Tentative Interim Amendment

NFPA 5000®
Building Construction and Safety Code®
2009 Edition

Reference: 41.5
TIA 09-2
(SC 08-7-29/TIA Log #911)
Note: Text of the TIA issued and incorporated into the text of Section 41.5 and therefore no separate publication is necessary.

1. Revise Section 41.5 as shown below:

41.5 Seismic Requirements. In addition to the requirements of this chapter, the design and construction of concrete elements that resist seismic forces shall comply with the requirements of Section 14.2 of ASCE/SEI 7, except 14.2.2 of ASCE 7 shall be replaced by 41.5.1 of this *Code*. In addition, for purposes of seismic design under this *Code* and ASCE/SEI 7, instead of using ACI 318-05 as Section 23.1 of ASCE/SEI 7, the edition of ACI 318 listed in 2.3.4 of this *Code* shall be used.

41.5.1 Modifications to ACI 318. The text of ACI 318 shall be modified as indicated in 41.5.1.1 through 41.5.1.10. Italics are used for text within 41.5.1.1 through 41.5.1.10 to indicate requirements that differ from ACI 318. The modifications to ACI 318 are based on the edition listed in 2.3.4 of this *Code* instead of the edition adopted by Section 23.1 of ASCE/SEI 7.

41.5.1.1 Definitions. See also 3.3.608.

Detailed Plain Concrete Structural Wall. A wall complying with the requirements of Chapter 22 8, including 22.6.7 of ACI 31.

Ordinary Precast Structural Wall. A precast wall complying with the requirements of Chapters 1 through 18 of ACI 318.

Ordinary Reinforced Concrete Structural Wall. A cast-in-place wall complying with the requirements of Chapters 1 through 18 of ACI 318.

Ordinary Structural Plain Concrete Wall. A wall complying with the requirements of Chapter 22, excluding 22.6.7 of ACI 318.

Special Structural Wall. A cast-in-place or precast wall complying with the requirements of 21.1.3 through 21.1.7, 21.9, and 21.10 of ACI 318, 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."

Wall Pier. A wall segment with a horizontal length-to-thickness ratio of at least 2.5, but not exceeding 6, whose clear height is at least two times its horizontal length.

41.5.1.2 Ties Around Anchor Bolts. Section 7.10 of ACI 318 shall be modified by revising 7.10.5.6 of ACI 318 to read as shown in 41.4.1.2.1.

41.5.1.2.1 Where anchor bolts are placed in the top of columns or pedestals, the bolts shall be enclosed by lateral reinforcement that also surrounds at least four vertical bars of the column or pedestal. The lateral reinforcement shall also be distributed within 5 in. of the top of the column or pedestal, and shall consist of at least two No. 4 or three No. 3 bars. In structures assigned to Seismic Design Categories C, D, E, or F, the ties shall have a hook on each free end that complies with 7.1.4 of ACI 318.

~~**41.5.1.3 Scope.** Modify Sections 21.1.1.3 through 21.1.1.5 to read as follows:~~

~~21.1.1.3 *Structures assigned to SDC B shall comply with Chapters 1 through 19 and 22*. For a structure assigned to SDC B using ordinary moment frames as part of the seismic-force-resisting system, the provisions of 21.1.2 and 21.2 shall apply. For a structure assigned to SDC B and using intermediate or special systems, the applicable provisions of 21.1.3 through 21.1.7, and 21.3 through 21.10 shall also apply.~~

~~21.1.1.4 *Structures assigned to SDC C shall comply with Chapters 1 through 19, and the seismic-force-resisting system shall be intermediate or special moment frames, intermediate precast structural walls, or ordinary reinforced concrete or special structural walls.* For a structure assigned to SDC C and using intermediate moment frames as part of the seismic-force-resisting system the provisions of 21.1.2 and 21.3 shall apply. For a structure assigned to SDC C and using special moment frames, or intermediate precast or special structural walls, the applicable provisions of 21.1.3 through 21.1.7, and 21.4 through 21.10 shall also apply. Any structure assigned to SDC C shall satisfy 21.1.8. *Except for footings and basement walls in accordance with 22.10, structural elements of plain concrete are prohibited.*~~

