Draft ACI Proposed Changes to 2018 I-Codes
International Code Council
Group B 2019 Code Development Process
September 2019

Code change proposals are in draft form. Concepts will remain the same but specific proposed language and reason statements may be altered based on input for ACI members and industry allies.

International Building Code

Chapter 17 – Special Inspection and Tests

17-01A Sec. 1705.3 Adds 311.7 and removes Table 1705.3 REQUIRED SPECIAL INSPECTION AND TESTS OF CONCRETE CONSTRUCTION.

17-01B Sec 1705.3 References ACI 318 and removes Table 1705.3 REQUIRED SPECIAL INSPECTION AND TESTS OF CONCRETE CONSTRUCTION. (*To be recommended for disapproval if 17-01A is approved*.)

17-02 Sec. 1705.3 Adds ACI CPP630.1 policy requirements for Special Inspector

17-02 Sec. 1705.3 Adds: ACI CPP 610.1 *Concrete Field Testing Technician—Grade I for field testing of concrete or preparation of samples*;
ACI CPP 620.2 *Concrete Strength Testing Technician for compression and flexural testing only*;
ACI CPP 620.1 *Concrete Laboratory Testing Technician—Level 1 for any required laboratory testing*; and ACI CPP 620.1 *Concrete Laboratory Testing Technician—Level 2 for any required laboratory testing*; and
ACI CPP 630.1 *Concrete Construction Special Inspector.*

Chapter 18 Soils and Foundations

18-01 Sec.1808.1 Removes unnecessary and restrictive language specific to funnel placement of concrete.

18-02 Sec. 1808.1 Removes unnecessary requirements on pumpable concrete.

18-03 Sec. 1808.2 Aligns concrete cover requirements with ACI 318.

18-04 Sec. 1808.3 Aligns compressive strength requirements with ACI 318.

18-05 Sec. 1808.3 Aligns allowable capacity with ACI 318.

Chapter 19 Concrete

19-01 Sec. 1901.2 Clarifies requirements for detailed plain walls (not addressed in ACI 318).

19-02 Sec. 1901.2 Aligns requirements for precast in Seismic Design Categories (SDC) C through F with ACI 318.

19-03 Sec. 1901.3 Adds screws for anchors, consistent with ACI 318

19-04 Sec. 1901.5 Removes duplicate and potentially conflicting language on construction documents.

19-05 Sec. 1903.1 Removes cement standards to eliminate duplication in ACI 318.

19-06 Sec. 1901.5 Clarifies the code with improved language to coordinate the code with ACI 318 and ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures

19-07 Sec.1905.1.2 Aligns structural criteria for seismic design categories with ACI 318.

19-08 Sec. 1906.1 Aligns anchors provisions with the requirements of ACI 318.

19-09 Sec. 1906.1 Clarifies requirements for plain footings

19-10 Sec. 1907.1 Clarifies requirements for slabs-on-ground

19-11 Sec. 1908 Deletes shotcrete criteria in favor of requirements in ACI 318.

International Existing Building Code

Chapter 3 Provisions for All Compliance Methods

03-01 Sec. 303 Adds ACI 562 Adds ACI 562 *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*

ACI 17-01A-19
SEC. 1705.3 DELETE TABLE 1705.3 180629
ACI Proposed Code Change
2018 Edition of IBC Group B
To be heard before ACI 17-01B-19
Ask for Disapproval if ACI 17-01B-19 Approved

2018 International Building Code
Section 1705.3 Revise 1705.3 as follows, add new Sections 1705.3.1.1 and 1705.3.3, and delete Table 1705.3:

1705.3 Concrete construction. *Special inspections* and tests of concrete construction shall be performed in accordance this section~~. and Table 1705.3~~. *Special inspections* of concrete shall be in accordance with ACI 311.7.

Exception: *Special inspections* and tests shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above *grade plane* that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above *grade plane* that are fully supported on earth or rock where:
   2.1. The footings support walls of light-frame construction.
   2.2. The footings are designed in accordance with Table 1809.7.
   2.3. The structural design of the footing is based on a specified compressive strength, $f'c$, not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the *approved construction documents* or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

1705.3.1. Welding of reinforcing bars. *Special inspections* of welding and qualifications of *special inspectors* for reinforcing bars shall be in accordance with the requirements and AWS D1.4 for *special inspection* and of AWS D1.4 for special inspector qualification.

Exception: Periodic special inspection shall be permitted for single-pass fillet welds, maximum 5/16-in.

1705.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the *building official* shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.

1705.3.3 Anchor installation. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

~~TABLE 1705.3~~
~~REQUIRED SPECIAL INSPECTION AND TESTS OF CONCRETE CONSTRUCTION~~

~~TYPE~~	~~CONTINUOUS SPECIAL INSPECTION~~	~~PERIODIC SPECIAL INSPECTION~~	~~REFERENCED STANDARD*~~	~~IBC REFERENCE~~
~~1. Inspect reinforcement, including prestressing tendons, and verify placement.~~	~~—~~	~~X~~	~~ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3~~	~~1908.4~~
~~1. Reinforcing bar welding:~~ ~~• Verify weldability of reinforcing bars other than ASTM A706;~~ ~~• Inspect single-pass fillet welds, maximum $^5/_{16}$"; and~~ ~~• Inspect all other welds.~~	~~—~~ ~~—~~ ~~X~~	~~X~~ ~~X~~ ~~—~~	~~AWS D1.4~~ ~~ACI 318: 26.6.4~~	~~—~~

3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	 X —	 — X	 ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM 172 ASTM C31 ACI 318: 26.5, 26.12	1908.10
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	1908.6, 1908.7, 1908.8
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	1908.9
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	 X X	 — —	 ACI 318: 26.10	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

2. Where applicable, see Section 1705.12, Special inspections for seismic resistance.

3. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

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311.7—18 **Specification for Inspection of Concrete Construction**
1705.3

Reason:

This list of criteria is not as comprehensive as the list required by ACI 318. ACI 311.7 is written to the inspector and complies with the requirements of ACI 318. This code change simplifies this code, references ACI 311.7 on special inspection and removes conflicts with the requirements of ACI 318.

1) ACI 311.7 is added as a reference with charging language added to in Section 1705.3
2) Table 1705.3 is deleted to avoid conflicts between Table1705.3 and ACI 318.
3) As not to lose pertinent information provided in footnote b to the Table, new section 1705.3.3 Anchor installation is added.

The criteria in the IBC as not as accurate, complete and extensive as the criteria in ACI 311.7. ACI 311.7 is aligned with ACI 318 than Table 1705.3. Further Table 1705.3 does not include all the special inspection requirements of ACI 318. The omissions of criteria in ACI 318 suggest that the additional special inspections required by ACI 318 are not necessary. The result is that the lack of the special inspections as identified in ACI 318 could pose life safety issues. Coordinating and maintaining duplicate lists is always challenging and tends to lead to omissions and errors. The differences between the requirements for inspection between the 2018 IBC and ACI 311.7 are shown in Table 1. The solution, as recommended by this code change proposal, is to comply with the requirements of ACI 311.7. If

for some reason it is important for the building code officials to have a partial list of the inspection criteria, such as that in the 2018 edition of the IBC, then this abridged list would be more appropriate as commentary to the IBC. Differences between IBC Table 1705.3 and ACI 311.7 are:

- Items 1 through 3 – no difference
- Item 4 -
  - ACI 311.7 includes a reference to ACI 355.4 *Qualification of Post-Installed Adhesive Anchors in Concrete*, a standard that prescribes the qualifications for adhesive anchors. This standards was developed by ACI to fill a void that exists due to the absence of an ASTM Standard on adhesive anchor qualifications. Without this reference there are no requirements for qualifying adhesive anchors.
  - ACI 311.7 also requires compliance with both Sections 17.1.2 and 17.8.2 for mechanical anchors whereas the IBC only requires compliance with 17.8.2. ACI 318 Section 17.1.2 prescribes the minimum age of the concrete for anchoring adhesive anchors to concrete. This is crucial criteria necessary to achieve the performance of the adhesive anchors.
- Item 5 -
  - IBC requires compliance with 26.4.3 of ACI 318, but this section does not provide compliance criteria. Chapter 19 of the IBC requires concrete comply with ACI 318 so this specific reference is not required in the table.
  - IBC requires compliance with 26.4.4 of aCI 318, however aCI 311.7 provides more specific direction to the use. The compliance requirement appropriate for special inspections are specifically included in ACI 318 Section 26.4.4.1, as cited in ACI 311.7.
- Item 6 - Where the IBC only cites compliance with ASTM C31 and C172, ACI 311.6 Specification for Ready Mixed Concrete Testing Services, referenced in ACI 311.7, also provides for compliance with:
  - C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  - C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
  - C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
  - C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
  - C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
  - C511 Standard Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
  - C1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- Item 7 – no difference, ACI 311.7 reference more precise.
- Item 8 – no difference.
- Item 9 –
  - ACI 311.7 more precisely identifies the ACI 318 Section for compliance requirements.
  - ACI 311.7, consistent with ACI 318 also includes compliance with ACI 318 Section 26.13.2:
    (a) Placement of concrete.
    (b) Tensioning of prestressing steel and grouting of bonded tendons.
    (c) Installation of adhesive anchors in horizontal or upwardly inclined orientations to resist sustained tension loads in accordance with 17.8.2.4 and where required as a condition of the anchor assessment in accordance with ACI 355.4.
    (d) Reinforcement for special moment frames.
- Item 10 – no difference.
- Item 11 –
  - ACI 311.7 more precisely identifies the ACI 318 Section for compliance requirements.
  - ACI 311.7, consistent with ACI 318 also includes compliance with ACI 318 Section 26.13.3.3(e): "*Verification of in-place concrete strength before stressing post-tensioned reinforcement and before removal of shores and formwork from beams and structural slabs.*"
- Item 12 – no difference

In addition to the tabular information, ACI 311.7 is written specifically for special inspectors and provides the necessary direction to aid special inspectors determining compliance. ACI 311.7 also includes references to specifications necessary to properly conduct special inspections for specific elements, ACI 355.4 for post-installed anchors and ACI 311.6 for testing of ready-mixed concrete.

This code change avoids confusion for compliance with the intent of both the IBC and ACI 318. It also addresses items omitted form the IBC but required in ACI 318. Proper special inspection should be in accordance with ACI 318 and not only the truncated list in the IBC. Without this code change items crucial for life safety could be omitted from special inspection as the IBC criteria supersede the criteria of referenced standards. The omissions in the IBC suggest to the user that the additional criteria of ACI 318 are not required.

ACI, a technical professional society, recommends approval of this code change proposal as submitted to avoid confusion and conflicts between the IBC and ACI 318 and to help assure that all items identified as warranting special inspection in ACI 318 are addressed as compliance criteria where special inspection of concrete is required in the IBC.

Cost Impact: There is no increase in the initial cost of construction. Design and construction professionals adhering to the requirements of ACI 318, would being complying with these special inspections requirements as proposed herein and required by Chapter 19 of the IBC. Code change avoids confusion for compliance with both the IBC and ACI documents.

TABLE 1
REQUIRED SPECIAL INSPECTION AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION		PERIODIC SPECIAL INSPECTION		REFERENCED SECTIONS[a] ACI 318 unless shown otherwise		IBC REFERENCE
	IBC 2018	ACI 311.7	IBC 2018	ACI 311.7	IBC 218	ACI 311.7	
1. Inspect reinforcement, including prestressing tendons, and verify placement.	--	--	X		Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	Ch. 20, 25.2, 25.3, 26.6.1 through26.6.3	1908.4
2. Reinforcing bar welding: • Verify weldability of reinforcing bars other than ASTM A706; • Inspect single-pass fillet welds, maximum $^{5}/_{16}$″; and • Inspect all other welds.	-- -- X	-- -- X	X X --		AWS D1.4 26.6.4	AWS D1.4 26.6.4	—
3. Inspect anchors cast in concrete.	--	--	X		17.8.2	17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X --	X --	-- X	-- X	17.8.2.4 17.8.2	17.8.2.4 ACI 355.4 17.1.2 17.8.2	—
5. Verify use of required design mix.	--		X	X	Ch. 19, 26.4.3, 26.4.4	Ch 19 26.4.4.1	1904.1, 1904.2, 1908.2, 1908.3
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature	X	X	--	--	ASTM C172 ASTM C31 26.5, 26.12	ACI 311.6 26.12	1908.10
7. Inspect concrete and shotcrete placement for proper application techniques.	X	X	--	--	26.5	26.5.2	1908.6, 1908.7, 1908.8
8. Verify maintenance of specified curing temperature and techniques.	--	--	X	X	26.5.3-26.5.5	26.5.3.2 through 26.5.5.2	1908.9
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	X X	X\ X	-- --	-- --	26.10	26.10.1 and 26.13.3.2	—
10. Inspect erection of precast concrete members	--	--	X	X	26.9	26.9	—
11. Verify in-situ concrete strength, prior to stress- ing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	--	--	X	X	26.11.2	26.11.2.1 and 26.13.3.3e	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	--	--	X	X	26.11.1.2(b)	26.11.1.2(b)	—

ACI 17-01B-19
SEC. 1705.3 DELETE TABLE 1705.3 180629
ACI Proposed Code Change
2018 Edition of IBC Group B
To be heard after ACI 17-01A-19
Ask for Disapproval if ACI 17-01A-19 Approved

2018 International Building Code
Revise 1705.3 as follows, add new Sections 1705.3.1.1 and 1705.3.3, and delete Table 1705.3:

1705.3 Concrete construction. *Special inspections* and tests of concrete construction shall be performed in accordance this section and ~~Table 1705.3~~ and ACI 318.

Exception: *Special inspections* and tests shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above *grade plane* that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above *grade plane* that are fully supported on earth or rock where:
   2.1. The footings support walls of light-frame construction.
   2.2. The footings are designed in accordance with Table 1809.7.
   2.3. The structural design of the footing is based on a specified compressive strength, $f'c$, not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the *approved construction documents* or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

1705.3.1. Welding of reinforcing bars. *Special inspections* of welding and qualifications of *special inspectors* for reinforcing bars shall be in accordance with the requirements of Section 26.6.4 of ACI 318 and AWS D1.4 for *special inspection* and of AWS D1.4 for special inspector qualification.

Exception: Periodic special inspection shall be permitted for single-pass fillet welds, maximum 5/16-in.

1705.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the *building official* shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.

1705.3.3 Anchor installation. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

~~**TABLE 1705.3**~~
~~**REQUIRED SPECIAL INSPECTION AND TESTS OF CONCRETE CONSTRUCTION**~~

~~TYPE~~	~~CONTINUOUS SPECIAL INSPECTION~~	~~PERIODIC SPECIAL INSPECTION~~	~~REFERENCED STANDARD*~~	~~IBC REFERENCE~~
~~1. Inspect reinforcement, including prestressing tendons, and verify placement.~~	~~—~~	~~X~~	~~ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3~~	~~1908.4~~
~~a. Reinforcing bar welding:~~ ~~• Verify weldability of reinforcing bars other than ASTM A706;~~ ~~• Inspect single-pass fillet welds, maximum $^5/_{16}$"; and~~ ~~• Inspect all other welds.~~	~~—~~ ~~X~~	~~X~~ ~~X~~	~~AWS D1.4~~ ~~ACI 318: 26.6.4~~	~~—~~

3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X	X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	1908.10
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	1908.6, 1908.7, 1908.8
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	1908.9
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	X X	— —	ACI 318: 26.10	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

b. Where applicable, see Section 1705.12, Special inspections for seismic resistance.

c. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

a. Where applicable, see Section 1705.12, Special inspections for seismic resistance.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

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318—19 **Building Code Requirements for Structural Concrete**

722.2.4.3,1604.3.2, 1616.2.1, 1616.3.1, 1704.5, 1705.3, ~~Table 1705.3~~, 1705.3.1, 1705.3.2, 1705.3.3, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11.1, 1810.3.12, 1901.2, 1901.3, 1902.1, 1903.1, 1904.1, 1904.2, 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, 1906.1, 2108.3, 2206.1

Reason:

This code change makes 4 modifications to improve the code and avoid conflicts with the requirements of ACI 318.

1) Table 1705.3 is deleted to avoid conflicts between the Table and ACI 318.
2) Language referring Section 26.6.4 of ACI 318 regarding inspection of welding is moved from IBC Section 1905 and added to this section.

3) Provisions for types of inspection for welding that are currently in Table 1705.3 are moved to Section 1705.3.1
4) As not to lose pertinent information provided in footnote b to the Table, new section 1705.3.3 Anchor installation is added.

The criteria in the IBC as not as complete and extensive as the criteria in Chapter 26 of ACI 318. The omissions of criteria in ACI 318 suggest that the additional special inspections required by ACI 318 are not necessary. The result is that the lack of the special inspections as identified in ACI 318 could pose life safety issues. Coordinating and maintaining duplicate lists is always challenging and tends to lead to omissions and errors. The differences between the requirements for inspection between the 2018 IBC and ACI 318 are shown in Table 1. The solution, as recommended by this code change proposal, is to comply with the requirements of ACI 318. If for some reason it is important for the building code officials to have a partial list of the inspection criteria, such as that in the 2018 edition of the IBC, then this abridged list would be more appropriate as commentary to the IBC.
The 2018 IBC also indicates where "continuous" special inspection is required. This is addressed in Chapter 26 of ACI 318 and the comparisons of requirements are shown in Table 2. Differences between ACI 318 and the 2018 edition of the IBC are:

- 2018 IBC does not address curing method and duration of curing for each member where ACI 318 requires periodic inspection.
- 2018 IBC does not address reinforcement for special moment frames where ACI 318 requires periodic inspection.
- Footnote a is deleted as it only serves as a pointer to another section of the IBC. The pointer is no longer required with the deletion of the table.
- Footnote b requirements are relocated to new section 1705.3.3.

Table 1 – Comparison of Inspection Requirements - 2018 IBC and ACI 318

ACI 318 criteria listed in the 2018 IBC	*ACI 318 criteria omitted in 2018 IBC*	*Applicability*
Chapter/Section	*Chapter/Section*	
Not addressed	17.8.1	Qualified anchor installer
17.8.2	17.8.2	Cast-in anchors
17.8.2	17.8.2	Post installed anchors – mechanical
Not addressed	17.8.2.1	Post installed anchors – adhesive (proof loading)
Not addressed	17.8.2.2	Post installed anchors – adhesive (tension loads)
Not addressed	17.8.2.3	Post installed anchors – adhesive (acceptability of certification)
17.8.2.4	17.8.4	Post installed anchors – adhesive (continuous inspection for tension applications)
Chapter 19	Chapter 19	Mix design
Chapter 20	Chapter 20	Reinforcement
25.2	25.2	Reinforcement
25.3	25.3	Reinforcement
Not addressed	26.3	Member information
26.4.3	26.4.3	Mix design
26.4.4	26.4.4	Mix design
26.5	26.5	Strength, slump, air, temperature
Not addressed	26.5.1	Storage, deterioration, mixing, etc.
Not addressed	26.5.2	Debris, standing water, conveying, pumping, placement
26.5	26.5	Shotcrete
26.5.3	26.5.3	Curing temperature – LIMITED
Not addressed	26.5.3	Accelerated curing and other criteria
Not addressed	26.5.4	Cold weather
26.5.5	26.5.5	Hot weather

Not addressed	26.5.6	Construction, contraction and isolation joints
Not addressed	26.5.7	Concrete member details and locations type of reinforcement, dimensional change, saw-cutting, integrated elements, steel fiber reinforcement for shear, diaphragms, requirement monolithic pours, etc.
26.6.1	26.6.1	Reinforcement design information
Not addressed	26.6.2	Reinforcement placement
26.6.3	26.6.3	Reinforcement bending
26.6.4	26.6.4	Welding
Not addressed	26.7	Anchoring – design and compliance information
Not addressed	26.8	Embedments – design and compliance information
26.9	26.9	Precast erection
26.10	26.10	Prestressing forces and grouting
Not addressed	26.11.1.2	Leakage, construction loads, placement, bracing, movement
26.11.1.2(b)	26.11.1.2(b)	Formwork shape, location, dimensions
26.11.2	26.11.2	Concrete strength prior to stressing
26.12	26.12	Strength, slump, air, temperature
AWS D1.4	26.6.4.1	Welding
ASTM C31	26.12.3.1	ASTM C31 - Strength, slump, air, temperature
ASTM C172	26.12.3.1	ASTM C172 - Sampling strength, slump, air, temperature
Not addressed	26.4.1.1	ASTM C150 - Portland cement
Not addressed	26.4.1.1	ASTM C595 - Blended cement but has exclusions for Type IS and IT
Not addressed	26.4.1.1	ASTM C618Flyash and natural pozzolan
Not addressed	26.4.1.1	ASTM C845 - Expansive hydraulic cement
Not addressed	26.4.1.1	ASTM C898 - Slag Cement
Not Addressed	26.4.1.1	ASTM C1157 - Hydraulic cement
Not addressed	26.4.1.1	ASTM C1240 - Silica fume
Not addressed	26.4.1.2	ASTM C33 - Normalweight aggregates
Not addressed	26.4.1.2	ASTM C330 - Lightweight aggregates
Not addressed	26.4.1.3	ASTM C1602 - Mixing water
Not addressed	26.4.1.4	ASTM C260 - Admixtures (air entrainment)
Not addressed	26.2.1.4	ASTM C494 - Admixtures (water reduction/set time)
Not addressed	26.4.1.4	ASTM C1017 - Admixtures (flow producing)
Not addressed	26.4.1.4	ASTM C1582 - Admixtures (chloride inhibiting)
Not addressed	26.4.1.5	ASTM C820 - Steel fiber reinforcement
Not addressed	26.4.2.2	ASTM C1116 - Steel fiber reinforcement for shear
Not addressed	26.5.1	ASTM C94 - Mixing and transporting equipment
Not addressed	26.5.1	ASTM C685 - Mixing and transporting equipment
Not addressed	26.5.2.1	ASTM C94 - Retempering
Not addressed	26.5.3.2	ASTM C-39 - Strength testing
Not addressed	26.6.4.1	ASTM A706 - Welding
Not addressed	26.12.1.1	ASTM C1077 - Testing agencies
Not addressed	26.12.4.1	ASTM C42 - Cores for low strength
Not addressed	26.12.5.1	ASTM C1609 - Fiber reinforced concrete for shear

Table 2 – Comparison of Continuous Inspection Requirements - 2018 IBC and ACI 318

IBC Required	*ACI Required Section*	*Applicability*
Table 1705.3 Item1 Periodic	26.13.3.3(a) Periodic	reinforcement, including prestressing tendons, and verify placement.
Not addressed	26.13.3.3(b) Periodic	curing method and duration of curing for each member.
Table 1705.3 Item 2a	26.6.4.1(a)	weldability of reinforcing bars other than ASTM A706

Periodic		
Table 1705.3 Item 2b Periodic	New language in 1705.3.1	single-pass fillet welds, maximum 5/16 in.
Table 1705.3 Item 2c Continuous	26.6.4.1(a)	all other welds.
Not addressed	26.6.4.1(b)	Limitations on welding cross-bars
Table 1705.3 Item 3 Periodic	26.13.3.3(f) and (g) Periodic	anchors cast in concrete.
Table 1705.3 Item 4a Continuous	26.13.3.2(c) Continuous	adhesive anchors
Table 1705.3 Item 4b Periodic	26.13.3.3(f) Periodic	mechanical anchors
Table 1705.3 Item 6 Continuous	26.13.3.2(c) Continuous	fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.
Table 1705.3 Item 7 Continuous	26.13.3.2(a) Continuous	concrete and shotcrete placement for proper application techniques.
Table 1705.3 Item 9a Continuous	26.13.3.2(b) Continuous	application of prestressing forces
Not addressed	26.13.3.3(e) Periodic	in-place concrete strength before stressing post-tensioned reinforcement
Table 1705.3 Item 9b Continuous	26.13.3.2 (b) Continuous	grouting of bonded prestressing tendons.
Table 1705.3 Item 10 Periodic	26.13.3.3(d) Periodic	erection of precast concrete members
Table 1705.3 Item 11 Periodic	26.13.3.3(e) Periodic	in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete
Table 1705.3 Item 11 Periodic	26.13.3.3(e) Periodic	in-situ concrete strength, prior to removal of shores and forms from beams and structural slabs.
Table 1705.3 Item 12 Periodic	26.13.3.3(c) Periodic	formwork for shape, location and dimensions
Not addressed	26.13.3.2(d)	reinforcement for special moment frames

ACI 17-02-19
SEC 1705.3 SPECIAL INSPECTOR 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

Add new section 1705.3.1 Structural concrete; add new reference; and renumber subsequent sections.

1705.3 Concrete construction. *Special inspections* and tests of concrete construction shall be performed in accordance with this section and Table 1705.3.

Exception: Special inspections and tests shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above grade plane that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above grade plane that are fully supported on earth or rock where:
   2.1. The footings support walls of light-frame construction.
   2.2. The footings are designed in accordance with Table 1809.7.
   2.3. The structural design of the footing is based on a specified compressive strength, f □c, not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the approved construction documents or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

1705.3.1 Structural concrete special inspectors. An individual satisfying the requirements of ACI CPP 630.1 as Concrete Construction Special Inspector shall be permitted to act as special inspectors for structural concrete construction.

1705.3.~~1~~2 Welding of reinforcing bars. Special inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.

1705.3.~~2~~3 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.

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CPP 630.1—15: Concrete Construction Special Inspector
1705.3.1

Reason: This change facilitates special inspection by specifically identifying qualifications for individuals in addition to individuals already permitted by the code. This change helps satisfy industry needs and the demand to have qualified personnel available for special inspection of structural concrete. The American Concrete Institute Committee C630 - Construction Inspector Certification has developed a rigorous program to certify individuals as qualified to perform special inspection of concrete construction. This code change proposal does not alter any existing criteria of other individuals qualified as special inspectors, but adds provisions for individuals who are ACI certified Concrete Construction Special Inspectors to be permitted to satisfy the code criteria as special inspectors for concrete construction. This code change proposal increases the pool of qualified individuals available to conduct special inspections of concrete construction and provides the criteria for personnel to be considered qualified. This proposal provides the criteria, but does not require individuals to be certified as an ACI Concrete

Construction Special Inspector. The link to the policies is:
https://www.concrete.org/Portals/0/Files/PDF/cpp_6301-15.pdf and the policies are as follows:

*** ACI CERTIFICATION POLICIES FOR CONCRETE SPECIAL INSPECTOR ***

SECTION 1.0 CERTIFICATION CRITERIA

1.1 The American Concrete Institute (ACI) shall recognize two classifications of certification for inspectors:
Concrete Construction Special Inspector
Associate Concrete Construction Special Inspector

1.2 Certification as an Associate Concrete Construction Special Inspector shall require:
A) Successful completion of respective written examinations on inspection and plans reading.
B) Fulfillment of requirements in ACI Concrete Field Testing Technician—Grade I (CFTT) as follows:
1. Be currently certified as an ACI Concrete Field Testing Technician—Grade I
OR
2. Have been certified as an ACI Concrete Field Testing Technician—Grade I at one time
AND
3. Pass the current ACI Concrete Field Testing Technician—Grade I written exam within one year of passing the Inspector exam.
If the Concrete Field Testing Technician—Grade I requirement is not held at the time of testing for Associate Concrete Construction Special Inspector, the requisite Concrete Field Testing Technician—Grade I certification or validation of prior Concrete Field Testing Technician—Grade I certification with successful completion of the current Concrete Field Testing Technician— Grade I written examination must be obtained within one year of the first examination passed for Inspector. Otherwise, the written inspection and plans reading examinations must be retaken in their entireties. No specific education or work experience shall be required to sit for the examination for Associate Concrete Construction Special Inspector.
ACI CFTT certification program content and operation is described in ACI Certification Policies for Concrete Field Testing Technician – Grade I, Appendix C630.1-1.

1.3 Certification as a Concrete Construction Special Inspector shall require:
A) Successful completion of respective written examinations on inspection and plans reading.
B) Fulfillment of requirements in ACI Concrete Field Testing Technician—Grade I as follows:
1. Be currently certified as an ACI Concrete Field Testing Technician—Grade I ACI Certification Concrete Construction Special Inspector
OR
2. Have been certified as an ACI Concrete Field Testing Technician—Grade I at one time
AND
3. Pass the current ACI Concrete Field Testing Technician—Grade I written exam within one year of passing the Inspector exam.
If the ACI Concrete Field Testing Technician—Grade I requirement is not held at the time of testing for Concrete Construction Special Inspector, the requisite ACI Concrete Field Testing Technician—Grade I certification or validation of prior ACI Concrete Field Testing Technician— Grade I certification with successful completion of the current ACI Concrete Field Testing Technician—Grade I written examination must be obtained within one year of the first examination passed for Inspector. Otherwise, the written inspection and plans reading examinations must be retaken in their entireties.
ACI CFTT certification program content and operation is described in ACI Certification Policies for Concrete Field Testing Technician – Grade I, Appendix C630.1-1.
C) Demonstrate satisfactory education and work experience.

1.4 The education and work experience required for Concrete Construction Special Inspector certification is as follows:
A) A B.S. degree in Civil Engineering, Civil Engineering Technology, Engineering Technology, Construction Engineering or Construction Engineering Technology from a program accredited by ABET (aka

Accreditation Board for Engineering and Technology), including courses in concrete materials, design or construction, plus six months satisfactory work experience, or

B) A B.S. degree in an engineering program, plus one year of satisfactory work experience, or

C) A minimum of two years of college or technical school, earning at least 60 credit hours, plus two years of satisfactory work experience, or

D) A high school diploma, or equivalent, plus a minimum of three years of satisfactory work experience, or

E) Five years of satisfactory work experience.

1.5 Satisfactory work experience must include:

A) Decision making responsibility and authority.

B) Verification of compliance with plans, specifications, and codes. ACI Certification Concrete Construction Special Inspector

C) Evaluation of concrete construction in the field.

D) Documentation and reporting of inspection results.

E) Construction Special Inspector Certification requires proficiency in the following areas of inspection: formwork installation and removal, reinforcement, embedments, sampling and testing of freshly mixed concrete, conveying, placement, consolidation, finishing, jointing, curing, and protection.

1.6 ACI certification shall be valid for a period of five years from the date of completion of all certification requirements. An Associate Inspector shall be upgraded to full Inspector upon completion of appropriate certification requirements.

SECTION 2.0 EXAMINATION CRITERIA

2.1 The written inspection examination shall consist of approximately 80 multiple choice questions pertaining to inspection and reporting of inspection information for pre-placement, placement, and post-placement periods of concrete construction. The written plans reading examination shall consist of approximately 20 multiple choice questions designed to test the examinee's ability to read and understand engineering drawings.

2.2 The written inspection examination includes questions on formwork installation and removal, reinforcement, embedments, conveying, placement, consolidation, finishing, jointing, curing, protection, drilled piers, pilings, pavements and soil cement, as appropriate. The written plans reading examination includes questions on terminology, reinforcement, tolerances, and special requirements as expressed on engineering drawings.

2.3 The Concrete Construction Special Inspector written inspection examination is derived from the information listed in Job Task Analysis (JTA) for ACI Concrete Construction Special Inspector Certification, Appendix 630.1-2.

2.4 The examinations are open book. The technical materials allowed into the examination room are limited to the resource materials listed in Appendix 630.1-2.

2.5 A maximum time of three hours shall be allowed to complete the written inspection examination. A maximum time of one hour shall be allowed to complete the written plans reading examination.

2.6 The examination shall be supervised by an ACI-approved Examiner, assisted, when necessary, by a proctor appointed by the Examiner.

2.7 The Examiner, proctors, and members of the Sponsoring Group have no jurisdiction over the content of questions on any specific examinations.

2.8 Oral administration of the examinations shall be permitted, contingent upon prior approval by the ACI Certification Department.

2.9 Successful completion of each written examination requires a minimum grade of 70%.

2.10 The written inspection and plans reading examinations may be taken separately, but must be passed within one [1] year of each other. Otherwise, both the written inspection and plans reading examinations must be retaken in their entireties.

2.11 Examinations shall be graded by ACI.

2.12 Multiple versions of the examinations, of approximately equal difficulty, may be provided.

2.13 Arrangements for reexamination shall be made with the Sponsoring Group.

SECTION 3.0 APPEALS CRITERIA

3.1 An appeal procedure shall be available if the examinee feels some aspect of the examination process is unclear, incorrect, or unfair.

3.2 Appeals regarding the conduct of the examination should be referred initially to the Examiner. If the Examiner cannot satisfy the complaint, it should be referred to the Sponsoring Group.

3.3 Challenges regarding specific questions shall be referred to ACI in writing.

3.4 A challenge form shall be provided with each exam on which the examinee may describe a complaint involving specific questions. It should be returned with the completed examination.

3.5 ACI will consider a written challenge/appeal if it is received by the ACI Certification Department within 60 days from the receipt of the examination by ACI.

3.6 Appeals referred to ACI are handled in order by the following people or groups:

1. Sponsoring Group
2. ACI Managing Director of Certification
3. The Certification Appeals Committee [consisting of the Managing Director of Certification; the Certification Programs Committee Chairman, and the Chairman of Committee C 630]
4. Committee C 630, Construction Inspector Certification 5. Certification Programs Committee

SECTION 4.0 SPONSORING GROUP CRITERIA

Groups desiring to conduct ACI Certification program(s) shall adhere to the current Policy on Sponsoring Groups for Certification, Appendix 630.1-3.

SECTION 5.0 EXAMINER/PROCTOR CRITERIA

5.1 The Examiner shall be authorized by ACI to conduct the ACI certification examinations for:

Concrete Construction Special Inspector
Associate Concrete Construction Special Inspector

5.2 The Examiner shall be present and in full supervision during the examination session.

5.3 The Examiner shall be approved by ACI. Qualifications shall be submitted on the Examiner Application.

5.4 The Examiner shall meet the following requirements:

1. Be a registered professional engineer,
2. Have had five years of recent experience in inspection of concrete construction, and
3. Be adjudged qualified by ACI.

5.5 Proctors shall be permitted to assist the Examiner in conducting the written examination.

5.6 Proctors shall satisfy the following requirements:

1. Have some knowledge of concrete construction,
2. Be trustworthy and conscientious, and
3. Be adjudged qualified by the examiner.

5.7 Examiners and proctors shall be unrelated professionally and personally to the examinees. Government organizations may petition ACI, in writing, and request a waiver of this requirement. Waivers shall be granted only if it can be shown that the intent of the policy will be maintained.

5.8 The Examiner shall:

1. Select the proctors and inform ACI of their names.
2. Verify the identity of each examinee, and ensure that the examinees are aware of the certification criteria.
3. Confirm the suitability of the facilities selected by the Sponsoring Group.
4. Receive inspector applications, evaluate education and work experience, and determine if requirements for certification are met. This responsibility may be performed by ACI, if delegated by the Sponsoring Group.
5. Maintain secrecy of the examination content.
6. Refrain from defining terms or interpreting examination questions while conducting the examination.

SECTION 6.0 ACI RESPONSIBILITIES

6.01 ACI shall:

1. Approve the Sponsoring Group.

2. Approve the Examiner.
3. Grade the examinations and notify the examinee and the examiner of the final results in writing.
4. Evaluate education and work experience and determine conformance with requirements of applicants as a Concrete Construction Special Inspector if requested by the Sponsoring Group.
5. Authorize the Sponsoring Group to conduct examination sessions for:
   Concrete Construction Special Inspector
   Associate Concrete Construction Special Inspector
6. Issue a certificate and wallet card to successful examinees
7. Process appeals.

SECTION 7.0 RECERTIFICATION CRITERIA
Recertification criteria shall be the successful completion of the then-current requirements for certification. Reevaluation of work experience is not required for recertification at the same certification level.

*** END OF POLICIES ***

The American Concrete Institute. as a professional society whose mission includes working to facilitate the use and adoption of current concrete technology to assure the desired performance for the benefit of the public, encourages the committee to approve of this code change as submitted.

Cost Impact: This code change proposal will not increase the cost of construction.

DRAFT ACI 17-03-19
SEC. 1704.2 SPECIAL INSPECTION AND TESTS 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

International Building Code
Section 1704.2 add new section 1704.2.6:

1704.2 Special inspections and tests. Where application is made to the building official for construction as specified in Section 105, the owner or the owner's authorized agent, other than the contractor, shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705 and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are identified in Section 110.

[No changes to exception or sections 1704.2.1 through 1704.2.5, add new section 1704.2.6]

1704.2.6 Concrete technician qualifications. Where sampling or testing of concrete is required, the technician or testing agency shall provide written documentation to the building official demonstrating the technician's competence and relevant experience or training. Individuals with ACI CPP credentials shall be shall deemed qualified for the sampling and testing of concrete as follows:

1) ACI CPP 610.1 Concrete Field Testing Technician—Grade I for field testing of concrete or preparation of samples.
2) ACI CPP 620.2 Concrete Strength Testing Technician for compression and flexural testing only.
3) ACI CPP 620.1 Concrete Laboratory Testing Technician—Level 1 for any required laboratory testing.
4) ACI CPP 620.1 Concrete Laboratory Testing Technician—Level 2 for any required laboratory testing.

Add new references:

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CPP 610.1-18 Certification Policies for Concrete Field Testing Technician - Grade I
1901.6.1
CPP 620.2-12 Certification Policies for Concrete Strength Testing Technician
1901.6.2
CPP 620.1-12 Certification Policies for Concrete Laboratory Testing Technician – Level 1 and Concrete Laboratory Testing Technician – Level 2
1901.6.2

Reason:

Proper sampling, specimen preparation and acceptance testing of concrete delivered to construction projects is crucial for assuring proper performance of structural concrete. Inaccurate test results and the negative implications on the performance of concrete occur far too frequently. When field testing, preparation of samples and laboratory testing are not conducted properly there may be significant expenses and delays added to the cost of construction, such as extracting cores of hardened concrete to verify concrete strength. Improper sampling, preparation and testing often cause project delays, further increasing costs.

On many projects the qualifications for technicians are included in the construction documents. There is a need to assure cast-in-place concrete is properly sampled, prepared and tested. Cast-in-place concrete is one of the few building materials provided to the construction site in a condition other than its final state. Verification of properties should only be performed by qualified individuals.

Local jurisdictions have already begun to address this concern. In 2014 the Georgia Building Code included an amendment to the IBC which added ACI Concrete Field Testing Technician with Grade 1 certification: https://dca.ga.gov/sites/default/files/2014_ibcamendments.pdf. In 2018 the Georgia Building Code included another amendment to the IBC which added American Concrete Institute (ACI) Strength Testing Technician: https://dca.ga.gov/sites/default/files/2018_ibcamendments.pdf. This demonstrates the need to more clearly communicate the necessary qualifications for technicians conduction sampling, specimen preparation and testing of concrete.

It is important for the IBC to be the proper model for local jurisdictions adopting requirements for qualified technicians and inspectors. The requirements in the Georgia amendments permit an ACI Certified Field Technician Level 1 to "verify use of required design mix." This requirement should be charged to the special inspector. Field technician responsibilities are limited to conducting necessary field tests and preparing samples.

ACI, a technical professional society, recommends that the committee approve this code change proposal as submitted to 1) improve the quality assurance processes for structural concrete, 2) reduce project cost increases due to inappropriate sampling, preparation and testing, 3) reduce the frequency of related construction delays, and 4) help assure that the concrete being used in structural elements will provide the life safety and property protection necessary to satisfy the intent of the code.

Cost Impact: There is no cost increase for this code change proposals, as for most projects these requirements are included in the contract documents between the owners, designers, and contractors. This code change proposal helps to assure that these requirements are included for structural concrete.

ACI 18-01-19
SEC. 1808.8.1 FUNNEL HOPPER PLACEMENT 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

International Building Code
Section 1808.1 Remove text without replacement.

SECTION 1808
FOUNDATIONS

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1. ~~Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm).~~ Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

Reason: This code change removes outdated requirements from the IBC. Current concrete mixes are commonly designed with admixtures to better improve and assure placement using funnel hopper and this set of criteria specifying slump is no longer required in the code. The information in IBC Section 1808.1 is outdated as the slump criteria is only applicable for concrete mix designs not containing admixtures used for proper placement. Where such admixtures are used the slump requirement is likely not to be satisfied.
ACI, a professional technical society, recommends the deletion of this outdated criteria and encourages the committee to approve this code change as submitted.

Cost Impact: There is no increase in the cost of construction associated with this code change proposal.

ACI 18-02-19
SEC. 1808.8.1 PUMPABLE CONCRETE 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

International Building Code
Section 1808.1 Remove text without replacement.

SECTION 1808
FOUNDATIONS

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1.
Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). ~~Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture~~.

Reason: This code change removes an inappropriate requirement. Grout to be pumped needs to satisfy more requirements than just those required to facilitate pumping. The consistency of the concrete must also satisfy other requirements including but not limited to workability, durability and structural performance requirements. ACI 301 *Specifications for Structural Concrete* provides that: "*4.2.2.2 Slump—Unless otherwise specified, select a target slump or slump flow at the point of delivery for all concrete mixtures. Selected target slump shall not exceed 9 in. Selected target slump flow shall not exceed 30 in. Concrete shall not show visible signs of segregation. The target slump or slump flow value shall be enforced for the duration of the project.*" Current concrete technology provides for both concrete slump and flow as applicable for concrete placement and performance.
ACI 318 *Building Code Requirements for Structural Concrete* which is a reference in the IBC references ACI 301 for concrete mix design criteria. Thus the appropriate criteria are applicable for concrete are requirements of the IBC by reference. This text should be deleted to assure the appropriate criteria for concrete slump and flow are satisfied regardless of delivery methods. ACI, a technical professional society, recommends the committee approve this code change proposal as submitted.

Cost Impact: There is no increase in the cost of construction associated with this code change proposal.

ACI 18-03-19
SEC. 1808.8.2 CONCRETE COVER 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

International Building Code
Section 1808.2 and Table 1808.2. Delete language from Section 1808.2 and Table 1808.8.2 Remove replace language and delete Table 1808.2 without replacement.

SECTION 1808
FOUNDATIONS

1808.8.2 Concrete cover. Concrete cover for all concrete deep foundations shall be in accordance with ACI 318 Section 20.6.1.3.4 and this section. ~~The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808.8.2. Longitudinal bars spaced less than 11/2 inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.6.1.3.4 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.~~

1808.2.1 Structural steel deep foundations. The concrete cover for structural steel cores within a steel pipe, tube or permanent casing shall not be less than 2 inches.

~~**TABLE 1808.8.2**~~
~~**MINIMUM CONCRETE COVER**~~

~~FOUNDATION ELEMENT OR CONDITION~~	~~MINIMUM COVER~~
~~1. Shallow foundations~~	~~In accordance with Section 20.6 of ACI 318~~
~~2. Precast nonprestressed deep foundation elements~~ ~~Exposed to seawater~~ ~~Not manufactured under plant conditions~~ ~~Manufactured under plant control conditions~~	 ~~3 inches~~ ~~2 inches~~ ~~In accordance with Section 20.6.1.3.3 of ACI 318~~
~~3. Precast prestressed deep foundation elements~~ ~~Exposed to seawater~~ ~~Other~~	 ~~2.5 inches~~ ~~In accordance with Section 20.6.1.3.3 of ACI 318~~
~~4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing~~	~~2.5 inches~~
~~5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing~~	~~1 inch~~
~~6. Structural steel core within a steel pipe, tube or permanent casing~~	~~2 inches~~
~~7. Cast-in-place drilled shafts enclosed by a stable rock socket~~	~~1.5 inches~~

~~For SI: 1 inch = 25.4 mm.~~

Reason: This code change removes the requirements in IBC Section 1808.2 and Table 1808.2 on concrete cover for foundations to avoid confusion and conflicts between the IBC and ACI 318. Plus, the references are no longer correct, as concrete cover requirements for deep foundations are addressed in Section 20.6.1.3.6 and Table 20.6.1.3.6 of ACI 318. The 2018 IBC incorrectly directs the user to Section 20.6.1.3.3 of ACI 318.
The 2018 IBC advises that ACI 318 is to be followed in addition to any requirements in the IBC by the reference to Chapter 19 of the IBC:

> "1808.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808.8.1 through 1808.8.6 and the provisions of Chapter 19."

and Chapter 19 of the 2018 IBC reads:

" 1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318…"

There is no reason to duplicate requirements of ACI 318 in the IBC.

With regard to removal of text, there are two provisions in the text of IBC Section 1808.2.

1. There are criteria for longitudinal reinforcement and bundled bars, but the requirements in the IBC refer the user to ACI 318 Section 20.6.1.3.4. This is unnecessary language due to the IBC language in Section 1808.8 and 1901.2 as shown above.
2. The IBC language provides a definition for concrete cover which is already addressed in ACI 318: "distance between the outermost surface of embedded reinforcement and the closest outer surface of the concrete." note that concrete cover is a specified dimension. Thus, where concrete is placed inside casings or mandrels the closest outer surface of the concrete is clearly the inside of the casing or mandrel.

With regard to the criteria in Table 1808.2, the requirements are shown as a side-by-side comparison in the Table below. The requirements remain identical for all concrete cover requirements for foundations except as follows:

1. Concrete cover for precast elements exposed to seawater is permitted to be 2 inches in ACI 318 where the 2018 IBC requires 3 inches and 2-1/2 inches for precast nonprestressed and prestressed, respectively. This modification recognizes the performance of centrifugally manufacturers precast concrete piles, which were probably not a consideration when the cover provisions were introduced into the 2018 IBC. Where additional information on cover requirements as related to manufacturing process and materials the commentary of ACI 318 directs the user to ACI 543R *Guide to Design, Manufacture, and Installation of Concrete Piles*. Now that centrifugally are becoming more commonplace, the code would be remiss in not providing for the minimum requirement that reflect current practice and materials. This lowers costs by recognizing the performance of piles manufactured using zero-slump concrete.
2. Where the 2018 IBC permits cover to be a little as 2.5 inches for deep foundations not enclosed by a steel pipe, tube or permanent casing, ACI 318 finds that the ability to assure proper cover in deep foundations is more challenging than that required for shallow foundations. ACI 318 requires the minimum cover to remain the same for deep foundations as that required for shallow foundations, 3 inches.
3. ACI 318 does not differentiate the minimum concrete cover requirements between deep foundations enclosed within a steel pipe, tube or permanent casing whether there is a structural steel core. Further ACI 318 does not consider the requirements for structural steel deep foundations to be with their purview. Section 1808.2 is retained to include the provisions for these deep foundation systems.
4. Research considered by ACI Committee 318 and Subcommittee 318-0F on Foundations showed comparable performance for cover of precast elements regardless of whether manufactured at a plant or site cast.

ACI, a 501.C.3 professional society recommends approval as submitted to reflect current concrete technology and to assure appropriate minimum requirements are provided for the protection of reinforcement.

Table 1 – Comparison of IBC 1808.2 and ACI 20.6 requirements for Concrete Cover

TABLE 1808.8.2 MINIMUM CONCRETE COVER		ACI 318 Section 20.6.1 Specified concrete cover			
FOUNDATION ELEMENT OR CONDITION	Minimum cover, in.	Exposure	Member	Rein-forcement	Specified cover, in.
1. Shallow foundations	ACI 318 20.6	Table 20.6.1.3.1—Specified concrete cover for cast-in-place nonprestressed concrete members			

		Cast against and permanently in contact with ground	All	All	3
		Exposed to weather or in contact with ground	All except deep foundation elements	No. 6 through No. 18	2
				No. 5 bar and W31 and D31 wire and smaller	1-1/2
2. Precast nonprestressed deep foundation elements Exposed to seawater	3	Table 20.6.1.3.6—Specified concrete cover for deep foundation members			
		Exposed to seawater	Precast nonprestressed	All	2
2. Precast nonprestressed deep foundation elements Not manufactured under plant conditions	2	Table 20.6.1.3.6 —Specified concrete cover for deep foundations ACI 318 does not differentiate between plant and non-plant manufactured.			
		Not enclosed by steel pipe, tube, permanent casing, or stable rock socket	Deep foundation element	All	2
2. Precast nonprestressed deep foundation elements Manufactured under plant control conditions	ACI 318 20.6.1.3.3	Table 20.6.1.3.6—Specified concrete cover for deep foundation members			
		Permanently in contact with ground	Precast nonprestressed	All	1-1/2
3. Precast prestressed deep foundation elements Exposed to seawater	2.5	Table 20.6.1.3.6—Specified concrete cover for deep foundation members			
		Exposed to seawater	Precast prestressed	All	2
3. Precast prestressed deep foundation elements Other	ACI 318 20.6.1.3.3	Table 20.6.1.3.6—Specified concrete cover for deep foundation members			
		Permanently in contact with ground	Precast prestressed	All	2
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5	Table 20.6.1.3.6 Specified concrete cover for deep foundation members			
		Not enclosed by steel pipe, tube, permanent casing, or stable rock socket	Cast-in-place	All	3
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1	Table 20.6.1.3.6 Specified concrete cover for deep foundation members			
		Enclosed by steel pipe, tube, permanent casing, or stable rock socket	Cast-in-place	All	1-1/2
6. Structural steel core within a steel pipe, tube or permanent casing	2	Table 20.6.1.3.6 Specified concrete cover for deep foundation members ACI 318 does not specifically address deep foundations with steel core			
		Enclosed by steel pipe, tube, permanent casing, or stable rock socket	Deep foundation elements	All	1-1/2
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5	Table 20.6.1.3.6 Specified concrete cover for deep foundation members			
		Enclosed by steel pipe, tube, permanent casing, or stable rock socket	Deep foundation elements	All	1-1/2

Cost Impact: There is no significant increase in cost of construction. Cost is decreased for precast prestressed concrete piles by reducing cover and providing for acceptable performance of new technologies and materials. There may be a slight increase in costs where deep foundations are cast without casings or tubes because the cover is increased from 2-1/2 inches to 3 inches.

ACI 18-04-19
SEC. 1808.8.1 FOUNDATION COMP STRENGTH 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

International Building Code
Table 1808.8.1 Remove table without replacement and revise text in 1808.8.1 to cite table in ACI 318.

SECTION 1808
FOUNDATIONS

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table ~~1808.8.1~~ 19.2.1.1 of ACI 318.

Where concrete is placed through a funnel hopper at the top of a deep foundation element, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 8 inches (204 mm). Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

~~**TABLE 1808.8.1**~~
~~**MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT**~~

~~FOUNDATION ELEMENT OR CONDITION~~	~~SPECIFIED COMPRESSIVE STRENGTH, f'_c~~
~~1. Foundations for structures assigned to Seismic Design Category A, B or C~~	~~2,500 psi~~
~~2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to Seismic Design Category D, E or F~~	~~2,500 psi~~
~~2b. Foundations for other structures assigned to Seismic Design Category D, E or F~~	~~3,000 psi~~
~~3. Precast nonprestressed driven piles~~	~~4,000 psi~~
~~4. Socketed drilled shafts~~	~~4,000 psi~~
~~5. Micropiles~~	~~4,000 psi~~
~~6. Precast prestressed driven piles~~	~~5,000 psi~~

~~For SI: 1 pound per square inch = 0.00689 MPa.~~

Add Section 1908.1 to Reference:

ACI	American Concrete Institute 38800 Country Club Drive Farmington hills, MI 48331
318-~~14~~19: Building Code Requirements for Structural Concrete and Commentary	
	722.2.4.3,1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, 1808.1, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11.1, 1810.3.12, 1901.2, 1901.3, 1902.1, 1903.1, 1904.1, 1904.2, 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, 1906.1, 2108.3, 2206.1

Reason: Removes the table for compressive strength requirements for the 2018 IBC and directs the user to ACI 318 Table 19.2.1.1 Limits for f'_c. The user is already required to use information from ACI 318 for foundations. For example. Table 1808.8.2 Minimum Concrete Cover directs the user to the requirements of Section 20.6 of ACI 318. By not having information in two places will reduce confusion, avoid unintended differences and reduce the potential for errors. Rather than having criteria in two locations this change places criteria on one reference and helps assure that other applicable provisions of ACI 318 as required by 2018 IBC Chapter 19 are not overlooked. Table 1 below shows the comparison of criteria in 2018 IBC and ACI 318. It is noteworthy that, consistent with the overall methodology throughout ACI 318, the user is directed to one section for all relevant criteria. Note that Table 19.2.1.1 has all limits for specified compressive strength in one location. This improves the user-friendliness provided by ACI 318. Further with criteria in two documents that user is required to refer to both to identify potential differences which can be a cumbersome process.

TABLE 1
COMPARISON OF IBC AND ACI 318 MIN. COMPRESSIVE STRENGTH OF CONCRETE OR GROUT

	2018 IBC	**ACI 318**
Foundation Element of Condition	**Specified Compressive Strength f'_c**	**Minimum f'_c, psi**
General		2,500
Special moment frames		3,000[1]
1. Foundations for structures assigned to Seismic Design Category A, B or C	2,500 psi	2,500
2a. Foundations for ~~Group R or U occupancies of light-frame construction~~, stud bearing wall construction two stories or less in height, assigned to Seismic Design Category D, E or F	2,500 psi	2,500
2b. Foundations for other structures assigned to Seismic Design Category D, E or F[2]	3,000 psi	3,000
3. Precast nonprestressed driven piles	4,000 psi	4,000
4. Socketed drilled shafts	4,000 psi	4,000
5. Micropiles	4,000 psi	4,000
6. Precast prestressed driven piles	5,000 psi	5,000

[1] The f'_c for lightweight concrete in special moment frames and special structural walls shall not exceed 5000psi. The limit is permitted to be exceeded where demonstrated by experimental evidence that members made with lightweight concrete provide strength and toughness equal to or exceeding those of comparable members made with normalweight concrete of the same strength.

[2]Does not include foundations for stud bearing wall construction two stories or less.

ACI, a professional technical society, recommends the deletion of the specified compressive strength criteria form the IBC to better assure that all applicable requirements of ACI 318 are properly considered for design and construction of concrete foundations. ACI encourages the committee to approve this code change as submitted.

Cost Impact: There is no increase in the cost of construction associated with this code change proposal.

ACI 18-05-19
SEC. 1810.3.2.7 ALLOWABLE CAPACITY 180629
ACI Proposed Code Change
2018 Edition of IBC Group B

International Building Code
Sections 1810.3.2.6, 1810.3.2.7 and Table 1808.2. Revise text in 1810.3.2.6, delete 1808.3.2.7, remove concrete provisions from Table 1808.8.2, and add sections to existing reference.

SECTION 1810
DEEP FOUNDATIONS

1810.3.2.6 Allowable stresses. The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810.3.2.6.

~~**1810.3.2.7 Increased allowable compressive stress for cased mandrell-driven cast-in-place elements**. The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:~~

~~1. The design shall not use the casing to resist any portion of the axial load imposed.~~
~~2. The casing shall have a sealed tip and be mandrel driven.~~
~~3. The thickness of the casing shall be not less than manufacturer's standard gage No.14 (0.068 inch) (1.75 mm).~~
~~4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.~~
~~5. The ratio of steel yield strength (F_y) to specified compressive strength (f'_c) shall be not less than six.~~
~~6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).~~

TABLE 1810.3.2.6
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS[a]
1. Concrete or grout in compression[b]	In accordance with ACI 318
~~Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7~~	~~$0.4\ f'_c$~~
~~Cast-in-place in a pipe, tube, other permanent casing or rock~~	~~$0.33\ f'_c$~~
~~Cast-in-place without a permanent casing~~	~~$0.3\ f'_c$~~
~~Precast nonprestressed~~	~~$0.33\ f'_c$~~
~~Precast prestressed~~	~~$0.33\ f'_c - 0.27\ f_{pc}$~~
2. Nonprestressed reinforcement in compression	$0.4\ f_y \le 30{,}000$ psi
3. Steel in compression	
Cores within concrete-filled pipes or tubes	$0.5\ F_y \le 32{,}000$ psi
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5\ F_y \le 32{,}000$ psi
Pipes or tubes for micropiles	$0.4\ F_y \le 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35\ F_y \le 16{,}000$ psi
Helical piles	$0.6\ F_y \le 0.5\ F_u$
4. Nonprestressed reinforcement in tension	
Within micropiles	$0.6\ f_y$
Other conditions	$0.5\ f_y \le 24{,}000$ psi
5. Steel in tension	
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5\ F_y \le 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35\ F_y \le 16{,}000$ psi
Helical piles	$0.6\ F_y \le 0.5\ F_u$
6. Timber	In accordance with the ANSI/AWC NDS

a. ~~f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only;~~ f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of steel; F_u is the specified minimum tensile stress of structural steel.
~~b. The stresses specified apply to the gross cross-sectional area within the concrete surface. Where a temporary or permanent casing is used, the inside face of the casing shall be considered to be the concrete surface.~~

Add Section 1908.1 to Reference:

ACI	American Concrete Institute 38800 Country Club Drive Farmington hills, MI 48331
318-~~14~~19: Building Code Requirements for Structural Concrete and Commentary	
	722.2.4.3,1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.2.6, Table 1810.3.2.6, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11.1, 1810.3.12, 1901.2, 1901.3, 1902.1, 1903.1, 1904.1, 1904.2, 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, 1906.1, 2108.3, 2206.1

Reason: This proposed code change makes four modifications to the 2018 IBC:

1. In Section 1810.3.2.6, ACI 318 is added as the method for design and construction of concrete deep foundations. This aligns the code with the methodology in ACI 318 and also more clearly communicates that for conditions other than those identified in in 2018 IBC Section 1810.3.2.7, concrete deep foundations are permitted to be designed in accordance with Chapter 10 of ACI 318. This also align the design methodology with the approach used throughout ACI 318 which is based on allowable capacity and not allowable stress.
2. In Section 1810.3.2.7, all text is deleted as this information is provided in ACI 318. Comparison of the text in 2018 IBC and ACI 318 is shown in Table 1. Requirements are identical, except ACI 318 language more clearly communicates that there are other permissible design and construction methods in accordance with Chapter 10 of ACI 318.
3. Removing concrete criteria form Table 1810.3.2.6 coordinates with new proposed text in Section 1810.3.2.6 and continues the alignment of methodology with ACI 318. A comparison of the provisions of 2018 IBC and ACI 318 are shown in Table 2.
4. Adds the appropriate reference sections to the ACI listing in Chapter 35.

TABLE 1 COMPARISON OF 2018 IBC AND ACI 318 REQUIREMENTS

2018 IBC	ACI 318
1810.3.2.7 Increased allowable compressive stress for cased mandrell-driven cast-in-place elements. The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:	13.4.2 Allowable axial capacity 13.4.2.1 Where concrete deep foundation elements are laterally supported for the entire height and the applied forces cause bending moments no greater than those resulting from accidental eccentricities, structural design of the element using unfactored loads and the allowable capacities specified in Table 13.4.2.2 is permitted. Otherwise, the structural design of concrete deep foundation elements shall be in accordance with Chapter 10. 13.4.2.2 The maximum allowable axial capacity of deep foundation members shall be in accordance with Table 13.4.2.2. 13.4.2.2.1 The allowable axial capacity for permanently cased cast-in-place concrete deep foundation members that satisfy (a) through (f) shall be permitted to be increased to the value given in Table 13.4.2.2:

1. The design shall not use the casing to resist any portion of the axial load imposed. 2. The casing shall have a sealed tip and be mandrel driven. 3. The thickness of the casing shall be not less than manufacturer's standard gage No.14 (0.068 inch) (1.75 mm). 4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete. 5. The ratio of steel yield strength (Fy) to specified compressive strength (f 'c) shall be not less than six. 6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).	(a) The design shall not use the casing to resist any portion of the axial load imposed. (b) The casing shall have a sealed tip and be mandrel-driven. (c) The thickness of the casing shall not be less than manufacturer's standard gage No.14 (0.068 inch). (d) The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete. (e) The ratio of steel yield strength of the casing to f'_c shall be not less than six. (f) The nominal diameter of the element shall be not greater than 16-in.

TABLE 2 COMPARISON OF 2018 IBC TABLE 1810.3.2.6 AND ACI 13.4.2.2
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS

MATERIAL TYPE AND CONDITION	IBC 2018 MAXIMUM ALLOWABLE STRESS	ACI 318 MAXIMUM CAPACITY
1. Concrete or grout in compression		
Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7	$0.4\ f'_c$	$P_n = 0.4f'_cA_g$
Cast-in-place in a pipe, tube, other permanent casing or rock	$0.33\ f'_c$ $0.3\ f'_c$	$P_n = 0.33f'_cA_g$ $P_n = 0.3f'_cA_g$
Cast-in-place without a permanent casing	$0.33\ f'_c$	$P_n = 0.33f'_cA_g$
Precast nonprestressed	$0.33\ f'_c - 0.27\ f_{pc}$	$P_n = (0.33f'_c - 0.27f'_{pe})A_g$
Precast prestressed		

The reference to ACI 318 is not a new concept for obtaining information for deep foundations. The IBC currently refers to the American Wood council for provisions for deep timber foundations.
ACI, a professional technical society, supports these revisions to better align the IBC with current design and construction methodologies addressed in ACI 318 and to better communicate to the user that there additional methods that could result in lower initial costs and for conditions not addressed in 2018 IBC. ACI recommends that the committee approve this code change as submitted.

Cost Impact: There is no increase in cost of construction. This proposal aligns the IBC with the methods used for concrete design and construction in accordance with ACI 318.

DRAFT ACI 19-01-19
SEC. 1901.2.1 DETAILED PLAIN WALL 180524
ACI Proposed Code Change
2018 Edition of IBC Group B

2018 International Building Code
Revise Section 1901.2 by adding new Section 1901.2.1

SECTION 1901
GENERAL

1901.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

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. Precast concrete diaphragms in buildings assigned to *Seismic Design Category* C, D, E or F shall be designed in accordance with the requirements of ASCE 7, Section 14.2.4.

1901.2.1 Detailed plain concrete structural wall. ~~1905.1.3 DETAILED PLAIN CONCRETE STRUCTURAL WALL~~. Detailed plain concrete structural walls shall ~~A wall~~ comply~~ing~~ with the requirements of Chapter 14 of ACI 318 ~~including 14.6.2~~ with
~~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 –~~ ~~R~~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 Section 14.6.1 of ACI 318.

(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.
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.

1905.1.1 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 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.~~

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.”

Reason:

There is no change to the requirements for design and construction of structural concrete. This change improves the clarity of the code and the coordination with ACI 318 by:

1) removing redundant language that advises concrete shall be in accordance with "this chapter" and "Section 1905" where the latter is part of the chapter.
2) simply relocating the provisions for detailed plain concrete structural wall from IBC Section 1905.1.6 to new Section 1901.2.1 for clarity and to facilitate use.
3) removing definition of ordinary precast concrete wall which has the same definition as ordinary reinforced concrete wall and not differentiated in ACI 318 or in the IBC.
4) removing definitions for other walls systems defined in ACI 318 and transcribed from ACI 318 simply to have all wall system definitions in one place when adding a definition for "detailed plain concrete structural wall."

Deletion of "as amended in Section 1905 of this code." In Section 1901.2 "as amended in Section 1905 of this code" is removed because it is redundant. The same sentence where this text occurs advises that "structural concrete be designed and constructed in accordance with the requirements of this chapter and ACI 318." There is no need for the superfluous language: "as amended in Section 1905 of this code." Language already advises that both ACI 318 and Chapter 19 shall be satisfied and IBC administration sections advise that Chapter 19 shall governor over ACI 318.

Detailed plain concrete structural wall. The current organization forces the user to flip back and forth between the IBC and ACI 318, only to discover the differences in the two are only applicable to "detailed plain concrete structural walls" which are not addressed in ACI 318. The new proposed language makes it clear to the use the provisions only where "detailed plain concrete structural walls" are being used in the project. This code change proposal removed redundant and superfluous language and clarifies the code. This change removes text transcribed from ACI simply to have all definitions in one place.
Since ACI Committee 318 does not recognize "detailed plain concrete structural wall." It may be appropriate to include language in the commentary to IBC Chapter 19.
The text below is moved from Section 1905.1.6 new Section 1901.2.1 titled "detailed plain concrete structural wall" with minor editorial modifications necessary to accommodate the relocation.

***"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:

(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.

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."

Ordinary precast concrete wall. The definition for "ordinary precast structural wall" is deleted. The definition is identical to that for ordinary reinforced concrete structural wall and ACI does not differentiate between ordinary reinforced and precast structural walls. The language in the 2018 edition of the IBC creates confusion because the definition in the IBC encourages the user to seek specific language and criteria identified for ordinary precast concrete wall where it does not exist in ACI 318. ACI 318 is clear that both are addressed in ACI 318 Chapter 11. ACI 318 Section 11.1. Scope states:
"11.1.1 This chapter shall apply to the design of nonprestressed and prestressed walls including (a) through (c):

(a) Cast-in-place
(b) Precast in-plant
(c) Precast on-site including tilt-up"

Removal of repetitive definitions in the IBC. Several definitions in the 2018 IBC are similar to those in ACI 318. Continuation of carrying definitions in both documents requires additional coordination in Sections of ACI 318. The transcription of these definitions in the IBC was to have all structural wall definitions together when the IBC was simply adding criteria for "detailed plain concrete structural wall." Having the new Section 1901.2.1 addresses "detailed plain concrete structural wall" and eliminates potential confusion on the definitions and applicable section of ACI 318. This will reduce the need for subsequent code change proposals simply to coordinate ACI 318 and the IBC. The definitions in both documents are show in the table below.

2018 IBC 1905.1.1	**ACI 318**
Definition for "structural wall: is absent from the 2018 IBC.	**structural wall**—wall proportioned to resist combinations of shears, moments, and axial forces in the plane of the wall; a shear wall is a structural wall.
DETAILED PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, including 14.6.2.	**Detailed plain concrete structural walls** are not addressed in ACI 318. IBC text is moved from Section 1905.1.6 to new section 1901.2.1. Commentary to the IBC should be added to indicate that detailed plain concrete structural walls are not recognized by ACI Committee 318 and thus not addressed in ACI 318 *Building Code Requirements for Structural Concrete*.
ORDINARY PRECAST STRUCTURAL WALL. A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.	**Ordinary precast structural wall.** ACI 318 does not differentiate between ordinary precast structural walls and ordinary reinforced structural walls. Note that the definitions in the IBC are identical for both ORDINARY PRECAST STRUCTURAL WALL and ORDINARY REINFORCED CONCRETE STRUCTURAL WALL
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.	**structural wall, ordinary reinforced concrete**—a wall complying with Chapter 11.
ORDINARY STRUCTURAL PLAIN CONCRETE WALL. A wall complying with the requirements of Chapter 14, excluding 14.6.2.	**Structural wall, ordinary plain concrete**—a wall complying with Chapter 14. Section 14.6.2 does not exist in ACI 318 and is a modification to ACI 318 in IBC Section 1905.1.6 which provides new Section 14.6.2. This is very confusing. Text from 1905.1.6 identifying and adding a non-existing Section 14.6.2 in ACI 318 is revised to eliminate reference to ACI 318 and moves to new Section 1901.2.1
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	**structural wall, special**—a cast-in-place structural wall in accordance with 18.2.3 through 18.2.8 and 18.10; or a precast structural wall in accordance with 18.2.3 through 18.2.8 and 18.11.

reinforced concrete structural wall," it shall be deemed to mean a "special structural wall." IBC has no provisions for **INTERMEDIATE PRECAST WALLS**.	**structural wall, intermediate precast**—a wall complying with 18.5.

ACI, a 501.C.3 professional society encourages the approval of this code change proposal to improve the IBC by more clearly advising the user that there are provisions in the IBC for "detailed plain concrete structural walls" which are not addressed in ACI 318. The change removes transcription from ACI 318 and eliminates the need for frequent code change proposals to coordinate referenced ACI sections cited in the IBC.

Note to ICC Staff: This proposed code change is associated with another code change on definitions for "Design Displacement" and "Special Structural Wall." Should both these changes be approved Section 1905.1.1 will be removed in its entirety and replaced with new Sections 1901.2.1 and modification to SECTION 1902.

Cost Impact: This code change proposal does not result in any increase in cost of construction.

DRAFT ACI 19-02-19
SEC. 1901.2.1 PRECAST IN SDC C-F 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code
Revise Section 1901.2 by adding new Section 1901.2.1

SECTION 1901
GENERAL

1901.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

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. ~~Precast concrete diaphragms in buildings assigned to *Seismic Design Category* C, D, E or F shall be designed in accordance with the requirements of ASCE 7, Section 14.2.4~~.

Reason:

There is no change to the requirements for design and construction of structural concrete. This change improves the clarity of the code keeps provisions related to precast concrete in one location, ACI 318. and the coordination with ACI 318 by:

1) removing redundant language that advises concrete shall be in accordance with "this chapter" and "Section 1905" where the latter is part of the chapter.
2) simply relocating the provisions for detailed plain concrete structural wall from IBC Section 1905.1.6 to new Section 1901.2.1 for clarity and to facilitate use.
3) removing definition of ordinary precast concrete wall which has the same definition as ordinary reinforced concrete wall and not differentiated in ACI 318 or in the IBC.
4) removing definitions for other walls systems defined in ACI 318 and transcribed from ACI 318 simply to have all wall system definitions in one place when adding a definition for "detailed plain concrete structural wall."

Deletion of "as amended in Section 1905 of this code." In Section 1901.2 "as amended in Section 1905 of this code" is removed because it is redundant. The same sentence where this text occurs advises that "structural concrete be designed and constructed in accordance with the requirements of this chapter and ACI 318." There is no need for the superfluous language: "as amended in Section 1905 of this code." Language already advises that both ACI 318 and Chapter 19 shall be satisfied and IBC administration sections advise that Chapter 19 shall governor over ACI 318.

Detailed plain concrete structural wall. The current organization forces the user to flip back and forth between the IBC and ACI 318, only to discover the differences in the two are only applicable to "detailed plain concrete structural walls" which are not addressed in ACI 318. The new proposed language makes it clear to the use the provisions only where "detailed plain concrete structural walls" are being used in the project. This code change proposal removed redundant and superfluous language and clarifies the code. This change removes text transcribed from ACI simply to have all definitions in one place.
Since ACI Committee 318 does not recognize "detailed plain concrete structural wall." It may be appropriate to include language in the commentary to IBC Chapter 19.
The text below is moved from Section 1905.1.6 new Section 1901.2.1 titled "detailed plain concrete structural wall" with minor editorial modifications necessary to accommodate the relocation.

***"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:

(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.

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."

Ordinary precast concrete wall. The definition for "ordinary precast structural wall" is deleted. The definition is identical to that for ordinary reinforced concrete structural wall and ACI does not differentiate between ordinary reinforced and precast structural walls. The language in the 2018 edition of the IBC creates confusion because the definition in the IBC encourages the user to seek specific language and criteria identified for ordinary precast concrete wall where it does not exist in ACI 318. ACI 318 is clear that both are addressed in ACI 318 Chapter 11. ACI 318 Section 11.1. Scope states:

"11.1.1 This chapter shall apply to the design of nonprestressed and prestressed walls including (a) through (c):

(a) Cast-in-place

(b) Precast in-plant

(c) Precast on-site including tilt-up"

Removal of repetitive definitions in the IBC. Several definitions in the 2018 IBC are similar to those in ACI 318. Continuation of carrying definitions in both documents requires additional coordination in Sections of ACI 318. The transcription of these definitions in the IBC was to have all structural wall definitions together when the IBC was simply adding criteria for "detailed plain concrete structural wall." Having the new Section 1901.2.1 addresses "detailed plain concrete structural wall" and eliminates potential confusion on the definitions and applicable section of ACI 318. This will reduce the need for subsequent code change proposals simply to coordinate ACI 318 and the IBC. The definitions in both documents are show in the table below.

2018 IBC 1905.1.1	**ACI 318**
Definition for "structural wall: is absent from the 2018 IBC.	**structural wall**—wall proportioned to resist combinations of shears, moments, and axial forces in the plane of the wall; a shear wall is a structural wall.
DETAILED PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, including 14.6.2.	**Detailed plain concrete structural walls** are not addressed in ACI 318. IBC text is moved from Section 1905.1.6 to new section 1901.2.1. Commentary to the IBC should be added to indicate that detailed plain concrete structural walls are not recognized by ACI Committee 318 and thus not addressed in ACI 318 *Building Code Requirements for Structural Concrete*.
ORDINARY PRECAST STRUCTURAL WALL. A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.	**Ordinary precast structural wall.** ACI 318 does not differentiate between ordinary precast structural walls and ordinary reinforced structural walls. Note that the definitions in the IBC are identical for both ORDINARY PRECAST STRUCTURAL WALL and ORDINARY REINFORCED CONCRETE STRUCTURAL WALL

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.	**structural wall, ordinary reinforced concrete**—a wall complying with Chapter 11.
ORDINARY STRUCTURAL PLAIN CONCRETE WALL. A wall complying with the requirements of Chapter 14, excluding 14.6.2.	**Structural wall, ordinary plain concrete**—a wall complying with Chapter 14. Section 14.6.2 does not exist in ACI 318 and is a modification to ACI 318 in IBC Section 1905.1.6 which provides new Section 14.6.2. This is very confusing. Text from 1905.1.6 identifying and adding a non-existing Section 14.6.2 in ACI 318 is revised to eliminate reference to ACI 318 and moves to new Section 1901.2.1
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."	**structural wall, special**—a cast-in-place structural wall in accordance with 18.2.3 through 18.2.8 and 18.10; or a precast structural wall in accordance with 18.2.3 through 18.2.8 and 18.11.
IBC has no provisions for **INTERMEDIATE PRECAST WALLS**.	**structural wall, intermediate precast**—a wall complying with 18.5.

ACI, a 501.C.3 professional society encourages the approval of this code change proposal to improve the IBC by more clearly advising the user that there are provisions in the IBC for "detailed plain concrete structural walls" which are not addressed in ACI 318. The change removes transcription from ACI 318 and eliminates the need for frequent code change proposals to coordinate referenced ACI sections cited in the IBC.

Note to ICC Staff: This proposed code change is associated with another code change on definitions for "Design Displacement" and "Special Structural Wall." Should both these changes be approved Section 1905.1.1 will be removed in its entirety and replaced with new Sections 1901.2.1 and modification to SECTION 1902.

Cost Impact: This code change proposal does not result in any increase in cost of construction.

ACTION 1: Foster support for allied industry groups and encourage having them sign on as proponents of the code change proposal.

ACTION 2: Obtain and compile testimony from ACI members and other designers and contractors on the need for this code change proposal. Provide hyperlink to testimony in reason statement.

ACTION 3: Solicit testimony from government officials on the importance of this code change proposal and include any such testimony in hyperlink compilation.

ACTION 4: Work to obtain support from the National Conference of Structural Engineering Association and Precast/Prestressed Concrete Institute.

DRAFT ACI 19-03-19
SEC. 1901.3 ANCHORING TO CONCRETE 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code
Revise Section 1901.3 as follows:

1901.3 Anchoring to concrete. Anchoring to concrete shall be in accordance with ACI 318 as amended in Section 1905, and applies to cast-in (headed bolts, headed studs and hooked J- or L-bolts), post-installed expansion (torque-controlled and displacement-controlled), undercut, ~~and~~ adhesive, and screw anchors.

Reason:

This code change adds screws conforming to the requirements of ACI 318 as permissible anchoring devices. This make the IBC more current and reflects technological advancements integrated into standardization. Further the use of screws adds flexibility for design and construction.

ACI, a 501.C.3 professional society encourages the approval of this code change proposal to improve the IBC by adding increased flexibility by adding screws as acceptable elements for anchoring to concrete.

Cost Impact: While there is no quantitative data, the additional of another method of anchorage improves flexibility in design and construction which may reduce initial cost. The addition of screws as a method for attachment will not increase cost.

DRAFT ACI 19-04-19
SEC 1901.5 CONSTRUCTION DOCUMENTS 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

SECTION 1901
GENERAL

2018 International Building Code
Section 1901.5 Delete Section 1901.5 in its entirety.

~~**1901.5 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 posttensioning 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.~~

Reason: This code change proposal removes an incomplete list of criteria necessary for the construction documents applicable to structural concrete. The list in the IBC is not as comprehensive as the list in ACI 318. Many of the omissions from the IBC list are shown in the table below. Since the IBC supersedes ACI 318 the partial list in the IBC is all that would be required although ACI 318 has significantly more extensive requirements. If the list in the IBC is to indicate what may be of particular importance to the building code official, then that list might be best included in the commentary to the IBC, but not provided as the applicable requirements for construction documents. Further maintaining duplicate lists becomes problematic and results code change proposals that would not alter the requirements. The list in the IBC is outdate and many important items recently ACI 318 are not addressed, in particular note the requirements for anchors and qualifications for personnel.

IBC Requirements Section 1901	ACI Requirements Chapter 26
	Loads used in design
	Design work delegated to contractor
	Cementitious materials and combinations
	Water cement ratio
	Aggregates
	Mixing water
	Admixtures
	If water reducing – amount of modification
	If retarding – modification in setting time
	Where expansive cements are used – admixture compatibility
	Steel fiber reinforcement
Compressive strength of concrete	Compressive strength of concrete
	Test age for compressive strengths
	Maximum water cement ratio

	Maximum size of aggregate
	Exposure Category F – air content
	Exposure Class C – chloride ion limits
	Exposure Class S – types of cement
	Density of lightweight aggregate
	Volumetric fracture of aggregates where required in design
	Where used for shear – requirements for steel-fiber reinforced concrete
	Exposure class at option of engineer
	Compressive strength as various phases at option of engineer.
	Concrete mix proportions
	Material storage
	Concrete batching, mixing, and transport/delivery
	Pump pipe requirements
	Concrete placement
	Vertical lift requirements
	Field cured specimens if required
	Temperature of high early strength concrete
	Accelerated curing requirements if employed
	Protection and curing concrete
	Cold weather concrete procedures if applicable
	Hot weather concrete procedures if applicable
	Locations where slab column interfaces are integrated
	Locations where steel-fiber reinforcement is required
	Saw cutting locations
Strength or grade of reinforcement	Designation and grade of reinforcement
Size and location of elements	Size and location of members
	Tolerance of members
Size and location of reinforcement	Size and location of reinforcement
	Tolerances for reinforcement
	Designation of protective coatings
	Mill reports
	Field bending of reinforcement
Provisions for dimensional change	Provisions for dimensional change
	Qualifications of anchors
	Type, size, location requirements, effective embedment depth, and installation requirements for anchors
	For adhesive anchors, minimum age of concrete, concrete temperature range, moisture condition of concrete at time of installation, type of lightweight concrete if applicable, and requirements for hole drilling and preparation
	Qualifications for anchor installers
	Corrosion protect for exposed anchors
	Type, size, details, and location of embedments
	Details of lifting devices, embedments, and related reinforcement required to resist temporary loads from handling, storage, transportation, and erection, where designed by the licensed design professional.

Magnitude and location of prestressing forces	Magnitude and location of prestressing forces
Anchor and lap splice lengths	Anchor and lap splice lengths
Type and location of welded and mechanical splices	Type and location of welded and mechanical splices
	Type and location of end-bearing splices
Details and location of construction joints	Details and location of construction joints
	Design of construction joints
	Surface preparation
	Shear transfer where required
Minimum compressive strength for post-tensioning	Minimum compressive strength for post-tensioning
Post-tensioning stressing sequence	Post-tensioning stressing sequence
	Tolerances for tendons
	Materials and details of corrosion protection for tendons, couplers, end fittings, post-tensioning anchorages, and anchorage regions.
	Requirements for grouting of bonded tendons, including maximum water-soluble chloride ion
	Formwork, including removal
	Qualifications of filed technicians
	Qualifications of inspectors
	Qualifications of testing agency and technicians
Is slab resisting seismic forces?	Addressed in Section 18.12.6.1

ACI, a 501.C.3. professional society, recommends approval of this code change as submitted to assure that all relevant requirements for structural concrete as included on construction documents and to reduce confusion and eliminate the need to maintain duplicate lists.

Cost Impact. The is no increase to the cost of construction.

DRAFT ACI 19-05-19
SEC. 1903.1 CEMENT STANDARDS 180524
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code
Section 1903.1 Remove exception in Section 1903.1 and delete referenced standards:

SECTION 1903
SPECIFICATIONS FOR TESTS AND MATERIALS

1903.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

~~Exception: The following standards as referenced in Chapter 35 shall be permitted to be used.~~

~~1. ASTM C150~~
~~2. ASTM C595~~
~~3. ASTM C1157~~

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

C150/C150M—15: Specification for Portland Cement
~~1903.1,~~ Table 2507.2
C595/C595M—14e1: Specification for Blended Hydraulic Cements
~~1903.1,~~ Table 2507.2
C1157/C1157M—11: Standard Performance Specification for Hydraulic Cement
~~1903.1,~~ Table 2507.2

Reason: This language was introduced when there was concern that reference to the re-formatted edition of ACI 318-14 might not be approved for inclusion as a referenced standard in the 2015 edition of the International Building Code (IBC). The re-formatted edition of ACI 318 was included in the IBC and thus these cement standards, as referenced in ACI 318, are part of the IBC because language in Chapter 19 advises that:

> ***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.*

Further, ACI 318 permits other cementitious materials and the exception has implied to some users that these are the only cementitious materials permitted for concrete. All permissible cement standard specifications are listed in ACI 318:

C150/C150M-12—Standard Specification for Portland Cement
C595/C595M-14—Standard Specification for Blended Hydraulic Cements
C618-12a—Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C845/C845M-12—Standard Specification for Expansive Hydraulic Cement
C989/C989M-13—Standard Specification for Slag Cement for Use in Concrete and Mortars
C1157/C1157M-11—Standard Performance Specification for Hydraulic Cement
C1240-14—Standard Specification for Silica Fume Used in Cementitious Mixtures

ACI, a 501.C.3 professional society, encourages the approval of this code change proposal as submitted to remove redundant and potentially misleading language.

Cost Impact: The is no increase in the cost of construction related to the code change proposal.

DRAFT ACI 19-06-19
SEC. 1905.1 COORDINATION OF TERMS 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code
Revise and relocate text from Section 1905.1 to revised Section 1902:

SECTION 1902
~~DEFINITIONS~~ COORDINATION OF TERMS

1902.1 General. ~~The words and terms defined in ACI 318 shall, for the purposes of this chapter and as used elsewhere.~~ Coordination of terminology used in ACI 318 and ASCE 7 is as follows:
~~in this code for concrete construction, have the meanings shown in ACI 318 as modified by Section 1905.1.1.~~

1902.1.1 Design displacement. Where ACI 318 refers to design displacement it shall be deemed to mean story drift as used in ASCE 7.

1902.1.2 Special structural wall. Where ACI 318 refers to special structural wall it shall be deemed to mean special reinforced concrete shear wall as used in ASCE 7.

1905.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through 1905.1.8.

1905.1.1 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 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*.

~~**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."*~~

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

Reason:

This proposed change does not alter the requirements for design and construction of structural concrete. This change would provide clarity in coordinating ASCE 7, ACI 218 and the IBC for coordination of the terminology related to "design displacement" and "special structural wall."

The presentation of the criteria in Section 1905.1 as modifications to ACI 318 creates confusion and by implying there are major differences and suggests that the user seek deviations between ASCE 7, IBC, and ACI 318 that simply do not exist. Most engineers will general understand the use of different terminology to accomplish the same design results. However, the presence of this modifications suggests that there is a need for this coordination of terminology to be present in the IBC. The current language in the IBC direct the user to sections of ACI 318 simply to discover that there are different terms. The proposed change simplifies and clarifies the intend of the current provisions in the IBC.
There is no technical change because both ASCE 7 and ACI 318 look at displacement for each story, one referring to the displacement as story drift and the other as design displacement.
Also, the current language is confusing as to which the sections and chapters of which documents. The language for the 2018 IBC and ACI 318 is shown in the Table below.
This change will also eliminate the need for routine code change proposals currently necessary to coordinate these IBC sections with appropriate sections of ACI 318.

DESIGN DISPLACEMENT. Total lateral displacement expected for the design-basis earthquake, as specified by Section 12.8.6 of ASCE 7.	design displacement—total calculated lateral displacement expected for the design-basis earthquake. Proposed new language addresses coordination with ASCE 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."	structural wall, special—a cast-in-place structural wall in accordance with 18.2.3 through 18.2.8 and 18.10; or a precast structural wall in accordance with 18.2.3 through 18.2.8 and 18.11. Duplication of definition is eliminated and removes coordination issue related to ACI 318 Sections. Further new language provides the necessary coordination between terms used in ASCE 7 and ACI 318.

ACI, a 501.C.3 professional society encourages the approval of this code change proposal to improve IBC by clarifying language to make the IBC more user friendly and better align the code language for coordination with ACI 318 and ASCE 7.

Note to ICC Staff: This proposed code change is associated with another code change on definitions and criteria for "detailed plain concrete structural walls." Should both these changes be approved Section 1905.1.1 will be removed in its entirety and replaced with new Sections 1901.2.1 and modification of SECTION 1902.

Cost Impact: There is no increase to the cost of consturction.

DRAFT ACI 19-06-19
SEC. 1905.1.2 SDC – STRUCTURAL 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code

Section 1905.1 Revise criteria in Section 1905.1 and place in new Section 1906 by editorially deleting and revising text as necessary to relocate provisions in identifiable sections as follows:

SECTION 1906
SEISMIC DESIGN REQUIREMENTS

~~**1905.1.**~~ **1906.1 Seismic design category requirements.** ~~**ACI 318, Section 18.2.1.** Modify ACI 318 Sections 18.2.1.2 and 18.2.1.6 to read as follows:~~ The requirements of this section shall govern the design and construction of structural concrete elements subjected to seismic forces.

1906.1.1 ~~*18.2.1.2*~~ **Seismic Design Category A**. *Structures assigned to Seismic Design Category A* shall not be required to satisfy the requirements of Chapters 18 of ACI 318~~through 17 and 19 through 26; *Chapter 18 does not apply.*~~

1906.1.2 Seismic Design Categories B, C, D, E, and F. Structures assigned to *Seismic Design Category* B, C, D, E or F shall satisfy Sections 18.2.1.3 through 18.2.1.7 of ACI 318, as applicable.

~~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:~~

1906.1.3 Plain structural concrete. ~~*Except for structural elements of plain concrete complying with Section 1905.1.7 of the International Building Code, s*~~*Structural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E or F* except as follows*:*

(a) 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 71/2 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 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.

1906.1.4~~18.2.1.6~~ **Seismic force resisting systems**.~~–~~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 of ACI 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 Section 18.3 of ACI 318.

(b) Ordinary reinforced concrete structural walls *and ordinary precast structural walls* need not satisfy any provisions in Chapter 18 of ACI 318.

(c) Intermediate moment frames shall satisfy Section 18.4 of ACI 318.

(d) Intermediate precast *structural* walls shall satisfy Section 18.5 of ACI 318.

(e) Special moment frames shall satisfy Sections 18.6 through 18.9 of ACI 318.

(f) Special structural walls shall satisfy Section 18.10 of ACI 318.

(g) Special structural walls constructed using precast concrete shall satisfy Section 18.11 of ACI 318.

1906.1.5 Special structural elements. ~~**ACI 318, Section 18.11.** Modify ACI 318, Section 18.11.2.1 to read as follows:~~

~~18.11.2.1~~ Special moment frames and special structural walls shall also satisfy Sections 18.2.4 through 18.2.8 of ACI 318.

1906.1.6 Precast special structural concrete walls. ~~**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 Sections 18.10 *for cast-in-place special structural walls* and ~~in addition to~~ 18.5.2 of ACI 318.

1906.1.7 Seismic force-resisting foundations. ~~**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.*

1906.1.8 Connections. ~~**1905.1.3 ACI 318, Section 18.5.** Modify ACI 318, Section 18.5 by 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~~. Connections satisfy the requirements of this section.

1906.1.8.1 Connections designed to yield. ~~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.

1906.8.1.2 Elements of connections not designed to yield. ~~18.5.2.3~~ Elements of the connection that are not designed to yield shall develop at least 1.5 S_y.

1906.1.9 Wall Piers.~~18.5.2.4~~ In structures assigned to SDC D, E or F, wall piers shall be designed in accordance with ACI 318 Section 18.10.8 or 18.14 ~~in ACI 318~~.

Reason:

These proposed revisions do not alter the criteria in the IBC, but instead make it clear to the user what systems and applications are being addressed. Rather than having the user read sections 14.1.4, 14.1.4.1 etc., the revisions clearly advise the user what is being addressed in the section. The user can more easily determine if the criteria are applicable to the project.

Modifications shown as new section 1906.1. The Chapter already requires compliance with applicable sections of ACI 318. The change removes superfluous language included to simply advise the user that the requirements of Chapter 18 are not applicable in SDC A.

Modifications shown as new section 1906.1.2. Retains the criteria for structures assigned to SDC B, C, D, E, and F. but clearly identifies that criteria as only being applicable to those SDCs. This change makes the code more user friendly, especially where used for project sin SDC A.

Modifications shown as new section 1906.1.3. This revision more clearly presents the requirements and exceptions for plain concrete used in seismic design categories in an appropriately identified section. The criteria of section 1905.1.7 is moved to new section 1906.1.3. This also eliminates a pointer to other sections of the code.

Modifications shown as new section 1906.1.4. This revision identifies the section topic as "Seismic force resisting systems" in lieu of ACI 318 Section "18.2.1.6." This provides clarity and improves direction to the user.

Modifications shown as new section 1906.1.5, This revision identifies the section topic as "Special structural elements." and not as ACI 318, Section 18.11. This provides clarity and improves direction to the user

Modification shown as new section 1906.1.6. This revision identifies the section as "Precast special structural concrete walls." in lieu of 1905.1.4 ACI 318, Section 18.11. This provide clarity and direction to the user. This revision makes it clear that the user need not be concerned with these criteria where projects do not involve precast concrete.

Modification shown as new section 1906.1.7. This revision identifies the section as "Seismic force-resisting foundations." in lieu of "ACI 318, Section 18.13.1.1." This provide clarity and direction to the user. This revision makes it clear that the user need not be concerned with these criteria where projects do not involve seismic force-resisting foundations.

Modification shown as new section 1906.1.8, This revision identifies the section as "Connections" in lieu of "ACI 318, Section 18.5." This provide clarity and direction to the user. This revision makes it clear that the user need not be concerned with these criteria are applicable to connections and further clearly delineates between elements designed to yield and those not designed to yield.

Modification shown as new section 1906.1.9. This revision identifies the section as "Wall piers" in lieu of "ACI "18.5.2.4." To the user it is unclear whether to search IBC or ACI 318 for Section 18.5.2.4. Further, if wall piers are not employed on the project, the user can easily identify that these requirements may not be applicable. Finally, the revised language makes it clearer that the cited references are both in ACI 318

ACI, a 501.C.3 professional society, encourages the approval of this code change proposal to improve the IBC by more clearly advising the user that the provisions addressed in this section are related to seismic design category requirements, reduces transcription/duplication of language in IBC and ACI 318, reduces confusion by eliminating multiple indicators that are solely section numbers from ACI 318.

Note to ICC Staff: Should this code change be approved with other reorganizing changes proposed by ACI in this cycle this new Section could replace current Section 1905. Current criteria in Section 1905 address detailed plain concrete structural walls, seismic design category requirements, definitions and terminology, and anchors. Proposed changes move detailed plain concrete structural walls to section 1901.2, terminology to Section 1902 Definitions, and splits anchors and seismic into separate sections. One would replace existing 1905 and other would be new section 1906 and exiting subsequent sections would need to be renumbered.

Cost Impact: No increase in initial cost of construction.

DRAFT ACI 19-08-19
SEC. 1906.1 ANCHORS 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code
New Section 1906.1 Revise Section 1906 by deleting duplicative text, moves current text to new section on anchors and editorially revises text accordingly:

SECTION 1906
ANCHORS TO CONCRETE

1906.1 General. ~~**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:~~Anchors to concrete shall be designed and installed in accordance with Chapter 17 of ACI 318 and provisions of this Section.

~~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.~~

1906.1.1 ~~**Exception:**~~ **Anchors resisting out-of-plane forces.** *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 17.2.3.4.3(d) of ACI 318.*

~~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 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.~~

1906.1.2. Anchorage of lightframe walls to concrete. ~~***Exceptions:***~~ *For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates or cold formed steel track of bearing or nonbearing walls of lightframe ~~wood~~ structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.5.2 and 17.5.3 need not be computed and 17.2.3.5.3 of ACI 318 shall be deemed to be satisfied provided all of the following are met:*

1906.1.2.1. Wood lightframe walls. *For ~~the calculation of the in-plane shear strength of~~ anchor bolts attaching wood sill plates ~~of bearing or nonbearing walls~~ of lightframe wood structures to foundations or foundation stem walls~~:, the in-plane 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 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.

1906.1.2.1. Cold-formed steel lightframe walls. *For ~~the calculation of the in-plane shear strength of~~ anchor bolts attaching coldformed 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 17.5.2 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 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 E3.3.1.*

1906.1.2.3. Anchors 1 inch (25 mm) or less in diameter. ~~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 17.2.3.5.3(a) through (c) of ACI 318 when the design strength of the anchors is determined in accordance with 17.5.2.1(c) of ACI 318.*

Reason:

This code change proposal:

1) More clearly identifies the subject matter as anchors to concrete.
2) Removes duplicative text transcribed from ACI 318 to which the chapter already requires compliance. Deleted text from the IBC is shown with text in ACI 318 in the table below.
3) More clearly indicates where exceptions for light-frame anchorage to concrete are applicable and that the exceptions are only applicable to light-frame.
4) Moves anchor requirement in one section.

2018 IBC	ACI 318
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.	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. Criteria are the same and text is recommended for deletion from IBC. Further such a change avoids routine code change proposals to coordinate section of ACI 318 referenced in the IBC.
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 □0. The anchor design tensile strength shall be calculated from 17.2.3.4.4.	(d) The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E, with the horizontal component of E increased by Ωo. The anchor design tensile strength shall satisfy the tensile strength requirements of 17.2.3.4.4 Criteria are the same and text is recommended for deletion from IBC. Further such a change avoids routine code change proposals to coordinate section of ACI 318 referenced in the IBC.
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	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

strength for resisting earthquake forces shall be determined in accordance with 17.5.	resisting earthquake forces shall be determined in accordance with 17.5 Criteria are the same and text is recommended for deletion from IBC. Further such a change avoids routine code change proposals to coordinate section of ACI 318 referenced in the IBC.

ACI, a 501.C.3 professional society, encourages the approval of this code change proposal to improve the IBC by removing transcription from ACI 318, as the transcription makes the user think there is something different that must be addressed when the chapter already requires compliance with ACI 318. Further this proposed revision places anchor requirements in one section.

Note to ICC Staff: Should this code change be approved with other reorganizing changes proposed by ACI in this cycle this new Section could replace current Section 1905. Current criteria in Section 1905 address detailed plain concrete structural walls, seismic design category requirements, definitions and terminology, and anchors. Proposed changes move detailed plain concrete structural walls to section 1901.2, terminology to Section 1902 Definitions, and splits anchors and seismic into separate sections. One would replace existing 1905 and other would be new section 1906 and exiting subsequent sections would need to be renumbered.

Cost Impact: No increase in initial cost of construction.

DRAFT ACI 19-09-19
SEC. 1906.1 PLAIN CONCRETE FOUNDATIONS 180524
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Building Code
Section 1906 Revise Section 1906 as follows:

SECTION 1906
~~STRUCTURAL PLAIN CONCRETE~~
FOOTINGS FOR LIGHT FRAME CONSTRUCTION

1906.1 Plain concrete footings. ~~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 thickness of plain concrete footings ~~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.

Reason:

This code change removes unnecessary text and clearly indicate to the user that the provisions of this sections are restricted to light-frame construction. Sections 1905 and 1901 already advise that structural plain concrete must follow the ACI 318 and the appropriate sections of the IBC. This redundant language is eliminated. Further text is editorially modified to alter language presented as an "exception" to be presented as an appropriate provision, The scope section is redundant and therefore adds confusion.

ACI, a 501.C.3 professional society, encourages the approval of this code change proposal to improve the IBC by more clearly advising the user that these provisions are only applicable footing supporting light-frame construction.

Cost Impact: There is no increase in cost of construction.

DRAFT ACI 19-10-19
SEC. 1907.1 SLABS-ON-GROUND 180629
ACI PROPOSED CODE CHANGE
2018 EDITION OF IEBC GROUP B

2018 International Building Code
Section 1907. Revises Sections 1901 and 1907.

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.~~ Precast concrete diaphragms in buildings assigned to Seismic Design Category C, D, E or F shall be designed in accordance with the requirements of ASCE 7, Section 14.2.4.

SECTION 1907
~~MINIMUM~~ SLABS-ON-GROUND ~~PROVISIONS~~

1907.1 General. The provisions of Section 1904 and this section shall apply to concrete slabs-on-ground.
1907.1.1 Slabs-on-ground transmitting loads. Where slabs-on-ground ~~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, design and construction shall satisfy all applicable provisions of this chapter.
1907.1.2 Thickness The thickness of concrete floor slabs supported directly on the ground shall be not less than 3-1/2 inches (89 mm).
1907.1.3 Vapor Retarder. A polyethylene vapor retarder having a minimum 6-mil (0.006 inch; 0.15 mm) thickness ~~polyethylene vapor retarder~~ and with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through
the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where *approved* based on local site conditions.

Reason: The current language is not clear. First the provisions are only applicable to slabs on ground and this should be more clearly stated. Further it is generally understood that all provisions of the IBC are minimum requirements. This code change places all provisions uniquely applicable to slabs-on-ground in one section rather than having provisions in sections 1901.2 and 1907.

Modifications shown as new section 1907.1.1. This portion of the proposed revision is editorial, deleting slab-on-ground provisions from Section 1901.2 (shown above as deleted text) and moving the provisions to the more appropriate section, 1907. This places provisions for concrete slabs-on-ground in one section.

Modifications shown as new section 1907.1.2. This portion of the proposed revision is editorial and clarifies that thickness criteria are for concrete slabs-on-ground.

Modifications shown as new section 1907.1.3. This portion of the proposed revision is editorial and appropriately assigns provisions for vapor retarders to vapor retarders and not to slabs-on-ground.

ACI, a 501.C.3 professional society, encourages the approval of this code change proposal to improve the IBC by more clearly advising the user that these provisions are only applicable to slabs-on-ground and relocates slab-on-ground provisions in one section.

Cost Impact: There is no increase in the initial cost of construction.

ACI 19-11-19
SEC. 1908 SHOTCRETE 180629
ACI PROPOSED CODE CHANGE
2018 EDITION OF IEBC GROUP B

2018 International Building Code
Section 1908 Revise Section 1908.1 and Table 1703.5 and delete Subsections 1908.2 through 1908.10.3 in their entirety as follows:

SECTION 1908
SHOTCRETE

1908.1 General. Shotcrete shall be designed and constructed in accordance with the requirements of ACI 318. ~~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.~~

~~**1908.2 Proportions and materials.** Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in finished in-place hardened shotcrete meeting the strength requirements of this code.~~
~~**1908.3 Aggregate.** Coarse aggregate, if used, shall not exceed 3/4 inch (19.1 mm).~~
~~**1908.4 Reinforcement.** Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1908.4.1 through 1908.4.4.~~
~~**1908.4.1 Size.** The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.~~
~~**1908.4.2 Clearance.** Where No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of 21/2 inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. Where two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters. **Exception:** Subject to the approval of the *building official*, required clearances shall be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.~~
~~**1908.4.3 Splices.** Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of 2 inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted where *approved* by the *building official*, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.~~
~~**1908.4.4 Spirally tied columns.** Shotcrete shall not be applied to spirally tied columns.~~
~~**1908.5 Preconstruction tests.** Where preconstruction tests are required by Section 1908.4, 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 1704.5.~~
~~**1908.6 Rebound.** Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.~~
~~**1908.7 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.~~
~~**1908.8 Damage.** In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced~~

~~while still plastic. **1908.9 Curing.** During the curing periods specified herein, shotcrete shall be maintained above 40°F (4°C) and in moist condition.~~

~~**1908.9.1 Initial curing.** Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an *approved* curing compound.~~

~~**1908.9.2 Final curing.** Final curing shall continue for seven days after shotcreting, or for three days if highearly-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with an *approved* moisture-retaining cover.~~

~~**1908.9.3 Natural curing.** Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent, and is authorized by the *registered design professional* and *approved* by the *building official*.~~

~~**1908.10 Strength tests.** Strength tests for shotcrete shall be made by an *approved agency* on specimens that are representative of the work and that have been water soaked for not fewer than 24 hours prior to testing. Where the maximumsize aggregate is larger than 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. Where the maximum-size aggregate is 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.~~

~~**1908.10.1 Sampling.** Specimens shall be taken from the in-place work or from test panels, and shall be taken not less than once each shift, but not less than one for each 50 cubic yards (38.2 m3) of shotcrete.~~

~~**1908.10.2 Panel criteria.** Where the maximum-size aggregate is larger than 3/8 inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). Where the maximum-size aggregate is 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.~~

~~**1908.10.3 Acceptance criteria.** The average compressive strength of three cores from the in-place work or a single test panel shall equal or exceed 0.85 $f'c$ with no single core less than 0.75 $f'c$. The average compressive strength of three cubes taken from the in-place work or a single test panel shall equal or exceed $f'c$ with no individual cube less than 0.88 $f'c$. To check accuracy, locations represented by erratic core or cube strengths shall be retested.~~

TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	IBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	~~1908.4~~
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum $^5/_{16}$"; and c. Inspect all other welds.	— X	X X	 AWS D1.4 ACI 318: 26.6.4	—
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X	 X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2, ~~1908.2, 1908.3~~
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C172 ASTM C31 ACI 318: 26.5, 26.12	~~1908.10~~
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	~~1908.6, 1908.7, 1908.8~~
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	~~1908.9~~

9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	 X X	 — —	ACI 318: 26.10	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.12, Special inspections for seismic resistance.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

Add Section 1908.1 to Reference:

ACI	American Concrete Institute 38800 Country Club Drive Farmington hills, MI 48331
318-~~14~~19: Building Code Requirements for Structural Concrete and Commentary	
	722.2.4.3,1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8.3.1, 1810.3.8.3.3, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11.1, 1810.3.12, 1901.2, 1901.3, 1902.1, 1903.1, 1904.1, 1904.2, 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, 1906.1, 1908.1. 2108.3, 2206.1

Reason Statement: The current criteria in the International Building Code (IBC) is based on American Concrete Institute (ACI) *Guide to Fiber-Reinforced Shotcrete* (ACI 506.1R). The guide was last updated in 2008 and much of the information in the current edition of the IBC is based on recommendations published in the 1998 edition of ACI 506.1R. The current criteria in the IBC is for the most part archaic and does not reflect shotcrete that is readily available today. Mandatory criteria for the design and construction of shotcrete is now integrated into ACI *Building Code Requirements for Structural Concrete and Commentary* (ACI 318). ACI 318 includes shotcrete along with plain and reinforced cast-in-place concrete and precast and prestressed concrete:

> "4.2.1.1 Design properties of shotcrete shall conform to the requirements for concrete except as modified by specific provisions of the Code."

The provisions unique to shotcrete as shown below under "Shotcrete provisions included in ACI 318," demonstrating a fully comprehensive effort by ACI Committee 318 to integrate shotcrete into ACI 318 *Building Code Requirements for Structural Concrete.* These provisions are in addition to all exiting applicable provisions of ACI 318. Among the significant differences between the current language in the 2018 edition of the IBC and ACI 318 are:

1) New durability requirements added to Chapter 19
2) Criteria that allow for additional spacings of reinforcement to improve economy added to Chapter 25.
3) Additional criteria for reinforcement and splices to better assure life safety and desired performance added to Chapter 25.
4) Criteria for inspection and quality assurance specific to shotcrete added to ACI 318 Chapter 26.

With ACI 318 being the premier document for design and construction of structural concrete, this inclusion elevates the overall acceptance of shotcrete thereby providing owners, developers, and designers with increased confidence when using shotcrete. This in turn allows owners, developers and designers to more readily use the most economical concrete solutions for their projects. Inclusion in ACI 318 also provides all relevant design and construction criteria in mandatory language required for design and construction of shotcrete to assure an acceptable level of life safety and performance while more appropriately addressing current industry practice.

Further ACI 318 is referenced as applicable to plain and reinforced concrete in Section 1901.2: "Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318…" Since shotcrete may be a type of structural concrete, the removal of the criteria in the IBC, in addition to updating the requirements to current technology and practice, will help remove confusion and eliminate errors.

This code change proposal:

1) Replaces general language in Section 1908.1 and simply directs the user to ACI 318.
2) Removes archaic criteria from the IBC in favor of current criteria applicable to current shotcrete products, design, construction, and inspection as addressed in ACI 318.
3) Removes pointers for inspection from Table 1705.3 Required Special Inspections and Tests of Concrete Construction, as these pointers are no longer required where compliance is in accordance with ACI 318.
4) Adds ACI 318 as a reference to Section 1908 of the IBC.

As a not-for-profit professional society, ACI recommends approval of this code change proposal as submitted to reflect current products and design and construction practices for the benefit of the pubic and to improve design and construction flexibility and lower costs.

Shotcrete provisions included in ACI 318 05/01/2018 from CA 153

Chapter 2 – Notation and Terminology

panel, mockup—a shotcrete specimen that simulates the size and detailing of reinforcement in a proposed structural member for preconstruction evaluation of the nozzle operator's ability to encase the reinforcement, or for the verification of acceptable final surface finishes.

panel, test—a shotcrete specimen prepared in accordance with ASTM C1140 for use in preconstruction evaluation of shotcrete mixtures, to qualify nozzle operators and equipment, surface finishes, or for quality control, or compressive or flexural strength testing, during the progress of a project.

shotcrete — mortar or concrete placed pneumatically by high velocity projection from a nozzle onto a surface.

shotcrete, dry mix—shotcrete in which most of the mixing water is added to the concrete ingredients at the nozzle.

shotcrete, wet mix—shotcrete in which the concrete ingredients, including water, are mixed before introduction into the delivery hose.

Chapter 4 – Structural System Requirements

4.2—Materials

4.2.1.1 Design properties of shotcrete shall conform to the requirements for concrete except as modified by specific provisions of the Code.

Chapter 19—Concrete: Design and Durability Requirements

19.3.3.3 Wet-mix shotcrete subject to freezing-and-thawing Exposure Classes F1, F2, or F3 shall be air entrained. Dry-mix shotcrete subject to freezing-and thawing Exposure Class F3 shall be air entrained. Air content shall conform to Table 19.3.3.3.

Table 19.3.3.3—Total air content for shotcrete exposed to cycles of freezing and thawing.

Mixture Type	Target air content, percent		
	F1	F2	F3
Wet-mix shotcrete, before placement	5.0	6.0	6.0
Dry-mix shotcrete (in place)	N/A	N/A	3.0

19.3.3.4 Wet-mix shotcrete shall be sampled in accordance with ASTM C172, and air content shall be measured in accordance with ASTM C231 or ASTM C173.

19.3.3.5 Dry-mix shotcrete shall be sampled and air content shall be measured as directed by the licensed design professional.

19.3.3.6 For f'_c exceeding 5000 psi, reduction of air content indicated in Tables 19.3.3.1 and 19.3.3.3 by 1.0 percentage point is permitted.

Chapter 25—Reinforcement Details

25.2—Minimum spacing of reinforcement

25.2.7 For shotcrete, with No. 6 bars and smaller, the clear spacing between parallel nonprestressed reinforcement shall be 3db of the largest reinforcing bar or 2 in., whichever is less, unless approved by the licensed design professional. For bars larger than No. 6, a mockup panel is required to demonstrate reinforcement is fully encased at the specified clear spacing.

25.2.8 Shotcrete shall not be permitted for columns with closely spaced ties or hoops spiral reinforcement separated with a clearance the lesser of three bar diameters apart; three times the maximum aggregate size; or 2 in. unless approved by the licensed design professional based on verifying that reinforcement is fully encased in mockup panels.

25.2.9 Shotcrete shall not be permitted for columns with closely spaced ties or hoops spiral reinforcement separated with a clearance the lesser of three bar diameters apart; three times the maximum aggregate size; or 2 in.

25.5—Splices

25.5.1.6 Reinforcement for No. 6 bars and smaller for use in shotcrete shall be non-contact lap splices with a clear spacing between bars of 3db of the largest reinforcing bar or 2 in., whichever is less. For non-contact splices with bars larger than No. 6, a mockup panel is required to demonstrate reinforcement is fully encased at the specified clear spacing.

Chapter 26 – Construction Documents and Inspection

26.3—Member information

26.3.1 (b) Members that can be constructed using shotcrete

26.3.2(a) Use of shotcrete for structural members not identified in the construction documents as permitted to be placed by shotcrete shall be permitted if approved by the licensed design professional.

26.4—Concrete materials and mixture requirements

26.4.1.2.1 Compliance requirements:

(c) For shotcrete, the aggregate gradation shall comply with ASTM C1436.

26.4.1.4 Admixtures

26.4.1.4.1 Compliance requirements:

(e) Admixtures used in shotcrete shall conform to ASTM C1141.

26.4.1.6 Packaged, pre-blended, dry, combined materials for shotcrete

26.4.1.6.1 Compliance requirements:

(a) Packaged, pre-blended, dry, combined materials for shotcrete shall conform to ASTM C1480.

26.4.2 Concrete mixture requirements

26.4.2.1 Design information:

(a)(5) For shotcrete, the nominal maximum size of coarse aggregate shall not exceed 1/2 in.

26.4.3 Proportioning of concrete mixtures

26.4.3.1 Compliance requirements:

(e) Shotcrete mixture proportions shall be established so that shotcrete satisfies (1) through (3):

(1) Can be readily placed without segregation and around reinforcement.

(2) Meets durability requirements given in the construction documents.

(3) Conforms to strength test requirements for shotcrete.

26.4.4 Documentation of concrete mixture characteristics

26.4.4.1 Compliance requirements:

(d) Documentation of shotcrete mixture characteristics shall be submitted for review by the licensed design professional before the mixture is used and before making changes to mixtures already in use. Evidence of the ability of the proposed shotcrete mixture to comply with the concrete mixture requirements in the construction documents shall be included in the documentation.

26.5.2 Concrete placement and consolidation

26.5.2.1 Compliance requirements:

(l) Prior to placement of shotcrete, rebound and overspray from adjacent placements shall be removed before placement of a new layer.

(m) Rebound, overspray, or cuttings from shotcrete placement shall not be incorporated into the Work.

(n) Shotcrete surfaces intended to receive subsequent shotcrete placement shall be roughened to a full amplitude of ¼-in. before the shotcrete has reached final set.

(p) Before placing additional material onto hardened shotcrete, laitance shall be removed, joints shall be cleaned, and the surface dampened.

(q) In-place fresh shotcrete that exhibits sags, sloughs, segregation, honeycombing, or sand pockets shall be removed and replaced. Note: Add provision here regarding certification.

(r) A certified shotcrete nozzle operator shall perform all Work.

26.5.3 Curing concrete and shotcrete

26.5.3.2 Compliance requirements:

(f) Shotcrete shall be cured in accordance with (1) through (3).

1. For 24 hours from completion of placement, initial curing shall be provided by one of the following methods:

i. Ponding, fogging, or continuous sprinkling;

ii. Absorptive mat, fabric, or other protective covering kept continuously moist;

iii. Application of a membrane-forming curing compound conforming to ASTM C309.

2. After 24 hours from completion of placement, final curing shall be provided by one of the following methods:

i. Continue method used in the initial curing process;

ii. Sheet materials conforming to ASTM C171;

iii. Other moisture-retaining covers kept continuously moist.

3. Final curing shall be maintained for a minimum duration of not less than the following:

i. 7 days,

ii. 3 days if high-early-strength cement or an accelerating admixture is used.

26.5.6 Construction, contraction, and isolation joints

26.5.6.1 Design information:

26.5.6.2 (f) For shotcrete, construction joint surfaces shall be cut at a 45-degree angle to the finished surface, unless a square joint is designated in the construction documents.

26.5.6.2(g) For shotcrete, proposed construction joint locations not shown on the construction documents shall be submitted to the licensed design professional for approval.

26.12—Concrete evaluation and acceptance

26.12.1 General

26.12.1.1 Compliance requirements:

(b) For shotcrete, a strength test shall be the average compressive strengths of at least three 3-in. diameter cores taken from a test panel prepared in accordance with ASTM C1140 and tested at 28 days from time of placement or at test age designated for f'_c. Test panels shall be placed in the same orientation and by the same nozzle operator placing shotcrete for the Work. Cores shall be obtained, conditioned, and tested in accordance with ASTM C1604

26.12.2 Frequency of testing

26.12.2.1 Compliance requirements:

(d) For shotcrete, prepare a test panel for each mixture and each nozzle operator at least once per day or for every 50 yd^3 placed, whichever results in the most panels

26.12.4 Acceptance for shotcrete

26.12.4.1 Compliance requirements:

(a) Specimens for acceptance tests shall be prepared and tested in accordance with ASTM C1140. (b) Strength level of a shotcrete mixture shall be acceptable if (1) and (2) are satisfied:

(1) Every arithmetic average of the strength from three consecutive test panels equals or exceeds f'_c.

(2) The average compressive strength of three cores from a single test panel is not less than 0.85 f'_c with no core having a strength less than 0.75 f'_c.

Cost Impact: No increase to initial cost of construction. This change removes antiquated criteria for the International Building Code (IBC) and simply refers to updated, but comparable, criteria in American Concrete Institute Building Code Requirements for Structural Concrete and Commentary (ACI 318). The provisions of ACI 318 are more inclusive of design and construction methods conditions and provide increase flexibility for designers and contractors. In many instances this increased flexibility has the potential to reduce costs.

ACI 03-01-19
SEC 303 ADDS ACI 562 180629
ACI Proposed Code Change
2018 Edition of IEBC Group B

2018 International Existing Building Code
Section 303. Add new Section and reference to Chapter 3 as follows and renumber subsequent Sections:

303.3 Concrete evaluation and design procedures. Evaluation and design of structural concrete shall be in compliance with this code and ACI 562.

Exception:
Seismic evaluation and design of structural concrete shall be in accordance with 303.4.

303.~~3~~4 Seismic evaluation and design procedures [No change to text, renumber Section and subsections]

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

562-19: Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures
301.1.5

Reason:
This code change proposal adds ACI 562: *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*, to establish minimum requirements for the design, construction, repair, and rehabilitation of concrete structural elements in buildings for various levels of desired performance as deemed appropriate for the project. In addition to improved life safety, the requirements clearly define objectives and anticipated performance for the code official, owners, designers, contractors and installers.

Background - In 2006, the repair industry approached ACI asking for a concrete repair and rehabilitation code that would improve the overall quality of concrete repairs by establishing common requirements and establishing clear responsibilities between owners, designers, and contractors. This code would also provide building code officials with a reference by which to evaluate rehabilitated concrete structures. ACI, following its rigorous American National Standards Institute accredited standards development process assembled a code committee with balanced representation and produced the first official code in 2012. The committee members reviewed and considered numerous reports and publications related to concrete repair and rehabilitation to identify and develop requirements consistent with current industry practice. The committee has received feedback from users of the code and are now completing their third version of this code, ACI 562-19.

Scope - ACI 562-16 complements the IEBC by providing specific direction on how to design concrete repairs and how to handle the unique construction problems associated with repair. This standard helps the designer assess the existing structure in accordance with the IEBC. The standard then provides the requirements that bridge the inconsistencies and gaps in acceptable criteria that occur from the two

following situations that a designer must solve: one, repairing a structure according to the original building code used at the time it was built using today's construction methods and materials; or, repairing a structure built according to an older building code but repaired according to the latest building code. Note that ACI 562 does not address the evaluation of lateral-force resisting systems in high seismic areas. ASCE 41 is the appropriate standard for this situation as stated in the IEBC.

Benefits - There are many benefits that ACI 562 provides for the designer, owner, contractor, and building code official. A few of these benefits are:

- Provides a level of expectation of life safety to the public in buildings where repairs or rehabilitation is performed on concrete structural elements.
- Provides clearly defined, uniform requirements aimed at extending the service life of existing structures.
- Improves the efficiency, safety, and quality of concrete repair.
- Establishes clear responsibilities between owners, designers, and contractors.
- Provides building code officials with a means to evaluate rehabilitation designs.
- Provides specific repair requirements that often result in less costly repairs compared to repairs required to meet only new construction requirements.

Flexibility – ACI 562 permits flexibility in evaluation, design, construction and repair materials to provide economies while establishing expected performance for the service-life of the rehabilitation or repairs.

Resources - Also, there many resources that complement ACI 562. Among these are:

- *Concrete Repair Manual: Fourth Edition 2013*
- ACI 563-18, *Specifications for Repair of Structural Concrete in Buildings*
- MNL-3(16) *Guide to the Code for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*

These resources are readily available to provide greater understanding of assessment, repair and rehabilitation of concrete structural elements. ACI MNL-3 provides case studies demonstrating the ease of use of ACI 562. Numerous technical notes, reports, guides, and specifications that provide background information and technical support are available through other organizations, such as American Society of Civil Engineers, British Research Establishment, Concrete Society, International Concrete Repair Institute, National Association of Corrosion Engineers, Post-Tensioning Institute, Society for Protective Coatings, and US Army Corps of Engineers. Many of these organizations publications related to concrete repair can be found in the Concrete Repair Manual.

Bibliography –

- Concrete Repair Manual - 4th Edition: 2-Volume Set, ACI and ICRI, 2013, 2093 pp.
- https://www.concrete.org/store/productdetail.aspx?ItemID=RPMN13PACK&Format=HARD_COPY
- Guide to the Code for Assessment, Repair, and Rehabilitation of Existing Concrete Buildings, ACI and ICRI, 2016, 176 pp. https://www.concrete.org/store/productdetail.aspx?ItemID=MNL316&Language=English

ACI, a professional technical society, has developed this standard in response to industry needs and to help assure minimum levels of life safety results where repairs and rehabilitation are associated with concrete structural elements. For this reason and the other benefits identified in this reason statement, ACI recommends this code change proposal for committee approval as submitted.

State Adoptions: Jurisdictions see the need for these requirements. As the model for state and local adoptions, the IEBC should include this reference with appropriate language.

State Building Code Council
HAWAII STATE BUILDING CODE
Effective Date: January 1, 2018

"3401.6 Alternative compliance.

1) Work performed in accordance with the International Existing Building Code shall be deemed to comply with the provisions of this chapter.

2) Work performed in accordance with the 2016 version of the American Concrete Institute Committee 562, "Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures" shall be deemed to comply with this chapter when used as a supplement to the requirements of this chapter or the International Existing Building Code. Wherever the term International Existing Building Code (IEBC) is used in ACI 562-16, it shall mean International Existing Building Code or Chapter 34 of the International Building Code."

Ohio Board of Building Standards
AMENDMENTS GROUP XCV (95)
PUBLIC HEARING DRAFT
June 1, 2018
Pending legislative approval to be determined in August 2018

3401.6 Concrete evaluation and design procedures. Evaluation and design of structural concrete repairs and rehabilitation shall be in compliance with Chapter 34 and ACI 562.

Cost Impact:
The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptance criteria that is amicable to both the owner and the building code official. The end result is the determination that the repair must meet the latest building code requirements for new construction. This standard increases the options available for repair and provides the acceptance criteria necessary to permit these options. A case study that illustrates this point is provided below:
"ACI 562 has been referenced in expert reports for litigation cases, resulting in significantly reduced financial settlements. Denver-based J. R. Harris & Company recently used the code as a standard in several litigation reports assessing damages in existing concrete structures.
As an approved consensus standard, according to American National Standards Institute (ANSI) procedures, ACI 562-13 has been accepted as the source standard to use for damage assessment and repair on individual projects by Greenwood Village and Pikes Peak Regional Building Departments in Colorado. Based on this acceptance, the consulting engineer was able to cite the code in their recommendation for structural remediation and determination of damages.

In one case involving rehabilitation work on four buildings with faulty construction, J.R. Harris was able to reduce the repair costs from $12 million to $3 million, with a repair plan based on the lesser of the demand-capacity ratio based on either the original or current building code per ACI 562."