



Florida Department of Transportation Research

Evaluation of Hybrid Slurry Resulting from the Introduction of Additives to Mineral Slurry

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High water tables in Florida make it difficult to excavate to a sufficient depth for many construction projects without water intrusion causing a collapse of earthen walls. In the case of drilled shafts, stabilization is achieved mechanically by using permanent or temporary casings or hydraulically by using mineral slurry. Slurry is a specially formulated suspension of clay minerals which exert a hydrostatic pressure to prevent intrusion and maintain wall integrity. Polymer materials are now available which can be used in place of clay minerals, and many additives to adjust the performance of slurries are on the market.

Until recently, the Florida Department of Transportation allowed only pure mineral products for slurry operations to stabilize excavations during installation of drilled shaft foundations. Specification changes in July 2008 allowed for the use of polymer slurry but limited its use to drill shafts up to a certain diameter and specific types of noncritical structures, such as mast arms and cantilever signs. The specification established acceptable properties for pure mineral and pure polymer slurries, but mineral-polymer hybrid slurries and mineral slurries with additives are not yet permitted because of questions about the performance of these mixtures. It is also unclear as to what set of specifications will assure the desired performance.

Researchers from the University of South Florida tested slurries with a wide range of additives.

The study focused on the performance of pure mineral slurries, polymer-fortified mineral slurries, and polymer-enhanced mineral slurries. Goals of the study were to identify whether or not current state specifications were sufficient and to determine what testing regime, using polymer slurry or mineral slurry specifications, was most appropriate for mineral slurries with

additives. Two types of tests were applied: The American Petroleum Institute (API) filter press test and the sand settlement/suspension test.

API filter tests were performed on existing slurry products to determine a baseline for slurry additives. This series of tests included all standard slurry property tests - density, viscosity, etc. -- as well as the filter press test. Three different pure mineral slurries and three polymer-modified mineral slurries were tested. Suspended sand content was determined for the range of slurries and with various added sand amounts.

The researchers found that additives, in the amounts used in the study, were generally beneficial and could be used to modify and enhance mineral slurries

without reducing the effectiveness of the base material. They also made recommendations for the slurry specifications to ensure performance. The researchers also compiled information about a wide variety of drilling products and slurry specifications from over 40 states.



The API filter press apparatus (lower left) and the Marsh cone viscometer (upper right) used in this study.