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) [CY 2019]	**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): Steve Kahl	**Phone Number:** 517-636-5708	**E-Mail** kahls@michigan.gov
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	$99,934.41	49%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$99,934.41 and 7.8%	$7,706.71	49%

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 this quarter, the research team worked on Tasks # 4, 5, and 9 of the research project:

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. The research team tested those specimens and compared the bond strength between CFCC and concrete and between steel and concrete.

Task #9 The research team performed the analysis of the test results obtained so far and started developing analytical models to compare the experimental test results with the analytical estimate.

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, 7, & 9 and will continue to share and discuss the test results with MDOT Engineers.

Significant Results:

In addition, the research team constructed two half-scale decked bulb T beams with a span of 40 ft prestressed with 0.7 in. CFCC strands and is currently working on constructing four more beams. One beam out of the six beams will be tested under flexural loading setup to evaluate the flexural capacity of a single beam, while the remaining five beams will be used to build a bridge model to be tested also under flexural loading setup. The test results of the bridge model will be compared with the results obtained in 2013 from testing an identical model but with 0.6 in. CFCC strands (under different MDOT research project). The research team also performed the first fire test on an AASHTO beam prestressed with 0.6 in. CFCC strands. This beam was salvaged from the full-scale bridge beam that was loaded in flexure to failure earlier in the project. In addition, the team performed initial thermal heating and cooling test on the freeze-thaw beams and will continue the testing before the beams are subjected the freeze-thaw cycles.

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: