

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 3/31/2021

Date: 3/31/21

Overview:

Main activities in this quarter were:

- Conducted temperature verification of the data acquisition system for sensors in an environmental chamber in the lab.
- Configured Labview software for acquiring sensor data.
- Finalized junction box installation at the bridge site and mapped out conduit locations.
- 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

Accomplishments:

Correlation of field monitoring data with thermoelastic model to assess durability

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 | 70% |
| Task 1.3: Implement Analytical Model | 11/1/2019 | 8/30/2021 | 55% |
| Task 1.4: Durability Assessment | 11/1/2019 | 12/31/2021 | 35% |
| 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 second quarter | In preparation |



Figure 1 Graduate student Braedon Kohler working on temperature verification of the data acquisition system for sensors in an environmental chamber in the lab

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:

- Complete the hardware installation at the Penobscot-Narrows Bridge site.
- Generate graphs summarizing the structural health monitoring data measured at the bridge site.
- We plan to use the data acquired and the model to determine if there are any performance issues that may affect durability.