# TRANSPORTATION POOLED FUND PROGRAM
# QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Michigan 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.*

| **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):** Steve Kahl | **Phone Number:** | **E-Mail** KahlS@michigan.gov |
| **Lead Agency Project ID:** OR15-541 | **Other Project ID (i.e., contract #):** 2016-0065 Z3 | **Project Start Date:** 1/2/2018 |
| **Original Project End Date:** 1/2/2021 | **Current Project End Date:** 1/2/2021 | **Number of Extensions:** 0 |

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 |
|---|---|---|
| $358,732.59 | $65,294.45 | 25% |

***Quarterly*** Project Statistics:

| Total Project Expenses and Percentage This Quarter | Total Amount of Funds Expended This Quarter | Total Percentage of Time Used to Date |
|---|---|---|
| $65,294.45 18.2% | $63,424.45 | 28% |

**Project Description**:

Recent research developments on MDOT 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. However, 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.

In this study the researcher will 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. The research will include an evaluation on the performance of 0.7 inch diameter CFRP strands for environmental conditions and extreme events; preparing design procedures and examples; along with preparing construction specifications for 0.7 inch CFRP strands and identifying fabrication concerns [if any] 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, 6, and 7 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 continued to prepare 5-ft long test specimens and prepared the required testing frames and the test setup for evaluating the performance of CFCC strands at high temperature and after exposure to multiple cycles of freezing and thawing. Final setup for the exposure to freeze-and-thaw cycles is currently underway.

Task #4: Creep/relaxation/prestress loss: The test specimens for creep and relaxation are currently under continuous monitoring. In addition, the research team continued to evaluate 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 two batches of test specimens to evaluate the transfer and development lengths. The research team also monitored the transfer length during the prestress release while constructing the full-scale beams as well as the beams for the fire testing (also full-scale).

Task #6 Precast beams under fire/freeze-thaw: The research team completed the construction of two full scale bulb T beams prestressed with 0.7 in CFCC strands for fire testing. In addition, original research plan included cutting segments from the full-scale 40-ft-long AASHTO I beams (Task #7) for fire testing, However, after flexural testing of the 0.7 in. CFRP prestressed full-scale beam, the beam sustained dense cracking pattern with some wide cracks that could affect the test results if used in fire testing. Therefore, it was decided to build new AASHTO I beams for fire testing.

Task #7 Full-scale beams: Out of three full scale 40-ft long AASHTO I beams, the research team has completed the testing of two beams (with steel strands and with 0.7 in. CFCC strands). The research team is currently working on the instrumentation and testing of the third beam with 0.6 in. CFCC strands. The final testing and failure of the beam is

**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 1, 3, 4, 5, 6, & 7 and will continue to share and discuss the test results with MDOT Engineers.

**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).**

**Potential Implementation:**