1. SYNTHETIC SLURRY FOR DRILLED SHAFTS (Added 4-28-11)

Description. Use of synthetic slurry construction methods, meeting the requirements herein, is permissible as an alternative to or in conjunction with temporary casing for drilled shaft excavations.

Materials. Do not use Mineral or water slurry. It is only permissible to use Synthetic slurries in conformance with the manufacturer's recommendations, the submitted quality control plan and these Special Provisions. The following synthetic slurries are approved as slurry systems:

Product Manufacturer

Novagel Geo-Tech Services, LLC

220 North Zapata Highway, Suite 11A

Laredo, TX 78043-4464

ShorePac GCV CETCO

1500 West Shure Drive

Arlington Heights IL, 60004

SlurryPro CDP KB International, LLC

Suite 216, 735 Broad Street

Chattanooga, TN 37402-1855

Super Mud\* PDS Company

8140 East Rosecrans Ave.

Paramount, CA 90723-2754

\*Approval as a product applies to the liquid product only.

Submit other proposed synthetic slurry products for approval. Submit proposed additives for approval.

Submittals. As part of the shaft installation plan provide the following:

Product name and manufacturer’s technical data sheets.

Detailed procedures for mixing, using, maintaining, and disposing of the slurry.

A detailed mix design (including all additives and their specific purpose in the slurry mix), and a discussion of its suitability to the anticipated subsurface conditions.

A detailed plan for quality control of the selected slurry, including tests to be performed, test methods to be used, and minimum and/or maximum property requirements which must be met to ensure that the slurry functions as intended, considering the anticipated subsurface conditions and shaft construction methods, in accordance with the slurry manufacturer's recommendations and these Special Provisions. At a minimum include in the quality control plans the following tests:

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| Property | Test Method |
| Density | Mud Weight (Density), API 13B-1, Section 1 |
| Viscosity | Marsh Funnel and Cup, API 13B-1, Section 2.2 |
| PH | Glass Electrode, pH Meter, or pH Paper |
| Sand Content | Sand, API 13B-1, Section 5 |

Arrange for a representative from the slurry manufacturer to provide technical assistance in the use of the slurry and submit the following to the Project Manager:

The name, current phone number and training/experience record of the slurry manufacturer's technical representative assigned to the project, and the frequency of scheduled visits to the project site by the representative.

The name(s) of the Contractor’s personnel assigned to the project and trained by the slurry manufacturer in the proper use of the slurry. Include a signed training certification letter from the slurry manufacturer for each trained Contractor’s employee listed, including the date of the training. If training and certification are to be performed on-site, indicate that in the submittal and furnish the certifications when they are available.

Construction.

Manufacturer’s Representative. The manufacturer's representative described above is required to: Provide technical assistance for the use of the slurry, be at the site prior to introduction of the slurry into the first drilled hole, and remain at the site during the construction and completion of a minimum of one shaft to adjust the slurry mix to the specific site conditions. In the manufacturer’s representative absence, the Contractor’s employee trained in the use of the slurry, as identified to the Project Manager in accordance with this Special Provision, is required to be present at the site during shaft slurry operations to perform the duties specified above.

Slurry installation requirements. Do not begin work until all the required submittals have been approved in writing by the Project Manager. All approvals given by the Project Manager will be subject to trial in the field and do not relieve the Contractor of the responsibility to satisfactorily complete the work.

When using slurry once the excavation operation has been started, perform the excavation in a continuous operation until the excavation of the shaft is completed, except for pauses and stops as noted, using equipment capable of excavating through the type of material expected. .

Pauses, defined as momentary interruptions of the excavation operation, are allowed only for casing splicing, tooling changes, slurry maintenance, and removal of obstructions. Shaft excavation operation interruptions not conforming to this definition are considered stops. Stops for uncased excavations (including partially cased excavations) cannot exceed 16 hours duration. For stops exceeding the 16 hour duration, stabilize the excavation using one or both of the following methods:

Install casing in the hole to the depth of the excavation. Provide casing with outside diameter no less than six inches less than either the Plan diameter of the shaft or the actual excavated diameter of the hole, whichever is greater. Prior to removing the casing and resumption of shaft excavation, sound the annular space outside the casing. If the sounding operation indicates that caving has occurred, do not remove the casing or resume shaft excavation until the excavation has been stabilized in accordance with the shaft installation plan conforming to this Special Provision.

