replacement of not less than 15 percent by weight of the portland cement with a pozzolan conforming to ASTM C 618 for Class N or F materials (Class C is not permitted).*
- 4. Replacement of not less than 40 percent by weight of the portland cement with slag cement conforming to ASTM C 989.*
- 5. Replacement of not less than 5 percent nor more than 10 percent by weight of Portland cement with silica fume conforming to ASTM C 1240.*
- 6. Replacement of portland cement with a ternary blend of portland cement, slag cement and pozzolan such that the resulting blend contains not more than 70 percent portland cement.*

ASTM C 1567 test shall be performed separately on the fine and coarse aggregate with one requiring the higher percentage of supplementary cementitious materials dictating the required replacement.

ASTM C 1260, ASTM C 1293 and ASTM C 1567 tests must have been performed within the past three years.

(1) **Normal weight aggregate**:: Aggregate shall be non-reactive as determined by one of the methods in ASTM C33 Appendix XI Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official.

1903A.6 1903A.5 Fly-Ash Limits on Cementitious Materials. Add- Modify ACI 318 Section 26.4.2.2(b) and Table 26.4.2.2(b) ~~3.2.3~~ as follows:

Fly ash or other pozzolan can be used as a partial substitute for ASTM C 150 portland cement, as follows:

1. Fly ash or other pozzolan shall conform to ASTM C 618 for Class N or Class F materials (Class G is not permitted), and
2. More than 15 percent by weight of fly ash or other pozzolans shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 5.3. See Section 1904A for durability requirements.
3. More than 40 percent by weight of ground granulated blast furnace slag conforming to ASTM C 989 shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 5.3. See Section 1904A for durability requirements.

The maximum percentage of pozzolans, including fly ash and silica fume, and slag cement in concrete assigned to all exposure categories shall be in accordance with Table 26.4.2.2(b) and (1) and (2).

1903A.7 1903A.7 Discontinuous Steel Fibers fiber reinforcement - Not permitted. - Modify ACI 318 Section 3.5.1 by adding the following:

Discontinuous steel fibers are not permitted.

1903A.8 1903A.8 Welding of reinforcing bars - Modify ACI 318 Section 3.5.2 26.6.4.1(b) by adding the following:

If mill test reports are not available, chemical analysis shall be made of bars representative of the bars to be welded. Bars with a carbon equivalent (C.E.) above 0.75 shall not be welded. Welding shall not be done on or within two bar diameters of any bent portion of a bar that has been bent cold. Welding of crossing bars shall not be permitted for assembly of reinforcement unless authorized by the structural engineer and approved by the enforcement agency per approved procedures.

Shop fusion welded stirrup/tie cage or spiral assemblies consisting of low-alloy steel reinforcing stirrups/ties conforming to ASTM A706 and longitudinal holding wires, conforming to ASTM A1064 shall be permitted. The fusion welds shall be made by machines using electric resistance welds. Tack welding of primary reinforcing bars together or to stirrups/ties is not permitted. Fusion welding of holding wires is not permitted on any portion of a reinforcing bar that is or will be bent in accordance with ACI 318 Section 25.3.

SECTION 1904A DURABILITY REQUIREMENTS

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1904A.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

~~**Exception:** For Group R-2 and R-3 occupancies not more than three stories above grade plane, the specified compressive strength, f'_c , for concrete in basement walls, foundation walls, exterior walls and other vertical surfaces exposed to the weather shall be not less than 3,000 psi (20.7 MPa).~~

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SECTION 1905A MODIFICATIONS TO ACI 318

1905A.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905A.1.1 through 1905.1.21 1905A.1.16.

~~**1905A.1.1 ACI 318, Section 2.3.** Modify existing definitions and add the following definitions to ACI 318, Section 2.3.~~

~~**DESIGN DISPLACEMENT.** Total lateral displacement expected for the design basis earthquake, as specified by Section 12.8.6 of ASCE 7.~~

~~DETAILED PLAIN CONCRETE STRUCTURAL WALL.~~ A wall complying with the requirements of Chapter 14, including 14.6.2.

~~ORDINARY PRECAST STRUCTURAL WALL.~~ A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

~~ORDINARY REINFORCED CONCRETE STRUCTURAL WALL.~~ A *cast-in-place* wall complying with the requirements of Chapter 14, excluding 14.6.2.

~~ORDINARY STRUCTURAL PLAIN CONCRETE WALL.~~ A wall complying with the requirements of Chapter 22, *excluding 22.6.7.*

~~SPECIAL STRUCTURAL WALL.~~ A cast-in-place or precast wall complying with the requirements of 18.2.4 through 18.2.8, 18.10 and 18.11, as applicable, in addition to the requirements for ordinary reinforced concrete structural walls *or ordinary precast structural walls, as applicable. Where ASCE 7 refers to a “special reinforced concrete structural wall,” it shall be deemed to mean a “special structural wall.”*

1905A.1.1 ~~1905A.1.14~~ ACI 318 Section 4.12.2.2 ~~18.2.4.~~ Modify ACI 318 Section 4.12.2.2 ~~18.2.4~~ by adding the following:

Where prestressed concrete elements are restrained from movement, an analysis of the stresses in the prestressed elements and loads in the adjoining structural system induced by the above-described effects shall be made in accordance with PCI Design Handbook, ~~7TH Edition.~~

1905A.1.2 ~~1905A.1.13~~ ACI 318, Section 4.12.2.3 ~~18.2.3.~~ Modify ACI 318 Section 4.12.2.3 ~~18.2.3~~ by adding the following:

For prestressed concrete members with recessed or dapped ends, an analysis of the connections shall be made in accordance with procedures given in PCI Design Handbook, ~~7TH Edition.~~

1905A.1.3 ~~1905A.1.6~~ ACI 318, Section 9.6.1.3. ~~10.5.3~~. Modify ACI 318 Section 9.6.1.3. ~~10.5.3~~ by adding the following:

This section shall not be used for members that resist seismic loads, except that reinforcement provided for foundation elements for one-story wood-frame or one-story light steel buildings need not be more than one-third greater than that required by analysis for all loading conditions.

1905A.1.4 ~~1905A.1.8~~ ACI 318, Section 11.2.4.1 ~~14.2.6~~. Replace ACI 318 Section 11.2.4.1 ~~14.2.6~~ as follows:

11.2.4.1 ~~14.2.6~~ - Walls shall be anchored to intersecting elements such as floors or roofs; or to columns, pilasters, buttresses, or intersecting walls; and footings with reinforcement at least equivalent to No. 4 bars at 12 inches (305 mm) on center for each layer of reinforcement.

1905A.1.5 ~~1905A.1.11~~ ACI 318 Section ~~16-11.7~~. Add Section 11.7.6 ~~16.11~~ to ACI 318 as follows:

11.7.6 ~~16.11~~ - Reinforcement. Perimeters of precast walls shall be reinforced continuously with a minimum of one No. 5 bar extending the full height and width of the wall panel. ~~Bars shall be continuous around corners. Where wall panels do not connect to abut columns or other wall panels to develop at least 75 percent of the horizontal wall steel as noted below, vertical~~ perimeter bars shall be retained by hooked wall bars. Edges of openings in precast walls shall be reinforced with a minimum of one No. 5 bar continuous past corners sufficient to develop the bar.

A continuous tie or bond beam shall be provided at the roof line either as a part of the roof structure or part of the wall panels as described in the next paragraph below.

This tie may be designed as the edge member of the roof diaphragm but, in any case, shall not be less than equivalent to two No. 6 bars continuous. A continuous tie equivalent to two No. 5 bars minimum shall also be provided either in the footing or with an enlarged section of the floor slab.

Wall panels of shear wall buildings shall be connected to columns or to each other in such a manner as to develop at least 75 percent of the horizontal wall steel. **No more than H-half** of this continuous horizontal reinforcing **shall** ~~may be~~ concentrated in bond or tie beams at the top and bottom of the walls and at points of intermediate lateral support. If possible, cast in-place joints with reinforcing bars extending from the panels into the joint a sufficient distance to meet the splice requirements of ACI 318 Section **25.5.2** ~~42-15~~ for Class A shall be used. The reinforcing bars or welded tie details shall not be spaced over eight times the wall thickness vertically nor fewer than four used in the wall panel height. Where wall panels are designed for their respective overturning forces, the panel connections need not comply with the requirements of this paragraph.

Where splicing of reinforcement must be made at points of maximum stress or at closer spacing than permitted by ACI 318 Section 7.6, welding may be used when the entire procedure is suitable for the particular quality of steel used and the ambient conditions. Unless the welds develop 125 percent of the specified yield strength of the steel used, reinforcement in the form of continuous bars or fully anchored dowels shall be added to provide 25 percent excess steel area and the welds shall develop not less than the specified yield strength of the steel.

Exception: Nonbearing, nonshear panels such as nonstructural architectural cladding panels or column covers are not required to meet the provisions of this Section.

1905A.1.6 ~~1905A.1.10~~ **ACI 318, Section 11.9. 14.9.** Modify ACI 318 by adding Section 11.9 ~~14.9~~ as follows:

11.9 ~~14.9~~ - **Foundation Walls.** Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing

not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318 Section [11.6 and 11.7](#). ~~14.3~~.

1905A.1.7 ACI 318, Section 12.7.3. Add Section 12.7.3.4 to ACI 318 as follows:

1905A.1.20 ACI 318, Section 21.11.7. Modify ACI 318 Section 21.11.7 by adding Section 21.11.7.7 as follows:

21.11.7.7 — Where boundary members are not required by ACI 318 Section 21.11.7.5, minimum reinforcement parallel to the edges of all diaphragms and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per linear foot of diaphragm.

12.7.3.4 – At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.

1905A.1.8 ~~1905A.1.21~~ (Chapter 19, Section 1905.1.8) **ACI 318, Section 17.2.3.** Modify ACI 318 Sections 17.2.3.4.2, 17.2.3.4.3(d) and 17.2.3.5.2 to read as follows:

17.2.3.4.2 - Where the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be

designed in accordance with 17.2.3.4.3. The anchor design tensile strength shall be determined in accordance with 17.2.3.4.4.

Exception: *Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 and Section 1604A.8.2 of this code shall be deemed to satisfy Section 17.2.3.4.3(d).*

17.2.3.4.3(d) - The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include **E**, with **E** increased by Ω_0 . The anchor design tensile strength shall be calculated from 17.2.3.4.4.

17.2.3.5.2 – Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.2.3.5.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.5.

Exceptions:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or non-bearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane design shear strength in accordance with 17.5.2 and 17.5.3 need not be computed and 17.2.3.5.3 shall be deemed to be satisfied provided all of the following are met:

1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AWC NDS Table 11E for lateral design values parallel to grain.

1.2. The maximum anchor nominal diameter is $\frac{5}{8}$ inches (16 mm).

1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

1.4. Anchor bolts are located a minimum of $1\frac{3}{4}$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or non-bearing walls of anchor bolts attaching cold-formed steel track of bearing or non-bearing walls of light-frame construction to foundations or foundation stem walls the in-plane design shear strength in accordance with 17.5.2 and 17.5.3 need not be computed and 17.2.3.5.3 shall be deemed to be satisfied provided all of the following are met:

2.1. The maximum anchor nominal diameter is $\frac{5}{8}$ inches (16 mm).

2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

2.3. Anchors are located a minimum of $1\frac{3}{4}$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100 Section E3.3.1.

3. In light-frame construction, bearing or nonbearing walls, shear strength of concrete anchors less than or equal to $\frac{5}{8}$ 1" inch [16mm] in diameter of sill plate or track to foundation or foundation stem wall need not satisfy 17.2.3.5.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.5.2.1(c).

1905A.1.9 ~~1905A.1.1~~ ACI 318, Table 19.2.1.1 Section 5.1.1. Modify ACI 318 Table 19.2.1.1 ~~Section 5.1.1~~ as follows.

For concrete designed and constructed in accordance with this chapter, f'_c , shall not be less than 3,000 psi (20.7 MPa). Reinforced normal weight concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall require prior approval of structural design method and acceptance criteria by the enforcement agency.

1905A.1.3 ACI 318, Section 8.13.5. Replace ACI 318 Section 8.13.5 as follows:

~~8.13.5 – Permanent burned clay or concrete tile fillers shall be considered only as forms and shall not be included in the calculations involving shear or bending moments.~~

~~The thickness of the concrete slab on the permanent fillers shall be designed as described in ACI 318 Section 8.13.6 as modified in Section 1905A.1.4.~~

1905A.1.4 ACI 318, Section 8.13.6. Replace ACI 318 Section 8.13.6 as follows:

~~8.13.6 – Where removable forms or fillers are used, the thickness of the concrete slab shall not be less than 1/12 of the clear distance between joists and in no case less than 2 1/2 inches (64 mm). Such slab shall be reinforced at right angles to the joists with at least the amount of reinforcement required for flexure, considering load concentrations, if any, but in no case shall the reinforcement be less than that required by ACI 318 Section 7.12.~~

1905A.1.5 ACI 318, Section 8.13. Add Section 8.13.9 to ACI 318 as follows:

8.13.9 Concrete bridging. Concrete bridging shall be provided as follows: one near the center of spans for 20 to 30 feet (6096 mm to 9144 mm) spans and two near the third points of spans over 30 feet (9144 mm). Such bridging shall be either:

~~(a) A continuous concrete web having a depth equal to the joist and a width not less than 3 1/2 inches (89 mm) reinforced with a minimum of one No. 4 bar in the top and bottom; or~~

~~(b) Any other concrete element capable of transferring a concentrated load of 1,000 pounds (4.5 kN) from any joist to the two adjacent joists.~~

Such bridging shall not be required in roof framing if an individual member is capable of carrying dead load plus a concentrated load of 1,500 pounds (6.7 kN) at any point.

1905A.1.7 ACI 318, Section 12.14.3. Add Section 12.14.3.6 to ACI 318 as follows:

~~12.14.3.6 – Welded splices and mechanical connections shall maintain the clearance and coverage requirements of ACI Sections 7.6 and 7.7.~~

1905A.1.9 ACI 318, Section 14.5 – Empirical design method. Not permitted by DSA.

1905A.1.12 ACI 318, Section 17.5.1. Modify ACI 318 Section 17.5.1 by adding Sections 17.5.1.1 and 17.5.1.2 as follows:

~~17.5.1.1 – Full transfer of horizontal shear forces may be assumed when all of the following are satisfied:~~

~~1. Contact surfaces are clean, free of laitance, and intentionally roughened to full amplitude of approximately 1/4 inch (6.4 mm).~~

~~2. Minimum ties are provided in accordance with ACI 318 Section 17.6.~~

3. Web members are designed to resist total vertical shear, and

4. All shear reinforcement is fully anchored into all interconnected elements.

17.5.1.2 – If any of the requirements of ACI 318 Section 17.5.1.1 is not satisfied, horizontal shear shall be investigated in accordance with ACI 318 Section 17.5.3 or 17.5.4.

1905.1.2 ACI 318, Section 18.2.1. Modify ACI 318 Sections 18.2.1.2 and 18.2.1.6 to read as follows:

~~18.2.1.2— Structures assigned to Seismic Design Category A shall satisfy requirements of Chapters 1 through 17 and 19 through 26; Chapter 18 does not apply. Structures assigned to Seismic Design Category B, C, D, E or F also shall satisfy 18.2.1.3 through 18.2.1.7, as applicable. Except for structural elements of plain concrete complying with Section 1905.1.7 of the International Building Code, structural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E or F.~~

~~18.2.1.6— Structural systems designated as part of the seismic force-resisting system shall be restricted to those permitted by ASCE 7. Except for Seismic Design Category A, for which Chapter 18 does not apply, the following provisions shall be satisfied for each structural system designated as part of the seismic force-resisting system, regardless of the Seismic Design Category:~~

- ~~(a) Ordinary moment frames shall satisfy 18.3.~~
- ~~(b) Ordinary reinforced concrete structural walls and ordinary precast structural walls need not satisfy any provisions in Chapter 18.~~
- ~~(c) Intermediate moment frames shall satisfy 18.4.~~
- ~~(d) Intermediate precast structural walls shall satisfy 18.5.~~
- ~~(e) Special moment frames shall satisfy 18.6 through 18.9.~~

~~(f) Special structural walls shall satisfy 18.10.~~

~~((g) Special structural walls constructed using precast concrete shall satisfy 18.11.~~

~~All special moment frames and special structural walls shall also satisfy 18.2.4 through 18.2.8.~~

1905A.1.18 ACI 318, Section 21.9.4. Modify ACI 318 by adding Section 21.9.4.6 as follows:

~~21.9.4.6 – Walls and portions of walls with $P_{u1} > 0.35P_o$ shall not be considered to contribute to the calculated strength of the structure for resisting earthquake induced forces. Such walls shall conform to the requirements of ACI 318 Section 21.13.~~

1905A.1.10 1905A.1.16 (Chapter 19, Section 1905.1.3) ACI 318, Section 18.5. [DSA-SS] Modify ACI 318, Section 18.5, by replacing Section 18.5.2.1, adding new Section 18.5.2.2 and renumbering existing Sections 18.5.2.2 and 18.5.2.3 to become 18.5.2.3 and 18.5.2.4, respectively:

18.5.2.1 – In connections between wall panels, yielding shall be restricted to steel elements or reinforcement. In connections between wall panels and the foundation, they shall be designed per Section 1616A.1.16.

