

**Table 2.6—Required slurry properties**

Item to be measured	Range of results at 68 F (20 C)	Test methods
1. Density before concreting lb/ft <sup>3</sup> (kg/m <sup>3</sup> ) for slurry 1 ft (300 mm) from pier bottom		(Mud balance) ASTM D 4380
a. Mineral slurries (bentonite/attapulгите)		
1. No end bearing	85 max (1.4 × 10 <sup>3</sup> )	
2. With end bearing	70 max (1.0 × 10 <sup>3</sup> )	
b. Polymer slurry		
1. No end bearing	64 max (1.0 × 10 <sup>3</sup> )	
2. With end bearing	64 max (1.0 × 10 <sup>3</sup> )	(Marsh funnel) API— RP13B—Section 2
2. Marsh funnel viscosity for entry, s/qt (s/L)		
a. Bentonite/attapulгите	26 to 50	
b. Polymer slurry	40 to 90*	(Sand screen set) ASTM D 4381
3. Sand content in slurry, immediately before concreting, 1 ft. (300 mm) from bottom, by volume, %		
a. Mineral slurries (bentonite/attapulгите)		
1. With end bearing	4 max	
2. No end bearing	20 max	
b. Polymer slurry		
1. With end bearing	1 max	
2. No end bearing	1 max	
4. pH during excavation	7 to 12	ASTM D 4972

\*Or as recommended by manufacturer and accepted by the Owner's Representative-Geotechnical Engineer.

### 3.2—Dry method

**3.2.1** Excavate drilled piers to dimensions and required elevations shown on the Project Drawings. Clear all obstructions encountered during excavation.

**3.2.2** Maintain sidewall stability during drilling and extend excavation to the stratum specified by the Owner's Representative-Geotechnical Engineer.

**3.2.3** The Owner's Representative-Geotechnical Engineer will determine actual final bearing levels during excavation based on suitability of bearing stratum.

**3.2.3.1** For end-bearing piers, explore bearing stratum with a probe hole to a minimum depth equal to the diameter of the bearing area below the bottom of each drilled pier, unless otherwise directed by the Owner's Representative-Geotechnical Engineer.

**3.2.3.2** Provide a safe method for personnel access to inspect the bottom of the drilled pier. Alternatives to direct downhole inspection shall be approved by the Owner's Representative-Geotechnical Engineer.

**3.2.3.3** Excavate for drilled pier bells, if applicable, immediately upon confirmation of the acceptability of the bearing stratum by the Owner's Representative-Geotechnical Engineer.

**3.2.3.4** Determine bell dimensions.

**3.2.4** Check each drilled pier for toxic and explosive gas before personnel enters and while personnel are in-hole. If

gas is found, ventilate with forced air until safe for entry, or follow alternative procedures acceptable to the Owner's Representative. During hand belling or other operations necessitating entry into the shaft, provide gas-testing equipment and a protective cage, or temporary casing of proper diameter, length, and thickness, plus other safety equipment called for by federal, state, and local laws for inspection and testing of drilled piers and protection of workers.

**3.2.5** Remove loose material and free water from bottom of drilled piers, unless otherwise directed by the Owner's Representative-Geotechnical Engineer. If the bottom is sloping rock, excavate to either a level plane (see 3.1.5) or step the bottom with one step whose rise is less than 1/4 the diameter of the bearing area.

**3.2.6** Excavate rock sockets as specified by the Contract Documents. Provide the socket roughness specified. Drill a probe hole to a maximum depth of one pier diameter, unless otherwise directed by the Owner's Representative-Geotechnical Engineer.

**3.2.7** Keep all excavated materials an acceptable distance away from each open pier excavation.

### 3.3—Steel casing and liner

#### 3.3.1 *Delivery, handling, and storage of casing*

**3.3.1.1** Deliver casing to the site in an undamaged condition.

**3.3.1.2** Handle and protect casing to maintain diameter within ±2% of the specified diameter.

**3.3.2** Casing shall be continuously joined and have the strength and rigidity needed to maintain the required excavation dimensions against earth, drilling, and water pressures. If an inner permanent liner is used to permit casing withdrawal, it shall have the strength and rigidity to contain the concrete during placement.

**3.3.2.1** Provide steel casing for shaft excavation where required. Make diameter of excavation such that the void space outside any temporary casing is minimized.

**3.3.2.2** Withdrawal of temporary casing is the Contractor's option, provided the requirements in Section 3.6 are met.

### 3.4—Reinforcing steel

**3.4.1** Reinforce drilled piers as specified in the Contract Documents.

**3.4.2** Place reinforcement for drilled piers, as shown on the Contract Documents, after acceptance of the drilled pier excavation.

**3.4.3** Reinforcement shall be free of mud, oil, other surface contamination, and excessive corrosion at time of concrete placement, in accordance with ACI 301.

**3.4.4** The sizes and configuration of vertical reinforcing and tie steel shall be as shown on the Project Drawings. Maintain proper dimension and location of reinforcing steel during concreting operations.

**3.4.5** Straighten or repair bars with kinks or unspecified bends in a manner acceptable to the Owner's Representative that will not damage the bars and will maintain the required cover.