~~21.1.1.5 *Structures assigned to SDC D, E or F shall comply with Chapters 1 through 19, and the seismic-force-resisting system shall be special moment frames, intermediate precast structural walls, or special structural walls.* For a structure assigned to SDC D, E, or F, the provisions of 21.1.2 through 21.1.8 and 21.4 through 21.13 shall apply. *Except for footings and basement walls in accordance with 22.10, structural elements of plain concrete are prohibited.*~~

41.5.1.3 Scope. Paragraphs 21.1.1.3 and 21.1.1.7 of ACI 318 shall be modified to read as shown in 41.5.1.3.1 and 41.5.1.3.2.

41.5.1.3.1 Structures assigned to Seismic Design Category A shall satisfy requirements of Chapters 1 to 19 and 22; Chapter 21 of ACI 318 does not apply. Structures assigned to Seismic Design Category B, C, D, E, or F also shall satisfy 21.1.1.4 through 21.1.1.8 of ACI 318, as applicable. Except for structural elements of plain concrete complying with 41.5.1.9, structural elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E or F.

41.5.1.3.2 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 21 of ACI 318 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*:

(1) Ordinary moment frames shall satisfy Section 21.2 of ACI 318.
(2) Ordinary *reinforced concrete* structural walls *and ordinary precast structural walls* need not satisfy any provisions in Chapter 21 of ACI 318.
(3) Intermediate moment frames shall satisfy Section 21.3 of ACI 318.
(4) Intermediate precast *structural* walls shall satisfy Section 21.4 of ACI 318.
(5) Special moment frames shall satisfy Section 21.5 through Section 21.8 of ACI 318.
(6) Special structural walls shall satisfy Section 21.9 of ACI 318.
(7) Special structural walls *constructed using precast concrete* shall satisfy Section 21.10 of ACI 318.
(8) All special moment frames and special structural walls shall also satisfy 21.1.3 through 21.1.7 of ACI 318.

41.5.1.4 Intermediate Precast Structural Walls. Section 21.4 of ACI 318 shall be modified by renumbering 21.4.3 to 21.4.4 and adding new 21.4.3 and 21.4.5 to read as shown in 41.5.1.4.1 through 41.5.1.4.3.1.

41.5.1.4.1 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.

41.5.1.4.2 Elements of the connection that are not designed to yield shall develop at least 1.5 Sy.

41.5.1.4.3 Wall piers not designed as part of a moment frame shall have transverse reinforcement designed to resist the shear forces determined from 21.3.3 of ACI 318. Spacing of transverse reinforcement shall not exceed 8 in. (203 mm). Transverse reinforcement shall be extended beyond the pier clear height for at least 12 in. (305 mm).

Exceptions: *The preceding requirement need not apply in the following situations:*

(1) Wall piers that satisfy 21.13.

(2) Wall piers along a wall line within a story where other shear wall segments provide lateral support to the wall piers and such segments have a total stiffness of at least six times the sum of the stiffnesses of all the wall piers.

41.5.1.4.3.1 Wall segments with a horizontal length-to-thickness ratio less than 2.5 shall be designed as columns.

41.5.1.5 Wall Piers and Wall Segments. Section 21.9 of ACI 318 shall be modified by adding new 21.9.10 of ACI 318 to read as shown in 41.5.1.5.1 through 41.5.1.5.1.3.

41.5.1.5.1 Wall Piers and Wall Segments.

41.5.1.5.1.1 Wall piers not designed as a part of a special moment frame shall have transverse reinforcement designed to satisfy the requirements in 21.9.10.2 of ACI 318.

Exceptions:

(1) Wall piers that satisfy Section 21.13 of ACI 318.