18.5.2.2 – Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at deformation induced by the design displacement or shall use type 2 mechanical splices.

18.5.2.3 – Elements of the connection that are not designed to yield shall develop at least $1.5 S_y$.

18.5.2.4 – In structures assigned to SDC D, E or F, Wall piers shall be designed in accordance with 18.10.8 or 18.14 in ACI 318.

1905A.1.11 ~~1905A.1.17~~ ACI 318, Section 18.10.6.5 ~~21.9.2.2~~ Modify ACI 318, Section 18.10.6.5 ~~21.9.2.2~~ by adding the following:

(c) Where boundary members are not required by ACI 318 Section 18.10.6.2 or 18.10.6.3 ~~21.9.6~~, minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot of wall. Horizontal extent of boundary element shall be ~~per~~ in accordance with ACI 318 Section 18.10.6.4 (a), (b) and (c). ~~21.9.6.4 (a) & (b).~~

1908.1.4 ~~ACI 318, Section 18.11~~ Modify ACI 318, Section 18.11.2.1, to read as follows:

18.11.2.1 — Special structural walls constructed using precast concrete shall satisfy all the requirements of 18.10 for cast-in-place special structural walls in addition to Section 18.5.2.

1905A.1.12 ~~1905A.1.19~~ ACI 318, Section 18.12.6 ~~21.11.4~~ Add Section 18.12.6.2 to ACI 318 as follows: Modify ACI 318 Section 21.11.4 by adding the following:

18.12.6.2 Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or $6 d_b$ thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1905A.1.13 (Chapter 19, Section 1905.1.5) ~~1905.1.5~~ ACI 318, Section 18.13.1.1 Modify ACI 318, Section 18.13.1.1, to read as follows:

18.13.1.1 – Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and ground shall comply with the requirements of Section 18.13 and other applicable provisions of ACI 318 unless modified by Chapter 18A of the California Building Code.

1905.1.6 ACI 318, Section 14.6. Modify ACI 318, Section 14.6, by adding new Section 14.6.2 to read as follows:

~~14.6.2.1—Detailed plain concrete structural walls.~~

~~14.6.2.1—Detailed plain concrete structural walls are walls conforming to the requirements of ordinary structural plain concrete walls and 14.6.2.2.~~

~~14.6.2.2—Reinforcement shall be provided as follows:~~

~~(a) Vertical reinforcement of at least 0.20 square inch (129 mm²) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening and at the ends of walls. The continuous vertical bar required beside an opening is permitted to substitute for one of the two No. 5 bars required by 14.6.1.~~

~~(b) Horizontal reinforcement at least 0.20 square inch (129 mm²) in cross-sectional area shall be provided:~~

- ~~1. Continuously at structurally connected roof and floor levels and at the top of walls;~~
- ~~2. At the bottom of load-bearing walls or in the top of foundations where doweled to the wall; and~~
- ~~3. At a maximum spacing of 120 inches (3048 mm).~~

~~Reinforcement at the top and bottom of openings, where used in determining the maximum spacing specified in Item 3 above, shall be continuous in the wall.~~

1905.1.7 ACI 318, Section 14.1.4. Delete ACI 318, Section 14.1.4, and replace with the following:

~~14.1.4—Plain concrete in structures assigned to Seismic Design Category C, D, E or F.~~

~~14.1.4.1—Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete, except as follows:~~

~~(a) Structural plain concrete basement, foundation or other walls below the base are permitted in detached one and two family dwellings three stories or less in height constructed with stud bearing walls. In dwellings assigned to Seismic Design Category D or E, the height of the wall shall not exceed 8 feet (2438 mm), the thickness shall not be less than 7 1/2 inches (190 mm), and the wall shall retain no more than 4 feet (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with 14.6.1.~~

