

Quarterly Progress Report:

Project Number and Title: 2.10 Durability Evaluation of Carbon Fiber Composite Strands in Highway Bridges
Research Area 2: New materials for longevity and constructability

PI: Roberto Lopez-Anido, University of Maine

Co-PI(s): Keith Berube and Andrew Goupee, University of Maine

Reporting Period: 01/01/2021 to 6/30/2021

Date: 6/30/21

Overview:

Main activities in this quarter were:

- Installed 900 ft of conduit for our fiber-optic sensor leads
- Ran the fiber-optic sensor leads through the conduit from each stay anchor back to the pylon.
- Installed junction boxes at each stay anchor for the power supplies and the wireless data acquisition systems
- Ran the copper lines from the stay anchor sensors to the wireless data acquisition units.
- Implemented a Labview data acquisition program that acquires data from both the fiber-optic sensor system and the wireless sensor system
- Installed the support rails for the onsite computer and fiber-optic sensor acquisition junction boxes.
- Collected the load cell data, LVDT data and stay temperature data wireless for the 6 stay locations; the fiber optic strain data was collected through cables.
- Conducted weekly trips to the bridge.
- Processed sensor data sets acquired at the bridge site.
- Drafted manuscript presenting project findings.

Meeting the Overarching Goals of the Project:

The activities performed in this quarter supported the following project tasks:

- Task 1.1: Upgrade Data Acquisition System
- Task 1.2: External Environmental Sensing
- Task 1.3: Implement Analytical Model
- Task 1.4: Durability Assessment

Accomplishments:

Wireless data acquisition system for structural health monitoring was installed in the Penobscot-Narrows Bridge.

Task Progress and Budget:

Table 1: Task Progress			
Task Number	Start Date	End Date	% Complete
Task 1.1: Upgrade Data Acquisition System	6/1/2019	12/31/2020	85%
Task 1.2: External Environmental Sensing	1/1/2020	12/31/2020	75%
Task 1.3: Implement Analytical Model	11/1/2019	8/30/2021	60%
Task 1.4: Durability Assessment	11/1/2019	12/31/2021	40%
Phase 1 Overall	6/1/2019	12/31/2021	Phase 1 % Complete

Table 2: Budget Progress		
Project Budget	Spend – Project to Date	% Project to Date*
Enter Phase 1 Full Budget	Enter Phase 1 Full Spend Amount	Enter Phase 1 % Spent

**Include the date the budget is current to.*

Professional Development/Training Opportunities:

N.A.

Technology Transfer:

N.A.

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	Event	Type	Location	Date(s)
Implementation of a structural health monitoring system for carbon fiber composite strands in the Penobscot Narrows bridge	UMaine Student Symposium (#UMSS21)	Abstract #555	Virtual Recorded video	April 16, 2021

Table 4: Publications and Submitted Papers and Reports				
Type	Title	Citation	Date	Status
Journal paper	Hybrid wireless-fiber optic monitoring system of carbon fiber composite strands in highway bridges	Structural Health Monitoring, Sage	To be submitted in third quarter	In preparation

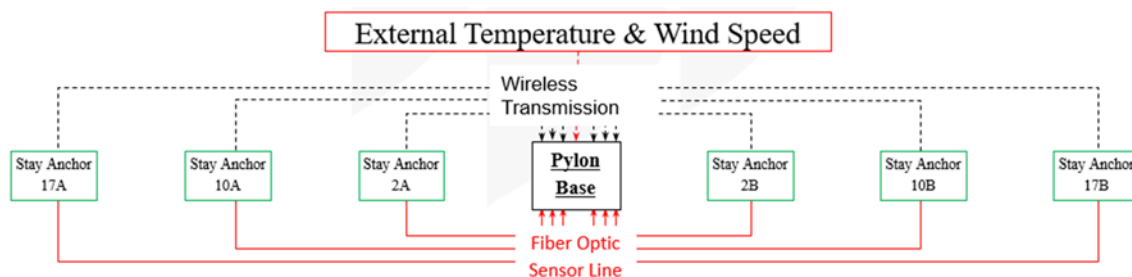


Figure 1 Wireless data acquisition system installed in the Penobscot-Narrows Bridge

Participants and Collaborators:

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	Email Address	Department	Role in Research
Roberto Lopez-Anido	RLA@maine.edu	UMaine Civil and Environmental Engineering	Project PI, Graduate student co-advisor, and Structural lead.
Keith Berube	keith.berube@maine.edu	UMaine Mechanical Engineering Technology	Project Co-PI and Data acquisition instrumentation lead.
Andrew Goupee	Andrew.goupee@maine.edu	UMaine Mechanical Engineering	Project Co-PI, Graduate student co-advisor, and Modeling lead.

Table 6: Student Participants during the reporting period

Student Name	Email Address	Class	Major	Role in research
Braedon Kohler		Masters	Mechanical Engineering	Modeling, programming and data acquisition

Table 7: Students who Graduated During the Reporting Period

Student Name	Degree	Graduation Date	Employment or continued degree

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
Maine DOT	Augusta, ME		x			

Table 9: Other Collaborators

Collaborator Name and Title	Contact Information	Organization and Department	Contribution to Research
			(i.e. technical advisory board, test samples, on-site equipment, data, etc.)

Technical Champion:

Name: Dale Peabody
 Title: Director, Transportation Research
 Organization: MaineDOT
 Location (City & State): Augusta, ME
 Email: Dale.Peabody@maine.gov

Changes:

The schedule has been affected by disruptions of day-to-day campus and field work due to the University restrictions imposed in response to COVID-19 health safety precautions.

Planned Activities:

The following activities are planned for the next three month period:

- Continue working with the data acquisition computer and software to configure it to automatically restart after a power outage.
- Complete the hardware installation at the Penobscot-Narrows Bridge site.
- Have the system configured and recording continuous data.
- Generate graphs summarizing the structural health monitoring data measured at the bridge site.
- Use the data acquired and the model to determine if there are any performance issues that may affect durability.