

SECTION 2362
DRILLED, CAST-IN-PLACE CONCRETE PIERS

PART 1.0 – GENERAL

1.01 SCOPE OF WORK

- A. Work Included - The work in this section shall include the material, equipment and labor necessary to layout and construct drilled, straight shaft, vertical reinforced cast-in-place concrete piers, with or without temporary casing, in the locations and to the depths shown on the plans. The work shall include excavation dewatering, form work and other work incidental thereto.

1.02 QUALITY ASSURANCE

- A. Notification - No site work shall be performed without notification of the Engineer at least 2 full working days prior to commencement of work.
- B. Site Information - The Contractor shall satisfy himself as to the nature and quantity of materials likely to be encountered at the site and other work to be performed, and any differences between site conditions shown on the drawings and the actual conditions immediately prior to commencement of work.
- C. Inspection and Testing - The Contractor shall provide the Engineer with access to the work and all reasonable facilities for inspecting and checking the work.
- D. Conformance of Materials - All materials used in the construction of the drilled piers shall conform to the most recent version and relevant standards of the American Society for Testing and Materials (ASTM), American Concrete Institute (ACI), International Association of Foundation Drilling (ADSC), Caltrans Standard Specifications (Caltrans), or other standards specified by the Engineer.

PART 2.0 – PRODUCTS

2.01 CONCRETE

The concrete must have a quality of workability suitable for uniform and proper placement, and when cured must have the required strength and durability. The concrete shall have a minimum 28 day compressive strength (f'_c) of 3,000 psi, unless otherwise specified by the Engineer.

When concrete is placed, the concrete slump shall conform to the requirement of the following Table measured in accordance with ASTM C-143.

Slump Range
5" ± 1"

Conditions
Placed in water-free uncased drilled hole.

- No reinforcement or reinforcement spaced 12 inches or greater, and

- No under-reamed bell.
- 6" ± 1 1/2" Placed in water-free drilled hole.
- Temporary casing used, or
 - Reinforcement closer than 12 inches, or
 - Under-reamed bell
- 7" ± 1" Placed by tremie under water or under drilling mud.

2.02 STEEL REINFORCING

Steel reinforcement shall be deformed bars of ASTM grade 60 ksi steel and conform to Caltrans, Section 52. The length and size of the steel reinforcement shall be as shown on the plans.

PART 3.0 – EXECUTION

3.01 EQUIPMENT

Pier excavations shall be drilled with a bucket or auger type drilling rig or other equipment of suitable capacity and power to excavate to the required diameter and depth. The diameter of the drilling bucket or auger bit, or the inside diameter of the casing, shall be equal to or larger than the required diameter, as shown on the plans. The drilling tools shall include carbide tipped augers and rock coring buckets as necessary for the conditions at the site. If necessary to prevent sloughing and caving, the Contractor shall use temporary steel casing of suitable size and strength.

3.02 ALIGNMENT

All pier excavations shall be located and aligned by the Contractor. The center of the top of the drilled hole shall not deviate more than three (3) inches in any direction from the center location shown on the plans.

3.03 DRILLED EXCAVATION

The pier excavation shall be performed under the observation of the Engineer, to confirm that subsurface conditions are as expected. The Contractor shall keep records of all pier excavation depths and the transition depth from soil to rock. Adjustments to the planned pier depths may be required by the Engineer

- A. Soil - Soil can be excavated with auger type equipment. If the drilled excavation is unstable and/or sloughing of the sides is occurring, then temporary casing must be used to maintain stability during and after drilling. As an alternate, drilling mud may be used to maintain hole stability, but only after the Contractor has fully described his proposed method, materials, and procedures and has received approval from the Engineer.
- B. Rock - Weathered rock can be excavated with some difficulty using heavy carbide tipped auger type equipment.

- C. Hard Rock - Hard rock is defined as rock that requires a rock core barrel or other hard rock equipment to excavate. The determination of the presence and depth of hard rock, if a separate pay item, shall be made by the Engineer.
- D. Cleanout - All water, loose soil, rocks and other debris shall be removed from the bottom of the drilled excavation prior to placing steel or concrete. Should small amounts of water or other material remain in the hole which cannot physically be removed to the satisfaction of the Engineer, then the Contractor shall place dry cement or sand-cement grout in the bottom of the hole as directed by the Engineer to stabilize the loose material.
- E. Ground Water - Should ground water be encountered during excavation operations, the pumping of water shall be required. The casing provided shall support the pier walls and prevent significant wall erosion due to flow of ground water. No more than two (2) inches of water will be permitted in the bottom of the pier at the time concrete placement begins, provided dry cement is placed in hole prior to placing concrete.
- F. Oversize Pier Head - If the pier excavation is fifty (50) percent or more greater than the design diameter within the upper five (5) feet, the upper five (5) feet of the shaft shall be formed to the design diameter.

3.04 PLUMBNESS

Pier excavations shall be made as nearly vertical as possible. The tip of the pier shall vary no more than one-half (1/2) of the pier diameter from the designated ground surface location. Steel reinforcement shall be placed vertically and securely blocked so that all steel is covered with at least three (3) inches of concrete.

3.05 PIER EXTENSION

If the Engineer directs a pier to be drilled two (2) feet or less deeper than that shown on the plans, reinforcing steel cage need not be extended. If the pier extension is greater than two (2) feet but no more than five (5) feet, each vertical cage bar shall be extended to within 0.5 feet of the bottom of the hole with a bar of equal size. Such extension bars shall overlap the cage bars by 36 diameters. Pier extensions greater than five (5) feet will be subject to redesign by the Engineer.

3.06 CONCRETE PLACEMENT

Each pier excavation and reinforcing steel placement may be inspected by the Engineer prior to placement of concrete. Concrete placement shall start as soon as possible after the drilling, dewatering, cleanout and steel placement is completed and shall progress in a continuous operation so that not more than one hour elapses between beginning and completion of the concrete placement in any pier excavation. A record of the amount of concrete placed in each excavation shall be maintained by the Contractor.

- A. Concrete Placement in Dry Excavation - To prevent segregation, concrete shall be placed so that it does not deflect off the sides of the holes or reinforcing steel. Concrete shall not free fall more than 10 feet. Tremie pipes with hoppers or flexible trunks, or approved alternate methods of placement shall be used where necessary. Concrete shall not rebound off the sides of the pier walls or reinforcing bars.

- B. Concrete Placement in Slurry Supported Excavation - Concrete placed in a slurry supported excavation or an excavation containing ground water in excess of 6 inches shall be tremied into the excavation. The concrete shall be placed by tremie pipe and hopper or pumped into the excavation with the pipe or pump hose placed at the bottom of the drilled hole. The pipe or pump hose shall be maintained at least 2 feet below the top of concrete as the level of concrete rises in the excavation. The top of concrete level shall be determined by probing.
- C. Concrete Placement in Cased Excavation - As concrete is placed, the casing shall be removed from the hole, however, the bottom of the casing shall be maintained no less than two (2) feet below the top of the concrete to prevent intrusion of the surrounding rock or soil into the concrete. The column of concrete shall not be permitted to separate during withdrawal of the casing, as evidenced by a rise of the surface of the concrete as the casing is being pulled. Hammering, vibrating the concrete internally or vibrating the casing, or other means shall be used, as necessary, to prevent separation. If the concrete column becomes separated, the steel reinforcing shall immediately be withdrawn from the hole and the concrete removed from the pier excavation before it sets up.
- D. Concrete Vibration - Concrete from bottom of the pier and extending to five (5) feet below grade shall not be vibrated. Concrete from five (5) feet below grade to top of the pier shall be thoroughly vibrated to ensure a well mixed and homogenous concrete.

END OF SECTION