~~(b) Isolated footings of plain concrete supporting pedestals or columns are permitted, provided the projection of the footing beyond the face of the supported member does not exceed the footing thickness.~~

~~**Exception:** In detached one and two family dwellings three stories or less in height, the projection of the footing beyond the face of the supported member is permitted to exceed the footing thickness.~~

~~(c) Plain concrete footings supporting walls are permitted, provided the footings have at least two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 4 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing. For footings that exceed 8 inches (203 mm) in thickness, a minimum of one bar shall be provided at the top and bottom of the footing. Continuity of reinforcement shall be provided at corners and intersections.~~

~~**Exceptions:**~~

- ~~1. In Seismic Design Category A, B, and C, detached one and two family dwellings three stories or less in height and constructed with stud bearing walls, plain concrete footings without longitudinal reinforcement supporting walls are permitted.~~
- ~~2. For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, a minimum of one bar shall be provided at the top of the stemwall and at the bottom of the footing.~~
- ~~3. Where a slab on ground is cast monolithically with the footing, one No. 5 bar is permitted to be located at either the top of the slab or bottom of the footing.~~

1905A.1.14 ACI 318, Table 21.2.2. Replace Table 21.2.2 as follows.:

Table 21.2.2 – Strength reduction factor ϕ for moment, axial force, or combined moment and axial force

Net tensile strain ϵ_t	Classification	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\epsilon_t \leq \epsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\epsilon_{ty} < \epsilon_t < 0.005$	Transition ^{[1][2]}	$0.75 + 0.15 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* 0.005 - \epsilon_{ty}}$	(c)	$0.65 + 0.25 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* 0.005 - \epsilon_{ty}}$	(d)
$\epsilon_t \geq 0.005$	Tension-controlled ^[3]	0.9	(e)	0.9	(f)

^[1]For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.

^[2] ϵ_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_g f'_c$ and 0.005.

^[3] For sections with factored axial compression force $P_u \geq 0.1A_g f'_c$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.

1905A.1.15 ~~1905A.1.15~~ ACI 318, Section 24.2.1-18.2. Add Section 24.2.1.1-18.2.7 to ACI 318 as follows:

18.2.7 – Span to Depth Ratio. Span to depth ratios for continuous prestressed concrete members shall not exceed the following, except when calculations of deflections prove that greater values may be used without adverse effects:

<u>Beams</u>	<u>30</u>
<u>One-way Slabs</u>	<u>40</u>
<u>Two-way Floor Slabs</u>	<u>40</u>

These ratios should be decreased for special conditions such as heavy loads and simple spans.

Maximum deflection criteria shall be in accordance with ACI 318 Section 9.5

24.2.1.1 - Prestressed beam and slab depths shall meet the minimum depth of non-prestressed slab or beam members given in Table 7.3.1.1 for one way slabs, Tables 8.3.1.1 and 8.3.1.2 for two way slabs and Table 9.3.1.1 for beams unless approved otherwise by the building official.

1905A.1.16 ~~1905A.1.2~~ ACI 318, Section 5.6.2.1 26.12.2.1(a). Replace ACI 318 Section 5.6.2.1 26.12.2.1(a) by the following.

26.12.2.1(a) ~~5.6.2.1~~ Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (345m³) of concrete, or not less than once for each 2,000 square feet (186 m²) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

**SECTION 1906A
STRUCTURAL PLAIN CONCRETE**

NOT PERMITTED BY DSA-SS.

1906.1 Scope. The design and construction of structural plain concrete, both cast in place and precast, shall comply with the minimum requirements of ACI 318, as modified in Section 1905.

Exception: For Group R-3 occupancies and buildings of other occupancies less than two stories above grade plane of light frame construction, the required footing thickness of ACI 318 is permitted to be reduced to 6 inches (152 mm), provided that the footing does not extend more than 4 inches (102 mm) on either side of the supported wall.

...

SECTION 1908A

SHOTCRETE

1908A.1 General. Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for plain or reinforced concrete and the provisions of ACI 506. *The specified compressive strength of shotcrete shall not be less than 3,000 psi (20.69 MPa).*

Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by sand blasting, and just prior to receiving shotcrete, shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be wetted before shotcrete is deposited, but not so wet as to overcome suction. Sand for sand blasting shall be clean, sharp and uniform in size, with no particles that will pass a 50-mesh screen.

...

