

BCAC Structural work group Report of Group B proposals

Item	Topic
1	ASTM E1996 (see structural #1)
4	1905 ACI
5	2308.4.4.1
11	SOG-IBC: 1901, 1907.1

BCAC Structural Item 1

IBC: 1609.2.2, 1609.2.3

IRC: R301.2.1.2.1

IBC

**1609.2.2 Application of ASTM E1996.**

The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the basic design wind speed,  $V$ , as follows:

6.2.2.1 Wind Zone 1—130 mph  $\leq$  basic design wind speed,  $V < 140$  mph.

6.2.2.2 Wind Zone 2—140 mph  $\leq$  basic design wind speed,  $V < 150$  mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 Wind Zone 3—150 mph (67 m/s)  $\leq$  basic design wind speed,  $V \leq 160$  mph (72 m/s), or 140 mph (63 m/s)  $\leq$  basic design wind speed,  $V \leq 160$  mph (72 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 Wind Zone 4—basic design wind speed,  $V > 160$  mph (72 m/s).

**1609.2.3 1609.2.2** Garage doors. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

IRC

**R301.2.1.2.1 Application of ASTM E1996.** The text of Section 2.2 of ASTM E1996 shall be substituted as follows:

2.2 ASCE Standard:

**ASCE 7-10** American Society of Civil Engineers *Minimum Design Loads for Buildings and Other Structures*

The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the ultimate design wind speed,  $V_{ult}$ , as follows:

6.2.2.1 Wind Zone 1—130 mph  $\leq$  ultimate design wind speed,  $V_{ult} < 140$  mph.

6.2.2.2 Wind Zone 2—140 mph  $\leq$  ultimate design wind speed,  $V_{ult} < 150$  mph at greater than 1 mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 Wind Zone 3—150 mph (67 m/s)  $\leq$  ultimate design wind speed,  $V_{ult} \leq 170$  mph (76 m/s), or 140 mph (63 m/s)  $\leq$  ultimate design wind speed,  $V_{ult} \leq 170$  mph (76 m/s) and within 1 mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 Wind Zone 4—ultimate design wind speed,  $V_{ult} > 170$  mph (76 m/s).

Reason: This proposal removes the technical criteria that is redundant with the current reference standards ASTM E1996-20 and ASCE7- 22. ASTM E1996 has changed to ultimate design from strength design and reduced the wind zones from 4 to 3. The 'correction' as specified in IBC Section 1609.2.2 and IRC Section R301.2.1.2.1 is no longer needed with the current ASTM E1996-20 and ASCE 7-22.

ASCE 7-10 changed the basis of its wind speed maps from allowable stress-level wind speeds to strength design-level wind speeds. However, due to the timing of the ICC code development cycle leading to the 2012 IBC and IRC and of the ASTM cycle for updating E1996, there was not enough time to correlate and update the wind speeds associated with the E1996 wind zones. Section 1609.2.2 was introduced as a temporary measure to correlate the E1996 wind zones with ASCE 7-10.

In addition, Wind Zone 4 was modified to trigger at a higher wind speed as was specified in E1996 at the time. Wind Zone 4 was originally introduced to bring Miami-Dade County on board with accepting ASTM E1996 as equivalent to the TAS 102. The IBC and IRC raised the Wind Zone 4 trigger as the ASCE 7-10 wind maps would have otherwise resulted in Wind Zone 4 extending beyond Miami-Dade County.

Cost: no increase or decreases.

Removing the IBC and IRC modification will not change any design or testing requirements as the wind zone definitions in E1996 largely match those in the modification. It may reduce confusion in southern Florida by removing reference to Wind Zone 4, which no longer exists in E1996.

## BCAC STR #4-ACI 04 211025 IBC 1905 Clean-up

IBC: 1905.1, 1905.1.1, 1905.1.2, 1905.1.3, 1905.1.4, 1905.1.5, 1905.1.6, 1905.1.7, 1905.1.8, New 1905.1.8.1 (17.10.5.2), New 1905.1.8.2 (17.10.5.3(d))

### IBC Chapter 19 Clean-up – No technical Changes

#### SECTION 1905 MODIFICATIONS TO ACI 318 SEISMIC REQUIREMENTS

**1905.1 General.** The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through 1905.1.8. Chapter 18 of ACI 318 shall not apply for structures assigned to Seismic Design Category A.

