

PROPOSAL 4-3 (2009)

SCOPE: Sec. 14.2 Concrete Sec. 14.2.3 Additional Detailing Requirements for Concrete Piles

PROPOSAL FOR CHANGE:

1 **Revise Sec. 14.2.3 and Sec. 14.2.3.1 of Part 1 of the 2009 Provisions as follows:**

2
3 **14.2.3 Additional Detailing Requirements for Concrete Piles.** In addition to the foundation
4 requirements set forth in Section 12.1.5 and 12.13 and in Section 21.12 ~~21.10~~ of ACI 318,
5 design, detailing and construction of concrete piles shall conform to the provisions this section.
6

7 **14.2.3.1 Concrete Pile Requirements for Seismic Design Category C.** Concrete piles in
8 structures assigned to Seismic Design Category C shall comply with the requirements of this
9 section.
10

11 **14.2.3.1.1 Anchorage of Piles.** All concrete piles and concrete filled pipe piles shall be
12 connected to the pile cap by embedding the pile reinforcement in the pile cap for a distance equal
13 to the development length as specified in ACI 318 as modified by Section 14.2.2 of this standard
14 or by the use of field-placed dowels anchored in the concrete pile. For deformed bars, the
15 development length is the full development length for compression or tension, in the case of
16 uplift, without reduction in length for excess area.
17

18 Hoops, spirals, and ties shall be terminated with seismic hooks as defined in Section 2.2 ~~21.1~~ of
19 ACI 318.
20

21 Where a minimum length for reinforcement or the extent of closely spaced confinement
22 reinforcement is specified at the top of the pile, provisions shall be made so that those specified
23 lengths or extents are maintained after pile cut-off.
24

25 **Revise Sections 14.2.3.2.1 through 14.2.3.2.5 of Part 1 of the 2009 Provisions as**
26 ***follows:***
27

28 **14.2.3.2.1 Site Class E or F Soil.** Where concrete piles are used in Site Class E or F, they
29 shall ~~have transverse reinforcement be designed and detailed~~ in accordance with Sections
30 21.6.4.2 through 21.6.4.4 ~~21.4.4.1, 21.4.4.2, and 21.4.4.3~~ of ACI 318 within seven pile diameters
31 of the pile cap and the interfaces between strata that are hard or stiff and strata that are
32 liquefiable or are composed of soft to medium stiff clay.
33

34 **14.2.3.2.2 Nonapplicable ACI 318 Sections for Grade Beam and Piles.** Section 21.12.3.3
35 ~~21.10.3.3~~ of ACI 318 need not apply where grade beams have the required strength to resist the
36 forces from the load combinations with overstrength factor of Section 12.4.3.2 or 12.14.3.2.2.

1 Section ~~21.12.4.4(a)~~ ~~21.10.4.4(a)~~ of ACI 318 need not apply to concrete piles. Section
2 ~~21.12.4.4(b)~~ ~~21.10.4.4(b)~~ of ACI 318 need not apply to precast, prestressed concrete piles.
3

4 **14.2.3.2.3 Reinforcement for Uncased Concrete Piles (SDC D through F).** Reinforcement
5 shall be provided where required by analysis. For uncased cast-in-place drilled or augered
6 concrete piles, a minimum of four longitudinal bars with a minimum longitudinal reinforcement
7 ratio of 0.005 and transverse reinforcement in accordance with Sections 21.6.4.2 through
8 21.6.4.4 ~~Section 21.4.4.1, 21.4.4.2, and 21.4.4.3~~ of ACI 318 shall be provided throughout the
9 minimum reinforced length of the pile as defined below starting at the top of the pile. The
10 longitudinal reinforcement shall extend beyond the minimum reinforced length of the pile by the
11 tension development length.
12

13 The minimum reinforced length of the pile shall be taken as the greater of

- 14 1. One-half of the pile length.
- 15 2. A distance of 10 ft (3m).
- 16 3. Three times the pile diameter
- 17 4. The flexural length of the pile which shall be taken as the length of from the bottom of the
18 pile cap to a point where the concrete section cracking moment multiplied by a resistance
19 factor 0.4 exceeds the required factored moment at that point.
20

21 In addition, for piles located in Site Classes E or F, longitudinal reinforcement and transverse
22 confinement reinforcement, as described above, shall extend the full length of the pile.
23

24 Where transverse reinforcement is required, transverse reinforcing ties shall be a minimum of
25 No. 3 bars for up to 20-in.-diameter (300 mm) piles and No.4 bars for piles of larger diameter.
26

27 In Site Classes A through D, longitudinal reinforcement and transverse confinement
28 reinforcement, as defined above, shall extend a minimum of seven times the pile diameter above
29 and below the interfaces of soft to medium stiff clay or liquefiable strata except that transverse
30 reinforcing ties not located within the minimum reinforced length shall be permitted to use a
31 transverse spiral reinforcement ratio of not less than one-half of that required in Section
32 21.6.4.4(a) ~~21.4.4.1(a)~~ of ACI 318. Spacing of transverse reinforcement not located within the
33 minimum reinforced length is permitted to be increased, but shall not exceed the least of the
34 following:

- 35 1. 12 longitudinal bar diameters.
- 36 2. One-half the pile diameter.
- 37 3. 12 in. (305 mm).

38
39 **14.2.3.2.4 Reinforcement for Metal-Cased Concrete Piles (SDC D through F).**
40 Reinforcement requirements are the same as for uncased concrete piles.
41

42 **EXCEPTION:** Spiral-welded metal-casing of a thickness not less than No. 14 gauge
43 can be considered as providing concrete confinement equivalent to the closed ties or
44 equivalent spirals required in an uncased concrete pile, provided that the metal casing
45 is adequately protected against possible deleterious action due to soil constituents,
46 changing water levels, or other factors indicated by boring records of site conditions.

1
2 **14.2.3.2.5 Reinforcement for Precast Concrete Piles (SDC D through F).** Transverse
3 confinement reinforcement consisting of closed ties or equivalent spirals shall be provided in
4 accordance with Sections 21.6.4.2 through 21.6.4.4 ~~21.4.4.1, 21.4.4.2, and 21.4.4.3~~ of ACI 318
5 for the full length of the pile.

6
7 **EXCEPTION:** In other than Site Classes E or F, the specified transverse confinement
8 reinforcement shall be provided within three pile diameters below the bottom of the pile cap,
9 but it shall be permitted to use a transverse reinforcing ratio of not less than one-half of that
10 required in Section 21.6.4.4(a) ~~21.4.4.1(a)~~ of ACI 318 throughout the remainder of the pile
11 length.

12
13 **REASON FOR PROPOSAL:**

14
15 To amend the ACI 318 Section Numbers in ASCE/SEI 7-05 Section 14.2.3 so that
16 they are consistent with ACI 318-08 rather than ACI 318-05.

17
18 No additional significant revisions of this ASCE/SEI Sec. 14.2.3 are proposed at
19 this time because of several on-going studies in the area of this proposal. The
20 recently completed PCI sponsored study by Fanous et al. (see text of proposal),
21 and work by Mays et al. in South Carolina and by the Structural Engineers
22 Association of Washington, and others, needs to be reviewed before such
23 revisions are proposed. An ACI 318 Task Group is working on the development
24 of appropriate revisions for the next ACI 318 Code.

25
26 **TS-4 VOTE:** In a ballot canvassed 12/14/2007 TS-4 voted

27 *YES = 9 Yes with Reservations = 1 No = 0 Not Voting = 1*

28
29 Amendments were made to the original proposal to address the Y/R and an editorial correction.
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