**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

**Lead Agency: Utah Department of Transportation**

**INSTRUCTIONS:**

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

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| **Transportation Pooled Fund Program Project #****TPF-5(244)** | **Transportation Pooled Fund Program - Report Period:**\_ Quarter 1 (January 1 – March 31, 2012) **\_** Quarter 2 (April 1 – June 30, 2012)\_ Quarter 3 (July 1 – September 30, 2012)**x Quarter 4 (October 1 – December 31, 2012)** |
| **Project Title:**Shaking Table Testing to Evaluate Effectiveness of Vertical Drains for Liquefaction Mitigation |
| **Name of Project Manager(s):**David Stevens | **Phone Number:** 801-589-8340 | **E-Mail** davidstevens@utah.gov |
| **Lead Agency Project ID:**5H06874H, 42046, ePM PIN 9933UDOT PIC No. UT07.708 | **Other Project ID (i.e., contract #):** UDOT Contract No. Pending  | **Project Start Date:** Contract in Preparation |
| **Original Project End Date:**Contract in Preparation | **Current Project End Date:** Contract in Preparation | **Number of Extensions:** |

Project schedule status:

 **X** On schedule \_ On revised schedule \_ Ahead of schedule \_ Behind schedule

Overall Project Statistics:

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|  **Total Project Budget** |  **Total Cost to Date for Project** |  **Percentage of Work**  **Completed to Date** |
| $115,000.00 | $0 | 0 |

***Quarterly*** Project Statistics:

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| --- | --- | --- |
|  **Total Project Expenses**  **and Percentage This Quarter** |  **Total Amount of Funds**  **Expended This Quarter** |  **Total Percentage of**  **Time Used to Date** |
| 0 | $0 | 0 |

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| **Project Description**:Vertical drains offer the potential to deal with liquefaction problems at 30 to 50% of the cost and time required with conventional densification techniques. Although blast liquefaction studies have shown that vertical drains greatly increase the rate of drainage under field conditions, they have not prevented liquefaction. In addition, it is difficult to compare pore pressure development during blasting and an earthquake. At present, no direct field or laboratory data is available to confirm whether or not the drains have the ability to limit pore pressures and resulting settlement to acceptable levels. However, shaking table tests can be conducted with a large shear box (20 ft high, 9 ft wide, and 16 ft long) containing drains at SUNY-Buffalo and compared with identical testing currently underway for another funded study. Tests will be performed at progressively higher acceleration levels and durations to allow comparison of performance (pore pressure & settlement) for earthquake conditions. Shaking table tests will be performed on sandy soils with vertical drains installed to confirm whether or not the drains have the ability to limit pore pressures and resulting settlement to acceptable levels during the earthquake event. Three objectives are outlined for this study: 1. Evaluate the ability of vertical drains to prevent liquefaction during an earthquake event as a function of acceleration and duration. 2. Compare settlement of treated sand relative to untreated soil when subjected to shaking and drained with vertical drains. 3. Evaluate the accuracy of simple models and computer models to predict measured behavior. The scope of work consists of five specific tasks: 1. Prepare test specimen in laminar shear box with vertical drains. 2. Conduct shaking table tests at progressively higher accelerations measuring water pressure, acceleration, and horizontal and vertical displacement. 3. Reduce the test data and compare with previous test on untreated sand. 4. Compare measured behavior with behavior computed using computer models and simplified models. 5. Prepare final report on effectiveness of drain technique.Dr. Kyle Rollins of BYU is the Principal Investigator for this research project. The TPF-5(244) testing is scheduled to begin at the SUNY-Buffalo shaking table testing facility in June 2013. BYU has been approved for shared-use status on the NEES-Buffalo shake table. |

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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**Dr. Kyle Rollins of BYU revised the project work plan and prepared it for review by the project technical advisory committee. BYU and the University of Buffalo (UB) signed the paper work to allow BYU to conduct research at the NEES-UB facility. Tentative schedule calls for the BYU test to be performed summer or late fall of 2013. Dr. Rollins coordinated with faculty at UB to prepare instrumentation plan and schedule requirements. Dr. Rollins also met with Prof. Meshak Yegian at Northwestern University who is scheduled to perform tests immediately prior to the BYU testing. Prof. Yegian was agreeable to allowing BYU to bump ahead of him on the schedule as it would not negatively impact his schedule.  |
| **Anticipated work next quarter**:The technical advisory committee will be established with the study partners and will participate in reviewing the project work plan. The approved work plan will be utilized to establish a UDOT research contract with BYU. UDOT and BYU will explore opportunities for the technical advisory committee to remotely view similar testing going on in early 2013 at SUNY-Buffalo. A tele-conference or web meeting will be held with the technical advisory committee. |

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| **Significant Results:** None at present |
| **Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that** **might affect the completion of the project within the time, scope and fiscal constraints set forth in the** **agreement, along with recommended solutions to those problems).** |

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| **Potential Implementation:**  |