**1905.1.1 Definitions.** ~~ACI 318, Section 2.3.~~ Modify existing definitions and add the following definitions to ACI 318, Section 2.3:

**DETAILED PLAIN CONCRETE STRUCTURAL WALL.** A wall complying with the requirements of Section 1905.1.6 and Chapter 14 of ACI 318, 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 Chapters 1 through 13, 15, 16 and 19 through 26.~~

**ORDINARY STRUCTURAL PLAIN CONCRETE WALL.** A wall complying with the requirements of Chapter 14, ~~excluding 14.6.2.~~

**1905.1.2 Plain concrete walls.** ~~ACI 318, Section 18.2.1.~~ Modify ACI 318 Sections 18.2.1.2 and 18.2.1.6 to read as follows:

Structural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E and F.

**Exception:** Structural elements of plain concrete complying with Section 1905.1.7

~~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 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.

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

**1905.1.3 ACI 318, Section 18.5. Intermediate precast structural walls.** Modify ACI 318, Section 18.5 by adding new Section 18.5.2.2 and renumber 18.5.2.3 and 18.5.2.4, respectively. Intermediate precast structural walls forming part of the seismic force resisting system shall comply with this section and Section 18.5 of ACI 318.

~~18.5.2.2~~ **1905.1.3.1 Connections designed to yield.** Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the 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.

**1905.1.4 ACI 318, Section 18.11. Special structural walls constructed of precast.** 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 and for cast in place special structural walls in addition to 18.5.2 of ACI.

**1905.1.5 ACI 318, Section 18.13.1.1. Foundations designed to resist earthquake forces.** 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 18.13 and other applicable provisions of ACI 318 unless modified by Chapter 18. ~~of the International Building Code.~~

**1905.1.6 ACI 318, Section 14.6. Detailed plain concrete structural walls.** Modify ACI 318, Section 14.6 by adding new Section 14.6.2 to read as follows:

~~14.6.2~~ 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 for detailed plain concrete structural walls shall be provided as follows:

- Vertical reinforcement of at least 0.20 square inch (129 mm<sup>2</sup>) 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 of ACI 318.
- Horizontal reinforcement at least 0.20 square inch (129 mm<sup>2</sup>) 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.
  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. Structural plain concrete** 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:

- Structural plain concrete basement, foundation or other walls below the base as defined in ASCE 7 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 be not 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.

- 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.

- 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 Categories A, B and C, detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.
2. For foundation systems consisting of a plain concrete footing and a plain concrete stem wall, 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.

**1905.1.8 ACI 318, Section 17.2.3. Design requirements for anchors.** ~~Modify ACI 318 Sections 17.10.5.2, 17.10.3(d) and 17.10.6.2 to read as follows:~~ Loading design requirements for anchors shall comply with ACI 318 and this section.

- ~~17.10.5.2~~ **1905.1.8.1 Where applied force does not exceed 20 percent of factored load.** 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 17.10.5.3 of ACI 318. The anchor design tensile strength shall be determined in accordance with 17.10.5.4 of ACI 318.

***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 shall be deemed to satisfy Section 17.10.5.3(d) of ACI 318.*

- ~~17.10.5.3(d)~~ **1905.1.8.2 Maximum tension.** 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  $\Omega_0$ . The anchor design tensile strength shall be calculated from 17.10.5.4 of ACI 318.

~~1905.1.8.3~~ **Where the applied force exceeds 20 percent of the factored load.** Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of factored load, the in-plane shear strength in accordance with 17.10.6.3 of ACI 318. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7 of ACI 318.