1908A.3 Aggregate. Coarse aggregate, if used, shall not exceed $\frac{3}{4}$ inch (19.1 mm).

For shear walls, when total rebar in any direction is more than 0.31 in² / ft. or rebar size is larger than # 5, shotcrete shall conform to course aggregate grading No. 2 per Table 1.1 of ACI 506.

...

1908A.5 Preconstruction tests. ~~Where preconstruction test are required by Section 1908.4,~~
a- A test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The sample panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is *approved by the building official*. Reports of preconstruction tests shall be submitted to the *building official* as specified in Section 1704A.5.

...

1908A.7 Joints. Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting.

Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

...

1908A.10 Strength tests. Strength tests for shotcrete shall be made *in accordance with ASTM C1604* by an approved agency on specimens that are representative of the work and which have been water soaked for at least 24 hours prior to testing. When the maximum-size aggregate is larger than $\frac{3}{8}$ inch (9.5 mm), specimens shall consist of not less than three 3-inch-diameter (76 mm) cores or 3-inch (76 mm) cubes. When the maximum-size aggregate is $\frac{3}{8}$ inch (9.5 mm) or smaller, specimens shall consist of not less than 2-inch-diameter (51 mm) cores or 2-inch (51 mm) cubes.

1908A.10.1 Sampling. Specimens shall be taken from the in-place work or from test panels, and shall be taken at least once each shift, but not less than one for each 50 cubic yards (38.2 m³) of shotcrete.

1908A.10.2 Panel criteria. When the maximum-size aggregate is larger than $\frac{3}{8}$ inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). When the maximum-size aggregate is $\frac{3}{8}$ inch (9.5 mm) or smaller, the test panels shall have minimum dimensions of 12 inches by 12 inches (305 mm by 305 mm). Panels shall be shot in the same position as the work, during the course of the work and by the nozzlemen doing the work. The conditions under which the panels are cured shall be the same as the work. *Approval from the enforcement agency shall be obtained prior to performing the test panel method.*

...

1908A.11 ~~1910A.11~~ Forms and Ground Wires for Shotcrete. *Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.*

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

1908A.12 ~~1910A.12~~ Placing. *Shotcrete shall be placed in accordance with ACI 506.*

**(Relocated to Section 2514) SECTION 1911A
-REINFORCED GYPSUM CONCRETE**

1911A.1 General. ~~Reinforced gypsum concrete shall comply with the requirements of ASTM C 317 and ASTM C 956. Reinforced gypsum concrete shall be considered as an alternative system.~~

...

(Amendments in the CBC 2013 Sections 1908A and 1909A are deleted except those relocated as noted below, since model code deleted those sections)

(Relocated to Section 1616A.1.20) ~~1908A.1.1 Power actuated fasteners. Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of this section.~~

~~Power actuated fasteners shall be permitted in seismic shear for components exempt from permit requirements by Section 1616A.1.18 of this code and for interior nonbearing non-shear wall partitions. Power actuated fastener shall not be used to anchor exterior cladding or curtain wall systems.~~

...

(Relocated to Section 1616A.1.19) ~~1909A.1.1 Specialty inserts. Specialty inserts, including cast-in-place specialty inserts, tested in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section.~~

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SECTION 1909A
RESERVED

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SECTION 1910A 1913A
CONCRETE, REINFORCEMENT AND ANCHOR TESTING

1910A.1 ~~1913A.1~~ Cementitious material. The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C 150 for portland cement and ASTM C 595 or ASTM C 1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C 618 or ASTM C 989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's Certificate of Compliance that represents the materials used by date of shipment for concrete. Cementitious materials without Certification of Compliance shall not be used.

1910A.2 ~~1913A.2~~ Tests of reinforcing bars. ~~Where s~~ Samples shall be ~~are~~ taken from bundles as delivered from the mill, with the bundles identified as to heat number and ~~provided the accompanying mill certificate. analyses accompany the report, o~~ One tensile test and one bend test shall be made from a sample specimen from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2 1/2 tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings or non-building structures provided they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1910A.3 ~~1913A.3~~ Tests for prestressing steel and anchorage. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the jobsite. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or jobsite shall be furnished by the contractor and tested by an approved independent testing agency:

1. For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.
2. For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.

Variations of the bearing plate size need not be considered.

The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the pre-stressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

Anchorage of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.
4. Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.

1910A.4 1913A.4 Composite construction cores. Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).