(2) Wall piers along a wall line within a story where other shear wall segments provide lateral support to the wall piers, and such segments have a total stiffness of at least six times the sum of the stiffnesses of all the wall piers.

41.5.1.5.1.2 Transverse reinforcement with seismic hooks at both ends shall be designed to resist the shear forces determined from 21.6.5.1 of ACI 318. Spacing of transverse reinforcement shall not exceed 6 in. (152 mm). Transverse reinforcement shall be extended beyond the pier clear height for at least 12 in. (305 mm).

41.5.1.5.1.3 Wall segments with a horizontal length-to-thickness ratio less than 2.5 shall be designed as columns.

41.5.1.6 Special Precast Structural Walls. Subsection 21.10.2 of ACI 318 shall be modified to read as shown in 41.5.1.6.1.

41.5.1.6.1 Special structural walls constructed using precast concrete shall satisfy all the requirements of Section 21.9 of ACI 318 for cast-in-place special structural walls in addition to 21.4.2 through 21.4.4 of ACI 318.

41.5.1.7 Foundations. Paragraph 21.12.1.1 of ACI 318 shall be modified to read as shown in 41.5.1.7.1.

41.5.1.7.1 Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and ground shall comply with the requirements of Section 21.12 of ACI 318 and other applicable provisions of ACI 318 unless modified by Sections 12.1.5, 12.13, or 14.2 of ASCE/SEI 7.

41.5.1.8 Detailed Plain Concrete Structural Walls. Section 22.6 of ACI 318 shall be modified by adding new 22.6.7 to read as shown in 41.5.1.8.1 through 41.5.1.8.1.3.

41.5.1.8.1 Detailed Plain Concrete Structural Walls.

41.5.1.8.1.1 Detailed plain concrete structural walls are walls conforming to the requirements of ordinary structural plain concrete walls and 22.6.7.2 of ACI 318.

41.5.1.8.1.2 Reinforcement shall be provided as follows:

(1) Vertical reinforcement of at least 0.20 in.^{2} (129 mm^2) 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 22.6.6.5 of ACI 318.

(2) Horizontal reinforcement at least 0.20 in.^{2} (129 mm^2) in cross-sectional area shall be provid.:

(a) Continuously at structurally connected roof and floor levels and at the top of walls.

(b) At the bottom of load-bearing walls or in the top of foundations where doweled to the wall.

(c) At a maximum spacing of 120 in. (3048 mm).

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

41.5.1.9 Plain Concrete in Structures Assigned to Seismic Design Category C, D E, or F. Section 22.10 of ACI 318 shall be deleted and replaced with text shown in 41.5.1.9.1 through 41.5.1.9.2.

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

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

(1) Structural plain concrete basement, foundation, or other walls below the base 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 ft (2438 mm), the thickness shall not be less than 7-1/2 in. (190 mm), and the wall shall retain no more than 4 ft (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with 22.6.6.5.

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

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

(3) Plain concrete footings supporting walls are permitted provided the footings have not less than 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 in. (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 detached one- and two-family dwellings three stories or less in height and constructed with stud-bearing walls, plain concrete footings supporting walls and without longitudinal reinforcement are permitted.

(2) For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, a minimum of one bar shall be provided at the top of the stemwall and at the bottom of the footing.

(3) Where a slab-on-ground is cast monolithically with the footing, one No. 5 bar is permitted to be located at either the top or bottom of the footing.

41.5.1.10 Strength Requirements for Anchors. Modify Section D.4 of ACI 318 shall be modified by adding a new exception at the end of D.4.2.2 to read as follows:

Exception: *If N_b is determined using Eq. D-7 of ACI 318, the concrete breakout strength of D.4.2 of ACI 318 shall be considered satisfied by the design procedure of D.5.2 and D.6.2 of ACI 318 without the need for testing regardless of anchor bolt diameter and tensile embedment.*