**Exceptions:**

~~1. For~~ *The calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 of ACI 318 need not be computed and 17.10.6.3 of ACI 318 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 ANSI/AWC NDS Table 12E for lateral design values parallel to grain.
- 1.2. The maximum anchor nominal diameter is 5/8 inch (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 13/4 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 (51 mm) or 3-inch (76 mm) nominal thickness.
2. ~~For~~The calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 of ACI 318 need not be computed and 17.10.6.3 of ACI 318 shall be deemed to be satisfied provided all of the following are met:
- 2.1. The maximum anchor nominal diameter is 5/8 inch (16 mm).
  - 2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).
  - 2.3. Anchors are located a minimum of 13/4 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 (0.84 mm to 1.73 mm) 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 J3.3.1.
3. In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) of ACI 318 when the design strength of the anchors is determined in accordance with 17.7.2.1(c) of ACI 318.

**Reason Statement:**

This proposal eliminates unnecessary and confusing transcription from ACI 318 and more concisely communicates contents of subsections with title rather than ACI 318 Section numbers. This proposal aligns the section with the IBC format convention and clearly communicates to the user what is different between the IBC and ACI 318. Further, additional confusion results because the proponents of the current format are not maintaining the excessive transcription from ACI 318 and errata needed to be developed for the 2021 edition of the IBC. The improved clarity and conciseness of the provisions is needed to assist in avoiding errors in design and construction of structural concrete. Finally, the clear descriptors indicating what is changed, allows the user to quickly identify if the criteria in the IBC is applicable to their project. For example, if the project does not use detailed plain structural concrete walls, the user clearly sees that those provisions do not apply for their project.

Specifically, the proposal:

- Clarifies what is contained in this section, i.e. seismic requirements.
- Communicates up front to the designer that requirements are not applicable to SDC A.
- More concisely communicates the provisions. Even with the additional words for descriptors in section and sub-section headings Parts I through IX use 24 percent fewer words to communicate the requirements of the code.
- Removes definitions that are the same as those in ACI 318. Multiple terms defined in ACI 318 are shown simply to add one term not addressed in ACI 318: "Detailed Plain Concrete Structural Wall."
- Avoids confusion for user looking to see what is different between definitions and requirements in IBC and 318 are technically the same.
- Relocates requirements for special plain walls in a section with an appropriate descriptor.
- Eliminates text that describes renumbering sections and modifying text of ACI 318 to more clearly communicate the code requirements.
- Concisely communicates that there are prohibitions regarding the use of structural plain concrete in SDC C, D, E, and F.
- Eliminates unnecessary transcription from ACI 318.
- Clearly communicates where specific provisions are only applicable to plain structural concrete walls.
- Aligns language with ICC convention for referring the use of italics.
- Aligns language with ICC convention for descriptive section and subsection titles.
- Helps to avoid the need for errata as Section numbers in ACI 318 change. Errata needed to be issued for the 2021 Edition of the IBC.

- Removes archaic approach to code and standard use. Additional requirements in the IBC were presented as modifications to ACI 318 to allow cut-and-paste the entire section into hard copies. Most of today's users use electronic formats and find the cut-and-paste confusing.
- In many instances there are no changes to the content in ACI 318 and text is simply transcribed. The excessive transcription increases the likelihood for the user to miss important differences between ACI 318 and the IBC.

Cost Impact:

There is no cost impact as there are no technical changes.



**Comparison of 2021 IBC Section 1905**  
**Current IBC Text (Left Column) and Text if ACI Proposals Are Approved (Right Column)**  
**Blocks with gray fill indicate no recommended modifications**