At least one core shall be taken from each building for each 5,000 square feet (465m²) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

~~**1913A.5 Tests of shotcrete.** Testing of shotcrete shall follow the provisions of Section 1910A and the general requirements of ACI 318 Section 5.6.~~

~~**1913A.6 Gypsum field tests.** Field tests shall be made during construction to verify gypsum strength. One sample consisting of three specimens shall be made for each 5,000 square feet (465 m²) or fraction thereof of all gypsum poured, but not less than one sample shall be taken from each half day's pour.~~

1910A.5 1913A.7 Tests for Post-Installed Anchors in Concrete. When post-installed anchors are used in lieu of cast-in place bolts, the installation verification test loads, frequency, and acceptance criteria shall be in accordance with this section.

1910A.5.1 1913A.7.1 General. Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

1910A.5.2 ~~1913A.7.5~~ Testing Procedure. The test procedure shall be as permitted by an approved test report using criteria adopted in this code. All ~~other~~ post-installed anchors shall be tension tested.

Exception [DSA-SS]: Torque controlled post installed anchors and screw type anchors shall be permitted to be tested using torque based on an approved test report using criteria adopted in this code.

Alternatively, the Manufacturer's recommendation for testing may be approved by the enforcement agency based on an approved test report using criteria adopted in this code.

1910A.5.3 ~~1913A.7.3~~ Test Frequency. When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

Exceptions:

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the factored design tension on anchors is less than 100 lbs. and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25% of the dowels shall be tested if all of the following conditions are met:
 - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
 - b. The number of dowels in any one member equals or exceeds 12.
 - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/Inspector Of Record (IOR).

4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.

1910A.5.4 1913A.7.2 Test Loads. Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter (1- 1/4) times the maximum design strength of anchors as provided in an approved test report using criteria adopted in this code or determined in accordance with Chapter 17 Appendix D of ACI 318.

Tension test load need not exceed 80% of the nominal yield strength of the anchor element ($= 0.8 A_{se} f_{ya}$).

2. The manufacturer's recommended installation torque based on an approved test report using criteria adopted in this code.

1910A.5.5 1913A.7.4 Test Acceptance Criteria. Acceptance criteria for post-installed anchors shall be based on an approved test report using criteria adopted in this code. Field tests shall satisfy the following minimum requirements.

1. Hydraulic Ram Method:

Anchors tested with a hydraulic jack or spring loaded ~~devices~~ apparatus shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

For adhesive anchors, where other than bond is being tested, the testing apparatus support device shall not be located within 1.5 times the anchor's embedment depth to avoid restricting the concrete shear cone type failure mechanism from occurring.

2. Torque Wrench Method:

Torque controlled post installed A anchors tested with a calibrated torque wrench shall must attain the specified torque within 1/2 turn of the nut; or one-quarter (1/4) turn of the nut for a 3/8 in. sleeve anchor only.

Exceptions:—

- a. Wedge or Sleeve type:—

One-quarter (1/4) turn of the nut for a 3/8 in. sleeve anchor only.

b.—~~[DSA-SS] Screw Threaded T~~type: anchors tested with a calibrated torque wrench shall attain the specified torque within ~~One~~one-quarter (1/4) turn of the screw after initial seating of the screw head.

SECTION ~~1911A~~ 1914A

EXISTING CONCRETE STRUCTURES

1911A.1 ~~1914A.1~~ Existing Concrete Structures.

The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m²) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed 3/4 inch (19 mm).

1911A.2 ~~1914A.2~~ Crack Repair by Epoxy Injection. Crack Repair of concrete and masonry member by epoxy injection shall conform to all requirements of ACI 503.7.

1911A.3 ~~1914A.3~~ Concrete Strengthening by Externally Bonded Fiber Reinforced Polymer (FRP). Design and construction of externally bonded FRP systems for strengthening concrete structures shall be in accordance with ACI 440.2R.

- Exceptions:
- 1) Near-Surface Mounted (NSM) FRP bars shall not be permitted.
 - 2) Strengthening of shear walls and diaphragms (including chords and collectors) shall be considered as an alternative system.

Design capacities, reliability, serviceability of FRP materials shall be permitted to be established in accordance with ICC-ES AC 125. Minimum inspection requirements of FRP composite systems shall be in accordance with ICC-ES AC 178.

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

NOTATION:

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