

# **FY 07/08 Research Initial Scope of Work**

## **I. Project Title: S034**

### **Characterization of the Seismic Response Properties of Silts**

## **II. Background:**

Field observations from recent earthquakes confirm that silts can liquefy as a result of significant ground shaking. However, there is great uncertainty the liquefaction susceptibility and cyclic response of silts. Additionally, the post-liquefaction response of silts is poorly understood compared to that of sands. A significant number of existing California highway bridges are founded on ground that contains fine-grained soil layers that would be characterized as potentially liquefiable by recently proposed liquefaction susceptibility criteria and liquefaction triggering procedures. Caltrans requires tools for characterizing fine-grained soils to reliably evaluate their liquefaction potential and their post-liquefaction seismic response.

## **III. Project Problem Statement:**

Develop dynamic soil property characterization tools and procedures for silts that utilize new and existing technologies to better characterize the seismic response of silts. Many of the existing bridges in the State of California traverse poor soils, many of which contain potentially liquefiable silts. Bridge engineers require guidance in the characterization of silts in the field and in the laboratory so that appropriate assessments of their seismic response can be made in the design of foundations on new structures and in the seismic retrofit of existing structures.

## **IV. Objective:**

The objective of this research is to develop effective, defensible dynamic soil property characterization tools and procedures for silts. These thrusts are the primary objectives of this study, i.e., to explore existing and innovative characterization tools, to develop sound guidance on how to characterize silts in the laboratory, and to provide bridge engineers with guidelines for foundations designs.

## **V. Description of Work and Expected Deliverables:**

The proposed work should include, but not be limited to, the following:

- A literature search of published works that provide information to aid in the preparation of a state-of-the-art liquefaction assessment of fine-grained soils, with a focus on silts.
- An assessment of potential field and laboratory testing techniques and procedures should be completed to identify testing techniques for evaluating the liquefaction susceptibility and resistance of silts.
- A guidance document that summarizes the state-of-the-art on current liquefaction evaluation procedures for silt describing the results from this study. This

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document delineating procedures for field and laboratory testing of silt soils for use on Caltrans design projects is the primary deliverable for this project.

### VI. Estimate of Duration:

36 months

### VII. Related Research:

This project builds upon the data and knowledge gained through a number of studies of the seismic response of fine-grained soils, including:

- Boulanger and Idriss (2006) "Liquefaction Susceptibility Criteria for Silts and Clays," J. of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 132, No. 11, pp. 1413-1426.
- Bray and Sancio (2006) "Assessment of the Liquefaction Susceptibility of Fine-Grained Soils," J. of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 132, No. 9, pp. 1165-1177.
- Ishihara (1996) "Soil behaviour in earthquake geotechnics", The Oxford engineering science series. No. 46, Oxford, England.
- Youd et al. (2001) "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils" J. of Geotechnical and Geoenvironmental Engineering, Vol. 127(10), pp. 817-833.

### VIII. Deployment Potential:

As a result of this research, new tools and soil characterization guidelines will be developed for evaluating the liquefaction susceptibility, cyclic resistance, and post-liquefaction strength of silts. These tools and guidelines will lead to a more realistic seismic assessment of the potentially vulnerability of the California highway bridge system.

### IX. Date: August 9, 2007