<p style="text-align: center;"><b>SECTION 1901 GENERAL</b></p> <p><b>1901.1 Scope.</b> The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.</p> <p><b>1901.2 Plain and reinforced concrete.</b> Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. <del>Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on-grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.</del></p>	<p style="text-align: center;"><b>SECTION 1901 GENERAL</b></p> <p><b>1901.1 Scope.</b> The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.</p> <p><b>1901.2 Plain and reinforced concrete.</b> Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code.</p>
<p style="text-align: center;"><b>SECTION 1905 MODIFICATIONS TO ACI 318</b></p> <p><b>1905.1 General.</b> <del>The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through 1905.1.8.</del></p> <p><b>1905.1.1 ACI 318, Section 2.3.</b> Modify existing definitions and add the following definitions to ACI 318, Section 2.3.</p> <p><b>DETAILED PLAIN CONCRETE STRUCTURAL WALL.</b> A wall complying with the requirements of Chapter 14, including 14.6.2.</p> <p><del><b>ORDINARY PRECAST STRUCTURAL WALL.</b> A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.</del></p> <p><del><b>ORDINARY REINFORCED CONCRETE STRUCTURAL WALL.</b> A cast in place wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.</del></p> <p><del><b>ORDINARY STRUCTURAL PLAIN CONCRETE WALL.</b> A wall complying with the requirements of Chapter 14, excluding 14.6.2.</del></p> <p><b>1905.1.2 ACI 318, Section 18.2.1.</b> Modify ACI 318 Sections 18.2.1.2 and 18.2.1.6 to read as follows:</p> <p><del>•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 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.</del></p> <p><del>•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</del></p>	<p style="text-align: center;"><b>SECTION 1905 SEISMIC REQUIREMENTS</b></p> <p><b>1905.1 General.</b> <u>Chapter 18 of ACI 318 shall not apply for structures assigned to Seismic Design category A.</u></p> <p><b>1905.1.1 Definitions.</b> Add the following definition to ACI 318, Section 2.3.</p> <p><b>DETAILED PLAIN CONCRETE STRUCTURAL WALL.</b> A wall complying with the requirements of Chapter 14, including 14.6.2.</p> <p><b>1905.1.2 Plain concrete walls.</b> <u>Structural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E and F.</u></p> <p><b>Exception:</b> <u>Structural elements of plain concrete complying with Section 1905.1.7</u></p> <p><b>Note:</b> Adjacent text from IBC is relocated for Section 1905.1.7</p>

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 structure l 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.
- Special moment frames and special structural walls shall also satisfy 18.2.4 through 18.2.8.

**1905.1.3 ACI 318, Section 18.5.** Modify ACI 318, Section 18.5 by adding new Section 18.5.2.2 and renumber 18.5.2.3 and 18.5.2.4, respectively.

~~18.5.2.2— Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the 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<sub>y</sub>.~~

~~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.~~

**1905.1.4 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 18.5.2.

**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 18.13 and other applicable provisions of ACI 318 unless modified by Chapter 18 of the International 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— 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:~~

- Vertical reinforcement of at least 0.20 square inch (129 mm<sup>2</sup>) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening and

**1905.1.3 Intermediate precast structural walls.**

Intermediate precast structural walls forming part of the seismic force resisting system shall comply with this section and Section 18.5 of ACI 318.

**1905.1.3.1 Connections designed to yield.**

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

**1905.1.4 Special structural walls constructed of precast.** Special structural walls constructed using precast concrete shall satisfy all the requirements of 18.10 in addition to 18.5.2 of ACI 318

**Exception:** Section 18.10.2.4 of ACI 318 shall not apply for precast walls where deformation demands are concentrated at panel joints.

**1905.1.5 Earthquake forces on foundations.**

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

**1905.1.6 Detailed plain concrete structural walls.**

Reinforcement for detailed plain concrete structural walls shall be provided as follows:

- Vertical reinforcement of at least 0.20 square inch (129 mm<sup>2</sup>) 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.

• *Horizontal reinforcement at least 0.20 square inch (129 mm<sup>2</sup>) 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.*
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:~~**

- *Structural plain concrete basement, foundation or other walls below the base as defined in ASCE 7 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 be not less than 7½ 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.*
- *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.*

- *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 Categories A, B and C, detached one- and two-family dwellings three stories or*

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.

• *Horizontal reinforcement at least 0.20 square inch (129 mm<sup>2</sup>) 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.*
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 Structural plain concrete.** Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete except as follows:

1. Structural plain concrete basement, foundation or other walls below the base as defined in ASCE 7 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 be not less than 7½ 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 of ACI 318.

2. 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.

3. 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 Categories A, B and C, detached one- and two-family dwellings three stories or

less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.

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.

