TIDC Transportation Infrastructure Durability Center AT THE UNIVERSITY OF MAINE

Quarterly Progress Report:

Project Number and Title: Thrust #1 Distributed Fiber Optic Sensing System for Bridge Monitoring
Research Area: Thrust #1
PI: Xingwei Wang, Electrical and Computer Engineering Department, University of Massachusetts Lowell
Co-PI(s): TzuYang Yu, Civil Engineering Department, University of Massachusetts Lowell.
Reporting Period: *03/01/2021-09/30/2021*
Submission Date: **6***/24/2021*

Overview: **(Please answer each question individually)**

- Fiber sensors installed on Salmon Fall River Bridge survived after 18 months and demonstrated good stability.
- Junction sections on the bridge generated noise to the BOTDR system.
- The sensors installed in the pedestrian Bridge located at UMASS Lowell were modified to be able to use the Optical Frequency Domain Reflectometry (OFDR).

Table 1: Task Progress			
Task Number	**Start Date**	**End Date**	**% Complete**
Task 1: Sensor development	1/1/2019	6/30/2019	Complete
Task 2: Signal processing and sensor characterization	1/1/2019	12/30/2019	Complete
Task 3: Preliminary field tests on bridge	6/1/2020	9/30/2021	90%
Overall Project:	*1/1/2019*	*9/30/2021*	90%

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date***
$102.1k	$90k	90%

Include the date the budget is current to.

Describe any opportunities for training/professional development that have been provided…

Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of any other technology transfer efforts that took place during the reporting period.)… Use the tables below to complete information about conferences, workshops, publications, etc. ***List all other outputs, outcomes, and impacts after the tables*** *(i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings).*

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	**Event**	**Type**	**Location**	**Date(s)**

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Optical Fiber Sensing textile for Temperature and	Smart structure + Nondestructive evaluation.	(SPIE)Conference	Online	03/22/21-03/26/21
Distributed Sensing Textile for Bridge Monitoring	TIDC Showcase Presentation	Showcase	Online	06/23/2021
Development of a System level distributed Sensing technique for long-term monitoring of concrete and composite bridges	TIDC Showcase Presentation	Showcase	Online	04/21/2019

Table 4: Publications and Submitted Papers and Reports

Type	Title	Citation	Date	Status
Conference	Optical Fiber Sensing textile for Temperature and Distributed Measurment			Accepted by the conference
Journal	Pipeline monitoring using fiber optic textile for Structural Health Monitoring			Updating draft with comments provided by the coauthors
Journal	Structural Health Monitoring of a bridge using optic sensing textile			In review from other coauthors

Encouraged to add figures that may be useful (especially for the website)…

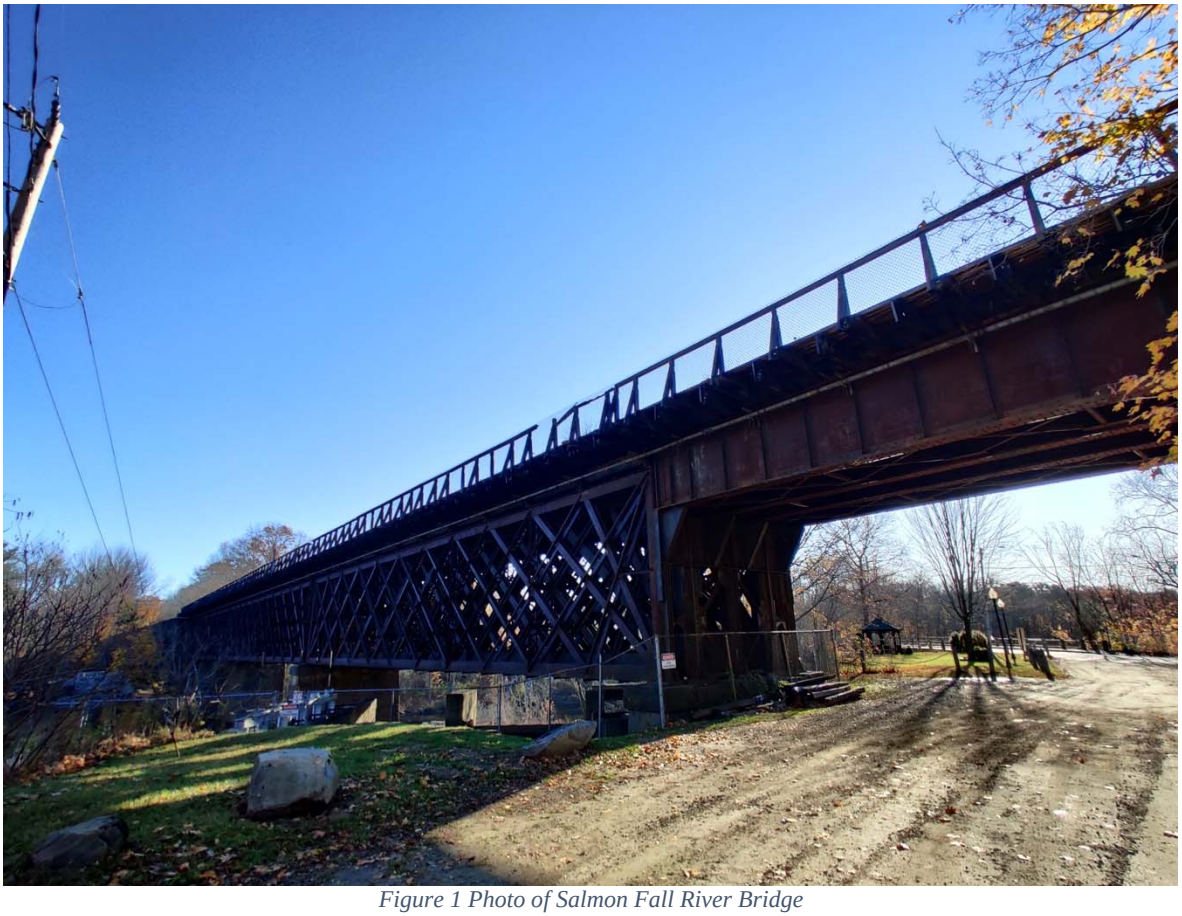

Figure 1 Photo of Salmon Fall River Bridge

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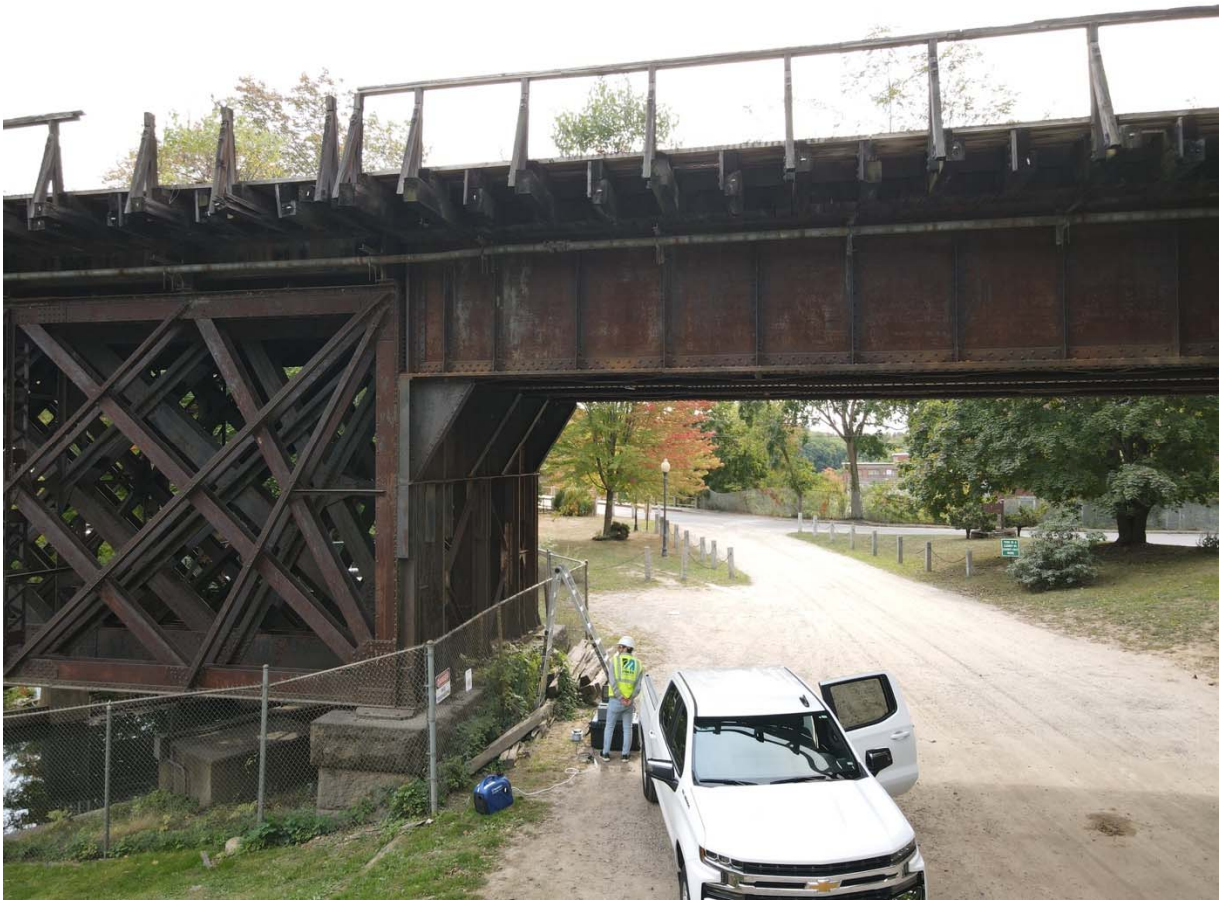

Figure 2 Photo of UML students collecting data under the bridge.

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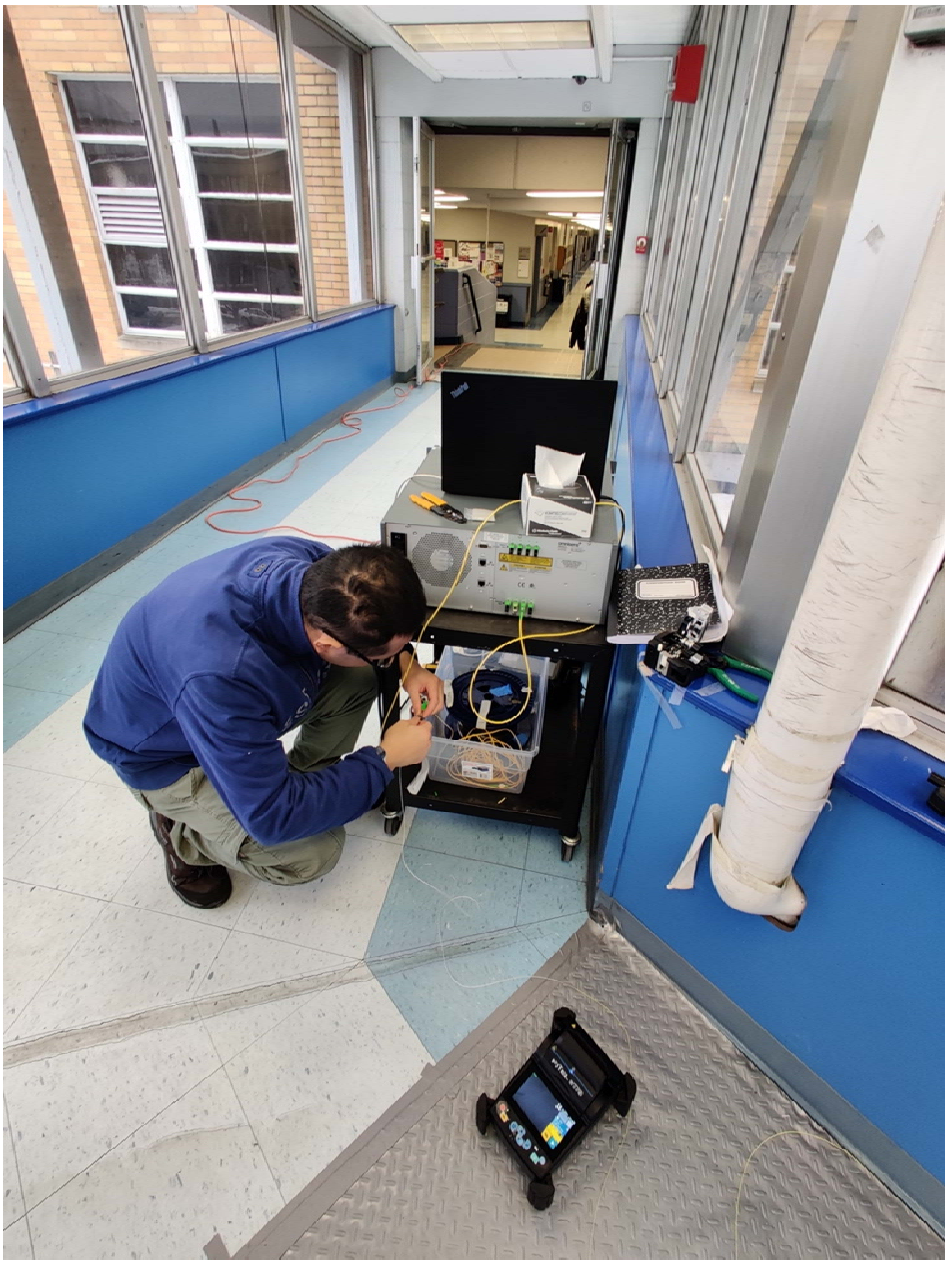

Figure 3 Photo of UML students testing on Pedestrian bridge on North Campus.

Participants and Collaborators:

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	**Email Address**	**Department**	**Role in Research**
Xingwei Wang	Xingwei_wang@uml.edu	Electrical and Computer Engineering	PI
TzuYang Yu	Tzuyang_yu@uml.edu	Civil Engineering	Co-PI

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Use the table below to list all students who have participated in the project during the reporting. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.)

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Andres Biondi		Ph.D.	ECE	Conduct field tests and analyze signals
Rui Wu		Ph.D.	ECE	Conduct field tests and analyze signals
Lidan Cao		Ph.D.	ECE	Conduct field tests and analyze signals
Gandhi, HarshNareshkumar"		Ph.D.	ECE	Remote structural sensing

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**

Use the table below to list organizations have been involved as partners on this project and their contribution to the project.

Table 8: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
~~Luna Innovation Omnisens~~	~~Virginia. USA Switzerland~~					

Note: Technical discussion through Zoom meeting.

List all other outputs, outcomes, and impacts here (i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings). Please be sure to provide detailed information about each item as with the tables above.

Have other collaborators or contacts been involved? If so, who and how? (This would include collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations.)

Table 9: Other Collaborators

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Collaborator Name and Title	Contact Information	Organization and Department	Contribution to Research
			(i.e. Technical Champion)

Number of active industrial partners involved in this research project

- 1 Saint Gobain

Number of technologies deployed in transportation applications through pilot or demonstration studies because of this research project. We conduct weekly meetings to discuss the project progress. UML Ph.D. student, Andres Biondi, went to Saint Gobain from time to time to work with their engineers on the sensing textile testing.

- LUNA

LUNA Innovation has provided an extension module to be used with the OFDR controller.
LUNA software updated

Number of active State DOT partners involved in the research project.

- MA DOT, we have met MA DOT, presented our work, and discuss more field test plans.

Number of technical Champions actively involved in this project

Craig Stratton.
Director of Sensing Sales- Northeast USA and Canada.
Email: strattonC@lunainc.com.
Phone: 864-509-7635

Changes:

No change.

Planned Activities:

We will continue to collect data every few months as weather permits and study the response of the sensor to different weather conditions. Additionally, we will use OFDR system to collect more data and analyze them.