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	$81,287.00	33%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$81,237.00 and 20%	$30,773.15	34%

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 # 1, 3, 4, 5, and 6 of the research project

Task #1 Literature review: The research team finalized the main sections of the literature review and summarized the main points of concern and those need further investigation

Task #3 High temp/freeze-thaw: The research team tested the first batch of CFCC specimens under 150 cycles of freeze and thaw. The research team is currently preparing for the second batch that will be subjected to 300. The research team also studied the effect of high temperature on the tensile strength of CFCC through heating and testing to failure multiple 6-ft long CFCC test specimens.

Task #4: Creep/relaxation/prestress loss: The test specimens for creep and relaxation are currently under continuous monitoring. In addition, the research team evaluated and presented to MDOT Engineers the loss of the prestressing force in 48-ft long CFCC strands anchored using three wedge anchors and coupler system during the construction of beam specimens for fire testing (Task #6).

Task # 5: Transfer & development length: The research team prepared and tested three batches of test specimens to evaluate the transfer and development lengths.

Task #6 Precast beams under fire/freeze-thaw: The research team completed the construction of all beams necessary for fire testing and is currentlypreparing and conditioning the fire chamber to conduct the fire test after the moisture in the beams drops to an acceptable testing levels to avoid concrete spalling and premature failure of the beams. In addition, the research team is currently building the form work and the reinforcement cages for the freeze-thaw beams. After these beams are built, they will be subjected to 300 cycles of freezing and thawing and then tested to failure under flexural loading to determine the residual strength and the mode of failure.

The research team also built a full-scale bulb T beam and tested the beam to failure in front of MDOT Engineers to evaluate the flexural capacity of the prestressed beam and the performance of CFCC strands. The research team also

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 3, 4, 5, & 6 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: