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concrete after hardening. These casings can be removed when the concrete has attained sufficient strength provided the following criteria are met.

1. Curing of the concrete is continued for the full curing period in accordance with the specifications.

2. Shaft concrete is not exposed to salt water or moving water for seven days or until reaching a compressive strength of at least 2500 psi (17.3 MPa).

814.12 SLURRY. When slurry is employed in the drilling process as in the wet construction method, mineral slurry or polymer slurry may be used in accordance with these specifications. The contractor shall provide a list of construction projects, within the past three years, where the proposed slurry has been used to construct drilled shafts in comparable site conditions as those anticipated for the required drilled shafts. The project list shall contain names and telephone numbers of owner's representatives who can verify the field performance of the proposed slurry.

All equipment in contact with the water or slurry during mixing or transporting to the excavation, such as mixing tanks, pumps, and water lines, shall be free of fresh concrete residue.

(a) Polymer Slurry:

(1) Approval Process: Polymer slurries and additives may be used when approved in writing by the DOTD Chief Construction Engineer. The request for approval of a polymer slurry shall be included with the drilled shaft installation plan. The following information shall be furnished with the submittal:

a. The manufacturer's specifications for polymer slurry and any additives.

b. Recommended instructions for proper slurry mixing

As a prerequisite to final approval of the polymer slurry, the Department may require construction of a trial shaft in accordance to Subsection 814.21 to evaluate the slurry's performance during drilled shaft construction. A manufacturer's representative shall be present during construction of the trial shaft or test drilled shaft to instruct DOTD and the contractor's personnel in the proper testing and construction techniques for the proposed polymer slurry.

(2) Polymer Slurry Requirements: The approved polymer slurry shall have sufficient viscosity to stabilize the shaft excavation and sufficient positive pressure head to inhibit the influx of ground water into the excavated hole. The material used to make the slurry shall not be detrimental to concrete

or surrounding ground strata. Control testing using suitable apparatus shall be carried out on the polymer slurry mixture by the contractor to determine the density, sand content, viscosity, and pH. Tests shall be performed when the slurry temperature is above 40°F (5°C). Acceptable values for these physical properties are shown in Table 814-1.

Table 814-1
Polymer Slurry Specifications

Property (Units)	At Time of Slurry Introduction	In Hole at Time of Concreting	Test Method
Density	63-64 pcf (1010 - 1026 kg/m ³) (fresh water)	63-64 pcf (1010 - 1026 kg/m ³) (fresh water)	Mud Balance (API 13B-Sec 1)
Viscosity (minimum)	45 seconds	N/A	Marsh Funnel (API 13B-Sec 2)
pH	8 – 10	8 – 10	pH Paper pH Meter (API 13B-Sec 6)
Max. Sand Content (% by Volume)	1	1	Sand Screen Set (API 13B- Sec 4)

The limits shown in Table 814-1 may be adjusted when field conditions warrant as demonstrated by a trial shaft, test drilled shaft, or other methods approved by the engineer.

(3) Polymer Slurry Mixing: The polymer slurry shall be mixed thoroughly with clean fresh water in a separate mixing tank with a high shear agitating mixer. Water hardness shall be tested prior to mixing to insure it meets the manufacturer's recommendations. The contractor shall take all steps necessary to prevent the slurry from losing the required viscosity.

(b)Mineral Slurries:

(1) Mineral Slurry Requirements: Mineral slurry shall consist of processed attapulgite, sepiolite, or bentonite clays containing pure sodium bentonite. The slurry shall have a mineral grain size such that it will remain in suspension and shall have sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. The percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of the excavation and to allow proper placement of concrete. The material used to make the slurry shall not be detrimental to concrete or surrounding ground strata.

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The contractor shall take the steps necessary to prevent the slurry from "setting up" in the shaft excavation, including but not limited to, agitation, circulation and/or adjusting the composition and properties of the slurry.

Control testing using suitable apparatus shall be carried out on the mineral slurry mixture by the contractor to determine density, sand content, viscosity, and pH. Tests shall be performed when the slurry temperature is above 40°F (5°C). Acceptable values for these physical properties are shown in Table 814-2.

**Table 814-2
Mineral Slurry Specifications**

Property (Units)	At Time of Slurry Introduction	In Hole at Time of Concreting	Test Method
Density	64.3 - 69.1 pcf (1030 - 1107 kg/m ³) (fresh water)	64.3 - 75.0 pcf (1030 - 1202 kg/m ³) (fresh water)	Mud Balance (API 13B- Sec 1)
Viscosity	28 - 45 seconds	N/A	Marsh Funnel (API 13B- Sec 2)
pH	8 - 11	8 - 11	pH Paper pH Meter (API 13B-Sec 6)
Max. Sand Content (% by Volume)	4	4	Sand Screen Set (API 13B- Sec 4)

The limits in Table 814-2 may be adjusted when field conditions warrant as demonstrated by a trial shaft, test drilled shaft, or other methods approved by the engineer.

(2) Mixing and Storage: The mineral slurry shall be premixed thoroughly with clean fresh water prior to introduction into the shaft excavation. When bentonite slurry is used, it should be held in storage for a period of time to allow complete hydration. The percentage of mineral admixture used to make the suspension shall be adequate to maintain the stability of the shaft excavation. Adequate water and/or slurry tanks are required when necessary to perform the work in accordance with these specifications. No excavated pits will be allowed without the written permission of the engineer. No mixing of slurry will be allowed in the drilled shaft excavation. Slurry shall not stand for more than four hours in the excavation without agitation. If this is not possible, the drilled shaft excavation shall be overreamed to remove filter cake.