

precast nonprestressed concrete piles. The longitudinal reinforcing shall be confined with closed ties or equivalent spirals of a minimum 3/8 in. (10 mm) diameter. Transverse confinement reinforcing shall be provided at a maximum spacing of eight times the diameter of the smallest longitudinal bar, but not to exceed 6 in. (152 mm), within three pile diameters of the bottom of the pile cap. Outside of the confinement region, closed ties or equivalent spirals shall be provided at a 16 longitudinal-bar-diameter maximum spacing, but not greater than 8 in. (200 mm). Reinforcement shall be full length.

14.2.3.1.6 Reinforcement for Precast Prestressed Piles (SDC C) For the upper 20 ft (6 m) of precast prestressed piles, the minimum volumetric ratio of spiral reinforcement shall not be less than 0.007 or the amount required by the following equation:

$$\rho_s = \frac{0.12f'_c}{f_{yh}} \quad (14.2-1)$$

where

ρ_s = volumetric ratio (vol. spiral/vol. core)

f'_c = specified compressive strength of concrete, psi (MPa)

f_{yh} = specified yield strength of spiral reinforcement, which shall not be taken greater than 85,000 psi (586 MPa)

A minimum of one-half of the volumetric ratio of spiral reinforcement required by Eq. 14.2-1 shall be provided for the remaining length of the pile.

14.2.3.2 Concrete Pile Requirements for Seismic Design Categories D through F

Concrete piles in structures assigned to Seismic Design Category D, E, or F shall comply with the requirements of this section.

14.2.3.2.1 Site Class E or F Soil Where concrete piles are used in Site Class E or F, they shall have transverse reinforcement in accordance with Sections 21.6.4.2 through 21.6.4.4 of ACI 318 within seven pile diameters of the pile cap and of the interfaces between strata that are hard or stiff and strata that are liquefiable or are composed of soft to medium stiff clay.

14.2.3.2.2 Nonapplicable ACI 318 Sections for Grade Beam and Piles Section 21.12.3.3 of ACI 318 need not apply to grade beams designed to resist the seismic load effects including overstrength factor of Section 12.4.3 or 12.14.3.2. Section 21.12.4.4(a) of

ACI 318 need not apply to concrete piles. Section 21.12.4.4(b) of ACI 318 need not apply to precast, prestressed concrete piles.

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

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

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

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

Where transverse reinforcing is required, transverse reinforcing ties shall be a minimum of No. 3 bars for up to 20-in.-diameter (500 mm) piles and No. 4 bars for piles of larger diameter.

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

1. 12 longitudinal bar diameters.
2. One-half the pile diameter.
3. 12 in. (300 mm).