TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): ____IOWA 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 # *TPF-5(4497)*	**Transportation Pooled Fund Program - Report Period:** Quarter 1 (January 1 – March 31, 2020) X Quarter 2 (April 1 – June 30, 2020) Quarter 3 (July 1 – September 30, 2020) Quarter 4 (October 1 – December 31, 2020)
Project Title: Robust wireless skin sensor networks for long-term fatigue crack monitoring of bridges	
Project Manager: Khyle Clute **Phone:** 239-1471 **E-mail:** khyle.Clute@dot.iowa.gov	
Project Investigator: Simon LaFlamme **Phone:** 294-3162 **E-mail:** laflamme@iastate.edu	

Lead Agency Project ID:	**Other Project ID (i.e., contract #):** Addendum 736	**Project Start Date:** May 15, 2020
Original Project End Date: May 14, 2023	**Contract End Date:**	**Number of Extensions:**

Project schedule status:

X On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Total Percentage of Work Completed
$ 540,000	$3,500	1%

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter

Project Description:

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

- Quick-off meeting occurred May 15th 2020.
- Plan to hold a first quarterly TAC in September 2020.
- COVID-19 and how it influences the project's schedule was discussed. The project is expected to move-on as-planned with no significant delays caused by the closure of laboratories. We plan to be able to catch up with any delay caused by part-closures during this summer.
- KU trained a student on the Xnode technology to readout data from the SEC and planned for small-scale tests to validate the DAQ.
- ISU ordered and received molds to fabricate corrugated SECs and fabricated/shipped non-corrugated SECs to UA and USC.
- ISU prepared CT specimens to conduct small-scale fatigue tests.
- UA reviewed a previous analog version of wireless SEC sensor board design and investigated the upgrade (i.e. digital version) requirement for automated bridge balancing/shunt calibration.
- UA modified the design of the DAQ to use a local micro processing unit (MCU) to empower automation without interactions with the mother board.
- USC built a test setup to investigate the performance of the SEC on complex geometries. The setup is a full-scale arch beam (see Figure 1).
- USC built finite element models to numerically investigate out-of-plane deformations of the SEC. This is currently considering impact-type deformations, but will be expanded to consider various geometries.
- USC developed an analytical model for out-of-plane deformation of the SEC that will relate a change in capacitance to a suspected out-of-plane deformation.

Figure 1: full-scale arch beam test setup

Anticipated work next quarter:

- KU to continue work on the Xnode and the generation I capacitance sensor board to collect wireless capacitance data from the SEC sensors. A plan for the next field trip aimed at collecting more field data will also be made in the next month.
- ISU will fabricate more sensors, including corrugated SECs of different geometries.
- ISU will test and compare different SEC geometries on small-scale CT specimens.
- UA will continue work on the pre-demodulation method, including simulations and experimental tests of the circuit.
- USC will conduct experiments on arch beams.
- USC will continue the development of finite element models to study behaviors from out-of-plane loadings.

Significant Results:

- Molds to accelerate the fabrication of the SECs
- A new design for the DAQ board.
- Numerical finite element models to simulation the SEC on steel (ISU) and concrete (USC)

Circumstance affecting project or budget (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). N/A