For both a cased and uncased excavations, backfill the hole with granular material. Backfill the hole to the ground surface, if the excavation is not cased, or to a minimum of five feet above the bottom of casing (temporary or permanent), if the excavation is cased. Backfilling of shafts with casing fully seated into rock, as determined by the Project Manager, will not be required.

Conform to the requirements of this Special Provision regarding the maintenance of the slurry and the minimum level of drilling slurry throughout the stoppage of the shaft excavation operation, and recondition the slurry to the required slurry properties in accordance with the submitted quality control plan and this Special Provision prior to recommencing shaft excavation operations.

Maintain the slurry level in the excavation a minimum of 10 feet above the groundwater level or greater as required to provide and maintain a stable hole. Provide casing, or other means, as necessary to meet these requirements. Maintain slurry above all unstable zones a sufficient distance to prevent bottom heave, caving or sloughing of those zones.

Slurry Mixing, Sampling and Testing. Thoroughly mix slurry hydrated in slurry tanks, ponds, storage areas, or as recommended by the Manufacturers technical representative. Draw sample sets from the slurry storage facility and test the samples for conformance with the appropriate specified material properties before beginning slurry placement in the shaft excavation. Conform to the quality control plan included in the shaft installation plan in accordance with this Special Provision and as approved by the project manager. Sample sets are composed of samples taken at mid-height and within two feet of the bottom of the storage area.

Sample and test all slurry in the presence of the project manager, unless otherwise directed. Record the results of the tests and date, time and names of the persons sampling and testing the slurry. Submit a copy of the recorded slurry test results to the project manager at the completion of each shaft, and during construction of each shaft when requested by the project manager.

Take and test sample sets of all slurry, composed of samples taken at mid-height and within two feet of the bottom of the shaft, during drilling as necessary to verify the control of the properties of the slurry. As a minimum, sample sets of synthetic slurry shall be taken and tested at least once every four hours after beginning its use during each shift. Take and test sample sets of all slurry at least once every two hours if the slurry is not re-circulated in the drilled hole or if the previous sample set did not have consistent specified properties. Recirculate or agitate slurry with the drilling equipment, when tests show that the sample sets do not have consistent specified properties.

Take and test sample sets of all slurry, as specified, prior to final cleaning of the bottom of the hole and again just prior to placing concrete. Do not start cleaning of the bottom of the hole and placement of the concrete until tests show that the samples taken at mid-height and within two feet of the bottom of the hole have consistent specified properties.

Clean, recirculate, de-sand, or replace the slurry to maintain the required slurry properties as necessary.

Demonstrate to the satisfaction of the project manager that stable conditions are being maintained. If the project manager determines that stable conditions are not being maintained, immediately take action to stabilize the shaft. Submit a revised shaft installation plan which addresses the problem and prevents future instability. Do not continue with shaft construction until the damage which has already occurred is repaired in accordance with the specifications, and until receiving the Project Managers approval of the revised shaft installation plan.

Dispose of the slurry as specified in the shaft installation plan as approved by the project manager, and in accordance with the Contractor’s permit requirements.

Immediately prior to commencing concrete placement, the shaft excavation and the properties of the slurry must conform to the quality control plan and this Special Provision. The sand content of slurry prior to final cleaning and immediately prior to placing concrete must be less than 2.0 percent, in accordance with API 13B-1, Section 5.

In the event a shaft is determined to be defective do not continue to use slurry construction methods without written approval from the Project Manager. The Project Manager may require amendment and resubmittal of the shaft construction methods.

Method of Measurement. Use of slurry for drilling is not measured for payment.

Basis of Payment. Include all costs associated with using slurry in bid item for “Drilled Shaft.”