

**701.3.3.1 Slurry Usage.** Drilling slurry shall be used if detailed in the approved installation plan, if in accordance with the contract documents or if approved in writing by the engineer. Drilling slurry may be used at the contractor's option if the slurry is not in accordance with the contract documents; however, any slurry shall be approved by the engineer prior to use. Drilling slurry, when used, will be noncompensable and effect on time of performance due to the use of the slurry will be nonexcusable.

**701.3.3.2 General Properties.** The material used to make the slurry shall not be detrimental to the concrete or surrounding ground strata. Mineral slurries shall have both a mineral grain size that remains in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. Polymer slurries shall have sufficient viscosity and gel characteristics to transport excavated material to suitable screening systems or settling tanks. The percentage and specific gravity of the material used to make the slurry shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement. If approved by the engineer, the contractor may use water and on-site soils as a drilling slurry. In that case, the range of acceptable values for density, viscosity and pH, as shown in the following table for bentonite slurry, shall be met, except that maximum density (unit weight) shall not exceed 70 pounds/cubic foot (1120 kg/m<sup>3</sup>). When water is used as the drilling fluid to construct rock sockets in limestone, dolomite, sandstone or other formations that are not erodible, the requirements for slurry testing will not apply.

**701.3.3.3 Preparation.** Prior to introduction into the shaft excavation, the manufactured mineral or polymer slurry admixture shall be pre-mixed thoroughly with clean, fresh water and for adequate time in accordance with the slurry admixture manufacturer's recommendations allotted for hydration. Water used for mixing shall be in accordance with Sec 1070. Slurry tanks of adequate capacity will be required for slurry mixing, circulation, storage and treatment. No excavated slurry pits will be allowed in lieu of slurry tanks without written approval from the engineer. Adequate desanding equipment will be required as necessary to control slurry properties during the drilled shaft excavation in accordance with the values provided in the table below. Desanding will not be required for signposts or lighting mast foundations unless specified in the contract documents.

**701.3.3.4 Control Tests.** Control tests using a suitable apparatus shall be performed by the contractor on the slurry to determine density, viscosity, sand content and pH of freshly mixed slurry, recycled slurry and slurry in the excavation. Tests of slurry samples from within one foot (0.3 m) of the bottom and at mid-height of the shaft shall be conducted in each shaft excavation during the excavation process to establish a consistent working pattern. A minimum of four sets of tests shall be conducted during the first eight hours of slurry use on the project. When the results show consistent behavior, the testing frequency may be decreased to one set every four hours of slurry use, or as otherwise approved by the engineer. Reports of all tests, signed by an authorized representative of the contractor, shall be furnished to the engineer on completion of each drilled shaft. An acceptance range of values for the physical properties will be as shown in the table below.

**701.3.3.5 Sampling.** When slurry samples are found to be unacceptable, the contractor shall bring the slurry in the shaft excavation to within specification requirements. Concrete shall not be poured until resampling and testing results produce acceptable values. Prior to placing shaft concrete, the contractor shall take slurry samples from within one foot (0.3 m) of the bottom and at mid-height of the shaft. Any heavily contaminated slurry that has accumulated at the bottom of the shaft shall be removed. Disposal of all slurry shall be done in areas approved by the engineer. The contractor shall perform final shaft bottom cleaning after suspended solids have settled from the slurry mix.

Range of Acceptable Values for Mineral and Polymer Slurries in Fresh Water Without Additives					
Property	Bentonite	Emulsified Polymer	Dry Polymer	Units	Test Method
<b>Density (Unit Weight)</b>					
At Introduction	63.5 - 66.8 (1017-1070)	< 63 (1009)	< 63 (1009)	lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	Density Balance
Prior to Concreting	63.5 - 70.5 (1017-1129)	< 63 (1009)	< 63 (1009)		
<b>Marsh Funnel Viscosity</b>					
At Introduction	32 - 60 (34 - 63)	33 - 43 <sup>b</sup> (35 - 45) <sup>b</sup>	50 - 80 <sup>b</sup> (53 - 85) <sup>b</sup>	sec/qt (sec/liter)	Marsh Funnel
Prior to Concreting	32 - 60 (34 - 63)	33 - 43 <sup>b</sup> (35 - 45) <sup>b</sup>	50 - 80 <sup>b</sup> (53 - 85) <sup>b</sup>		
<b>pH</b>					
At Introduction	8 - 10	8 - 11	7 - 11	--	pH Paper or pH Meter
Prior to Concreting	8 - 10	8 - 11	7 - 11	--	
<b>Sand Content</b>					
At Introduction	< 4	< 1	< 1	Percent by Volume	API Sand Content Kit
Prior to Concreting	< 10	< 1	< 1		
<b>Maximum Contact Time<sup>a</sup></b>	4	72	72	Hours	

<sup>a</sup>Without agitation and sidewall cleaning.

<sup>b</sup>Higher viscosities may be required to maintain excavation stability in loose or gravelly sand deposits.

#### 701.4 Construction.

**701.4.1 Protection of Existing Structures.** All precautions shall be taken to prevent damage to existing structures and utilities. These measures shall include, but are not limited to, monitoring and controlling the vibrations from the driving of casing or drilling of the shaft, and selecting construction methods and procedures that shall prevent excessive caving of the shaft excavation.

**701.4.2 Technique Shafts.** When required by the contract documents, the contractor shall demonstrate the adequacy of methods and equipment used during construction of the first drilled shaft, which shall be an out of position technique shaft, constructed with reinforcement as identified for production shafts on the plans. This technique shaft shall be drilled in the position as directed by the engineer and drilled to the maximum depth for any production shaft shown on the plans. If at any time the contractor is unable to demonstrate, to the satisfaction of the engineer, the adequacy of methods or equipment and alterations required, an additional technique shaft(s) may be required. Technique shafts shall be cut off 3 feet (0.9 m) below groundline, buried or otherwise disposed of as specified in the contract documents or as directed by the engineer. Once approval has been given to construct production shafts, no changes will be permitted in the methods of equipment used to construct the shaft without approval from the engineer. When a technique shaft is not required, construction of the first production shaft will be used to determine if the methods and equipment used by the contractor are acceptable. Failure at any time to demonstrate to the engineer the adequacy of methods or equipment will be cause for the engineer to require appropriate alterations in equipment or method by the contractor to eliminate unsatisfactory results.