TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Michigan 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.

Transportation Pooled Fund Program Project # *(i.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(363)	**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: Evaluation of 0.7″ Diameter Carbon Fiber Reinforced Polymer (CFRP) Pretensioning Strands in Prestressed Beams		
Name of Project Manager(s): Matthew Chynoweth	**Phone Number:**	**E-Mail**
Lead Agency Project ID: OR15-541	**Other Project ID (i.e., contract #):** 2016-0065/Z3	**Project Start Date:** 10/01/2017
Original Project End Date: 09/30/2020	**Current Project End Date:**	**Number of Extensions:** None

Project schedule status:

☑ On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
$358,732.00	$92,227.70	35%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$92,227.70 and 26%	$10,940.57	42%

Project Description:

Background:

MDOT has been working with Lawrence Technological University [in Michigan] for many years to develop carbon fiber reinforced polymer (CFRP) prestressed concrete beams. Recent research developments on demonstration projects have shown that 0.6 inch diameter CFRP strands have smaller nominal area and lower allowable capacity than steel 0.6 inch diameter steel strands; thus requiring more strands for a given design. This makes it difficult for bridge designers to find projects where we can fit enough CFRP strands in a beam to meet load carrying requirements.

Currently, 0.7 inch diameter CFRP strands are available; thus, making the use of CFRP pre-tensioning in pre-stressed beams more viable. The proposed research is necessary in order to evaluate the safe use of 0.7 inch diameter CFRP strands in a beam to meet load carrying requirements.

Objectives:

1. To evaluate material properties, details, and design criteria to use 0.7 inch diameter CFRP strands for pretensioning of prestressed AASHTO I girders, bulb-t, and box beams.

2. To evaluate performance of 0.7 inch diameter CFRP strands for environmental conditions and extreme events.

3. To prepare design procedures and examples.

4. To prepare construction specifications for 0.7 inch CFRP strands and identify fabrication concerns with the larger diameter strands.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

During the last quarter, the research team worked on Tasks # 3, 4, 5, and 6 of the research project:

Task #3 High temp/freeze-thaw: The research team tested the second batch of CFCC specimens under freeze and thaw cycles. Test results are currently under review and will be shared with MDOT Engineers. The research team completed the evaluation of high temperature effect on the tensile strength of CFCC through heating and testing to failure multiple 6-ft long CFCC test specimens. The team also evaluated the relaxation of CFCC specimens at elevated temperatures.

Task #4: Creep/relaxation/prestress loss: The test specimens for creep and relaxation have been under continuous monitoring since the start of the project. The research team evaluated the prestress loss in relaxation specimens and performed the necessary maintenance on the test setup to ensure that the creep specimens are still subjected to a constant load level.

Task # 5: Transfer & development length: the research team finalized the test results of the relaxation and development length specimens. In addition, the research team prepared another set of direct-pull-out specimens containing different diameters of steel and CFCC strands to compare the bond strength between CFCC and steel strands.

Task #6 Precast beams under fire/freeze-thaw: The research team completed the construction of all beams necessary for fire testing as well as the beams specimens for freeze-thaw testing. The fire beams are currently in the drying stage and the fire test will commence after the moisture level in the concrete drops to a safe level. The freeze-thaw specimens are instrumented and will be subjected to a seasonal temperature change with flexural loading to confirm the effect of seasonal temperature fluctuation on the prestress level. After that, the specimens will be subjected to 300 cycles of freezing and thawing conditions.

Anticipated work next quarter:

The research team will continue to work on different research items according to the proposed work schedule. During the next quarter, it is expected that the research team will work on Tasks 4, 5, & 9 and will continue to share and discuss the test results with MDOT Engineers.

Significant Results:

The research team hosted a demonstration day for MDOT Engineers and Engineers from other states participating in the project on Sept 13th, 2018. The PI presented the progress in the research and recent field deployments through two presentation. In addition, the Engineered toured the facility and observed the loading test and failure of a full-scale bulb T beam and the testing of development and transfer length specimens.

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).

Potential Implementation: