**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

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

**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 #***(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)**TPF-5(461)* | **Transportation Pooled Fund Program - Report Period:**□Quarter 1 (January 1 – March 31) 2023□Quarter 2 (April 1 – June 30) 2023🗹Quarter 3 (July 1 – September 30) 2023□Quarter 4 (October 1 – December 31) 2023 |
| **Project Title:**Soil and Erosion Testing Services for Bridge Scour Evaluations |
| **Name of Project Manager(s):***Kornel Kerenyi* | **Phone Number:***(202) 493-3142* | **E-Mail***kornel.kerenyi@dot.gov* |
| **Lead Agency Project ID:** | **Other Project ID (i.e., contract #):** | **Project Start Date:**  |
| **Original Project End Date:** | **Current Project End Date:** | **Number of Extensions:** |

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** |
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***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** |
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| **Project Description**:

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| **Objectives:**The objective of these pooled funds is to provide and/or support soil and erosion testing services for bridge projects over water crossings managed or coordinated by State DOTs, to provide technical assistance to design, fabricate, and install erosion testing devices to support and seek to broaden the use of erosion testing devices among State Department of Transportations, and to compile and analyze the collected soil and erosion testing data in a broader research effort to more accurately estimate reliable scour design depths given the soil conditions and hydraulic load during a given storm event. |
| **Scope of Work:**Task 1: Soil Erosion Test in the Turner Fairbank Highway Research Center (TFHRC) Hydraulics and/or Geotechnical Lab for various bridge projects: The Hydraulics and Geotechnical Lab staff will conduct soil and erosion tests utilizing the Ex-situ Scour Testing Device (ESTD) and/or Erosion Function Apparatus (EFA) on soil samples shipped to the Laboratories for bridge projects managed or coordinated by State DOTs.Task 2: Soil Erosion Test in the field for various bridge projects: The Hydraulics Lab staff will conduct soil erosion tests in the field using the In-Situ Scour Testing Device (ISTD) or Portable Scour Testing Device (PSTD) and collect samples for ESTD and/or EFA tests in the TFHRC Hydraulics Laboratory for projects managed or coordinated by State DOTs.Task 3: Laboratory and In-situ Soil Testing: The TFHRC Geotechnical Lab staff will conduct index testing (e.g. particle-size distribution, unit weight, moisture content, Atterberg limits, etc.) and other, more specialized laboratory soil tests (e.g. undrained shear strength, consolidation, etc.) in the TFHRC Geotechnical Laboratory to determine key soil parameters that may impact erosional resistance. Geotechnical Lab staff will coordinate Cone Penetration Testing at the site with the State DOTs.Task 4: Fabrication of an Erosion Testing Device: The TFHRC Hydraulics Lab staff will design and fabricate an Erosion Testing Device (e.g. ISTD or PSTD) to conduct soil erosion tests for projects managed or coordinated by State DOTs.Task 5: Soil Erosion Tests Support. TFHRC Hydraulics Lab staff will provide technical assistance for conducting and analyzing soil erosion tests in the field or in a Laboratory for projects managed or coordinated by State DOTs.Task 6: Laboratory and In-situ Soil Testing Support. TFHRC Geotechnical lab staff will provide technical assistance for conducting and analyzing ex- and in-situ soil testing for projects managed or coordinated by State DOTs.Task 7: Scour along Longitudinal Structures: This task will use NextScour principles (hydraulic loading functions versus soil erosion resistance), Computational Fluid Dynamics (CFD), Flume Experiments and Case Studies to research scour prediction for various flow conditions on longitudinal structure types and configurations in a riverine environment.   |

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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):*** Continued preparing bridge and culvert 3D models for the CFD simulation of the MSDOT Lynch Creek bridge scour project
* Continued the erosion tests and indexing tests of Shelby tube samples from MSDOT
* Received HRTM review comments and started responding to these comments on the NCDOT I-95 Bridge replacement study draft report
* Presented two papers on soil resistance and probabilistic scour analysis at ICSE-11
* Continued the monthly NextScour meetings to discuss the progress of the NextScour research
* Designed 156 geometries of bridges with various numbers of piers, angle of attacks, abutment blockage ratio on the floodplains, and 10 flow conditions including free, pressure and overtopping flows. And completed SRH-2D and OpenFOAM simulations on all these cases to obtain the shear stress amplification factors between OpenFOAM and 2D models
* Developed the pier and abutment shear stress decay functions using collected literature equilibrium scour data
* Completed the flume scour tests with spill-through and wing-wall abutment in the MFS flume at TFHRC’s Hydraulics Lab with different blockage ratios and velocities
* Completed the CFD simulation of flume scour tests and developed the shear stress decay function based on the nominal shear stress method
* Fitted the MFS flume collected temporal scour depth data, derived the scour depth rate and calculated the shear stresses at these scour rates using Van Rijn’s pick-up, and developed the shear stress decay function
* Validated aforementioned three shear stress decay functions for piers and wing-wall abutments with MFS flume scour test results
* Completed more than 200 cases of CFD and 2D simulations with longitudinal walls (three different slopes) and determined shear stress amplification factors
* Conducted CFD simulations for the Fernbridge pier retrofit project in California, and developed the shear decay function based on the simulation results
* Presented the preliminary NextScour pier and wing-wall abutment shear stress decay functions and three case studies applying these decay functions to the HEC-18 update team
* Shared NextScour publications and progress slides with the HEC-18 update team
* Worked on the piping of the clay flume and designed relative components
* Researched and designed a small-scaled pier in the ESTD’s Shelby tube to test soil strength and flow erosion power, which helped to determine the compaction pressure of the soil samples for the clay flume scour tests
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| **Anticipated work next Quarter**:* Conduct scour tests around cylindrical piers, along longitudinal walls with different sediment sizes in MFS flume
* Test the new shear stress decay procedure, which decays the contraction shear stress first until the equilibrium contraction scour depth, then amplifies the shear stress there to calculate the pier and abutment scour depths
* Revise the NCDOT draft report and resubmit it for HRTM and HPA review
* Revise the FDOT riprap study report, collect review comments, and submit it for HRTM and HPA review
* Collect more SRH-2D field cases and associated soil stratigraphy and calculate scour depths using the shear stress decay functions
* Continue to provide NextScour technical assistance for Caltrans’ Fernbridge project
* Continue the soil erosion tests and CFD simulation for the MSDOT Lynch Creek bridge scour project
* Collect more scour depth rate data from the literature for pier and abutment scour tests, convert scour depth rate to shear stress and populate the shear stress decay function data
* Activate the clay flume and prepare scour tests with pier, abutment and longitudinal walls in clay
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| **Significant Results:** |
| **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).**None to report. |