**1905.1.8 ACI 318, Section 17.10.5.** Modify ACI 318 Sections 17.10.5.2, 17.10.5.3(d) and 17.10.5.4 to read as follows:

• 17.10.5.2 – 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 17.10.5.3. The anchor design tensile strength shall be determined in accordance with 17.10.5.4.

**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 shall be deemed to satisfy Section 17.10.5.3(d).

• 17.10.5.3(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  $\Omega_0$ . The anchor design tensile strength shall be calculated from 17.10.5.4.

• 17.10.6.2 – 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 17.10.6.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7.

**Exceptions:**

1. ~~For~~ the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 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

less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.

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.

**1905.1.8 Design requirements for anchors.** Loading design requirements for anchors shall comply with ACI 318 and this section.

**1905.1.8.1 Where applied force does not exceed 20 percent of the factored load.** 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 17.10.5.3 of ACI 318. The anchor design tensile strength shall be determined in accordance with 17.10.5.4 of ACI 318.

~~17.2.3.4.3(d)~~ – **1905.1.8.2 Maximum tension.** 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  $\Omega_0$ . The anchor design tensile strength shall be calculated from 17.10.5.4 of ACI 318.

**1905.1.8.3 Where the applied force exceeds 20 percent of the factored load.** Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of factored load, the in-plane shear strength in accordance with 17.10.6.3 of ACI 318. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7 of ACI 318.

**Exceptions:**

1. The calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 of ACI 318 need not be computed and 17.10.6.3 of ACI 318 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 ANSI/AWC NDS Table 12E for lateral design values parallel to grain. 1.2. The maximum anchor nominal diameter is  $\frac{5}{8}$  inch (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  $\frac{1}{4}$  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 (51 mm) or 3-inch (76 mm) nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 of ACI 318 need not be computed and 17.10.6.3 of ACI 318 shall be deemed to be satisfied provided all of the following are met:

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

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

2.3. Anchors are located a minimum of  $\frac{1}{4}$  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 (0.84 mm to 1.73 mm) 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 J3.3.1.

3. In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).

with ANSI/AWC NDS Table 12E for lateral design values parallel to grain. 1.2. The maximum anchor nominal diameter is  $\frac{5}{8}$  inch (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  $\frac{1}{4}$  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 (51 mm) or 3-inch (76 mm) nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 of ACI 318 need not be computed and 17.10.6.3 of ACI 318 shall be deemed to be satisfied provided all of the following are met:

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

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

2.3. Anchors are located a minimum of  $\frac{1}{4}$  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 (0.84 mm to 1.73 mm) 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 J3.3.1.

