**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

Date: \_\_\_\_\_\_4/24/2017\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lead Agency (FHWA or State DOT): \_\_\_\_\_\_Washington State DOT\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**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(276)* | **Transportation Pooled Fund Program - Report Period:**Quarter 1 (January 1 – March 31)Quarter 2 (April 1 – June 30)Quarter 3 (July 1 – September 30)Quarter 4 (October 1 – December 31) |
| **Project Title:****Full-Scale Shake Table Testing to Evaluate Seismic Performance of Reinforced Soil Walls** |
| **Name of Project Manager(s):****Lu Saechao** | **Phone Number:****360.705.7260** | **E-Mail**saechal@wsdot.wa.gov |
| **Lead Agency Project ID:** | **Other Project ID (i.e., contract #):****GCB1359** | **Project Start Date:**2012 |
| **Original Project End Date:** | **Current Project End Date:****6/30/2018** | **Number of Extensions:**0 |

Project schedule status:

* 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** |
| $289,937(Ph1 $49,938 & Ph2 $239,999) | $225,261.04(Ph1 $49,938 & Ph2 $175,323.04) |  |

***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** |
|  | See Progress this Quarter section |  |

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| **Project Description**:

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| Phase 1 (completed)The objective of this project is to perform numerical studies and use the LHPOST to investigate the dynamic performance of one or two full-scale (7 m) reinforced soil retaining walls constructed using realistic materials and methods. Considering that these walls will be substantially taller than for any similar previous research (by a factor of 2), a key focus of the proposed research will be on the influence of wall height on overall system response (i.e., stability/deformation) and the distribution of dynamic tensile forces (i.e., seismic demand) in the soil reinforcement. Other focus areas will include dynamic earth pressure on facing elements, effects of dynamic loading on soil-reinforcement stress transfer mechanisms, and permanent deformations after dynamic loading. The tests will be conducted using a unique large soil confinement box (LSCB) that is currently under construction as part of a recently funded NSF grant. The scale of these tests will permit wall construction using realistic soil types, compaction methods, and structural elements. The box will also have a unique design that permits different boundary conditions at the rear of the soil mass, including a water-filled bladder or geofoam layer. Phase 2 (current work)The objective of Phase II is to perform reduced-scale shake table tests and numerical studies to further characterize the seismic performance of MSE abutments. Numerical modeling work will be conducted using FLAC-3D and allow us to extrapolate results from the reduced-scale physical tests to simulate seismic performance of MSE abutments for bridges with spans up to 150 ft. The results of this work will be used to assess whether or not a Phase III investigation, consisting of full-scale MSE abutment tests, will be conducted on the UCSD large outdoor shake table. |
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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**70% of the Phase 2 work has been completed. The project is on track to completing on time, with the main effort focused on the validation of the numerical simulations and full analysis of the experimental data. Task 1 (literature review) is ongoing throughout the duration of the project, Task 2 (detailed design) was completed in Q1 of this year, and Task 3 (MSE abutment testing program was completed in Q2 of this year. The main efforts this quarter were related a comprehensive testing report that summarizes and compares the results from the different shaking table experiments, and to a presentation of this information to Caltrans and the pooled fund partners on February 8th 2017. The other efforts included further in-depth analysis of the experimental results (Task 4), and the beginning of refining the numerical simulations of the MSE abutments (Task 5). Planning for a full-scale test on the Englekirk shaking table was also undertaken (Task 6). This quarter included salaries to support Yewei Zheng, the main PhD student working on the project, Wenyong Rong, a PhD student working on 3D numerical simulations, and the Powell laboratory staff. Several undergraduate assistants helped in the construction of the walls and disassembly of the testing setup. A summary of the specific tasks were completed: 1. Prepared preliminary analyses of the data from all of the experiments (Task 4).
2. Initiating the process of improving the dynamic 2D and 3D numerical simulations through validation with the experimental results and consideration of new constitutive models (Task 5).
3. Planning a full-scale MSE abutment test (Task 6).

Budget:January 1 – March 31, 2017 Expenditures = $1,950.42  |
| **Anticipated work next quarter**:The Phase 2 testing program is now complete, so the main efforts are related to analysis and improving simulations. In the next quarter the PI plans to:1. Improve analyses of results from the different experiments (Task 4).
2. Improve numerical simulations of the different experiments, and continue to explore 3D simulations (Task 5).
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| **Significant Results:**Completed interim report on February 20, 2017. |
| **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:**  |