3. In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).

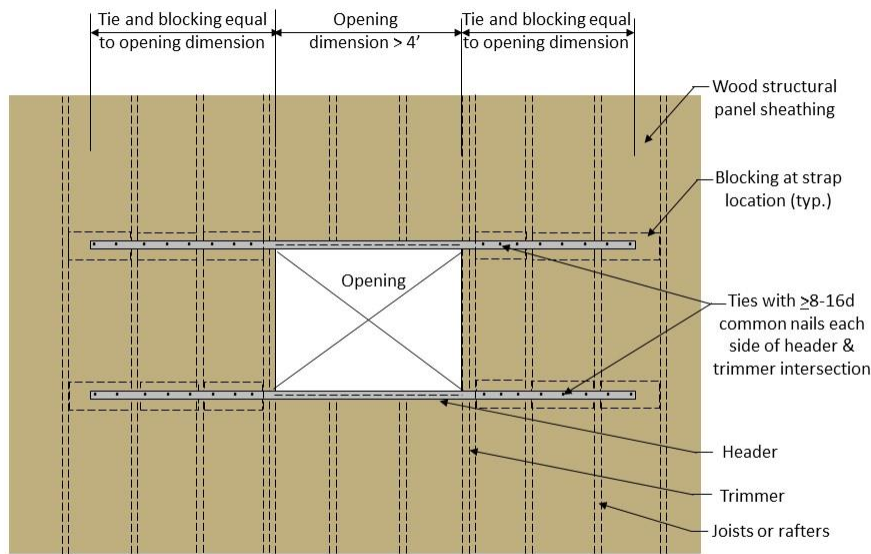
**BCAC STR Item 5**

**IBC: 2308.4.4.1, 2308.7.6.1**

**2308.4.4.1 Openings in floor diaphragms in Seismic Design Categories B, C, D and E.** Openings in horizontal *diaphragms* in *Seismic Design Categories B, C, D and E* with a dimension that is greater than 4 feet perpendicular to the joists or rafters shall be constructed with metal ties and blocking in accordance with this section and Figure 2308.4.4.1(1). Metal ties shall be not less than 0.058 inch [(16 galvanized gage)] in thickness by 1½ inches in width and shall have a yield stress not less than 33,000 psi. Blocking shall extend not less than the dimension of the opening in the direction of the tie and blocking. Ties shall be attached to blocking in accordance with the manufacturer’s instructions but with not less than eight 16d common nails on each side of the header- joist trimmer intersection.

**2308.7.6.1 Openings in roof diaphragms in Seismic Design Categories B, C, D and E.** In buildings classified as Seismic Design Category B, C, D or E. openings in horizontal diaphragms with a dimension that is greater than 4 feet (1219 mm) perpendicular to the joists or rafters shall be constructed with metal ties and blocking in accordance with this section and Figure 2308.4.4.1(1). Metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] in thickness by 1½ inches (38 mm) in width and shall have a yield stress not less than 33,000 psi (227 Mpa). Blocking shall extend not less than the dimension of the opening in the direction of the tie and blocking. Ties shall be attached to blocking in accordance with the manufacturer’s instructions but with not less than eight 16d common nails on each side of the header- joist trimmer intersection.

Proposed new Figure 2308.4.4.1(1) (Replace the current 2308.4.4.1(1))



SDCB, C, D and E

**Reason statement:** This proposal clarifies the current code text by adding “perpendicular to the joists or rafters”, replaces joist by trimmer and revise Figure 2308.4.4.1(1). The purpose of this prescriptive solution is “to strengthen openings greater than 4 feet in dimension perpendicular to the joists and provide a general means for a load path in these specific cases in lieu of requiring an engineered design.” The text of Sections 2308.4.4.1 and 2308.7.6.1 indicates that this provision applies when a floor diaphragm opening exceeds 4 feet. It details blocking and strapping perpendicular to the joists.

Sections 2308.4.4 and 2308.7.6.1 indicate that trimmers are to be doubled when the header span exceeds 4 feet, so the current Figure 2308.4.4.1(1) should be revised to show a double trimmer on each side of the opening. Since those trimmers are typically continuous, they act as collectors on either side of the opening parallel to the joists. Additional revisions to the figure as shown provide consistency with the code text. In summary, proposed changes to Figure 2308.4.4.1(1) include the following:

- Double trimmer shown on each side of the opening
- Remove vertical dimension of the opening
- Add opening dimension >4’ perpendicular to joists
- Add nailing requirements as shown based on code text

Cost. Non

This is a clarification of the current code text.

**SECTION 1901  
GENERAL**

**1901.2 Plain and reinforced concrete.** Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. ~~Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.~~

**SECTION 1907  
MINIMUM SLAB PROVISIONS  
SLABS-ON-GROUND**

**1907.1 General.** Non-structural slabs-on-ground shall comply with Section 1904 and this Section. Structural slabs-on-ground shall comply with all applicable provisions of this Chapter. Slabs-on-ground shall be considered structural where designed to:

- 1) transmit loads or resist lateral forces from other parts of the structure to the soil; or,
- 2) transmit loads or resist lateral forces from other parts of the structure to foundations; or
- 3) serve as tributary area for resisting uplift or overturning forces.

**Reason:**

This proposal:

1. Renames Section 1907 to “Slabs-on-Ground” as this section is not applicable to interim floor slabs or other slabs not on ground.
2. Moves all slab-on-ground requirements into one section by eliminating text in section 1901.2
3. Clarifies scenarios where slabs-on-ground are structural, adding language that addresses slabs on ground used as part of a diaphragm systems, transferring loads to micro-piles, etc. and as dead weight to resist overturning or uplift forces.