Quarterly Progress Report:
Project Number and Title: 3.4 Testing, Monitoring and Analysis of FRP Girder Bridge with Concrete Deck
Research Area: Thrust Area 3
PI: W. Davids, UMaine
Co-PI(s): H. Dagher, UMaine
Reporting Period: 1/1/2020 – 3/31/2020
Submission Date: 12/31/2019

Overview: (Please answer each question individually)

*Provide **BRIEF** overview and summary of activities performed during the reporting period.*

During the reporting period, observations of manufacture and construction of the Hampden bridge has continued (Task 1), initial planning of the live-load-test (Task 2) has commenced, and additional development has been made with the 3D finite element model (Task 3). All five of the FRP bridge girders have been manufactured with direct observation of the layup, preparation, infusion, and post-processing made, along with observations of one major manufacturing defect and its repair. Preparation for the load test has commenced, with a draft instrumentation plan and testing regiment being developed. A base-line finite element model of the Hampden Bridge has been made following the bridge's actual design drawings. The model mesh refinement has been verified and the model is ready for load input from field testing.

Provide context as to how these activities are helping achieve the overarching goal(s) of the project…

Observation of girder manufacture has enabled identification of problems that have arisen, with the obvious example being the manufacturing defect that was discovered and repaired. Although the defect's cause has yet to be established, its establishment will lead to a better understanding of this type of defect in the future, streamlining manufacture and increasing the bridge type's acceptance and competitiveness. In creation of preliminary instrumentation layouts and test plans, the overall objectives of testing were kept at the forefront. This has led to plans, which are specifically designed to extract data describing the bridge's flexural behavior and moment load distribution. The creation of a base-line finite element model of the bridge will, when test data are available, improve understanding of the bridge's flexural and load distributive behavior, enabling better predictions to be made in the future.

Describe any accomplishments achieved under the project goals…

Observations of the manufacturing process have been made and documented, including challenges that have arisen and the solutions developed to overcome them. The finite-element model of the bridge has also been further developed to account for the actual bridge's geometry and mechanics, simplifying the process of analysis when live-load test data become available.

Complete the following tables to document the work toward each task and budget (add rows/remove rows as needed, make sure you complete the Overall Project progress row and include all tasks even if they have ended or have not been started)…

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1:	3/2019	8/2020 (anticipated)	50
Task 2:	1/1/2020	8/2020 (anticipated)	5
Task 3:	1/1/2020	5/2021	30
Overall Project:	3/2019	5/2021	25

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*
$161,747	$48,329	29.9% (3/31/2020)

Include the date the budget is current to.

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

The project PI regularly provides input to the AIT engineers on design details and provides feedback on design assumptions and procedures employed by AIT.

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)**
"Testing, Monitoring, and Analysis of FRP Girder Bridge with Concrete Deck"	TIDC Thrust Area 3 Quarterly Presentation	Mini-Conference	Remote	2/7/2020

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
N/A				

No results have been disseminated due to the project's current scheduling.

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

Fully infused, cured, and post-processed FRP tub-girder


Investigation of Girder Defect

Participants and Collaborators:

Use the table below to list all individuals who have worked on the project.

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	**Email Address**	**Department**	**Role in Research**
William Davids	william.davids@maine.edu	Civil and Environmental Engineering	Principal investigator
Habib Dagher	hd@maine.edu	Civil and Environmental Engineering	Co-Principal investigator

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**
Andrew Schanck		Ph.D	Civil Engineering	Manufacture/construction observation, modeling

Use the table below to list any students who worked on this project and graduated during this reporting period.

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

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**
Advanced Infrastructure Technologies	Brewer, Maine	x		x		x

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.

No technology transfers has occurred within the reporting period.

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.)

Collaboration has been on-going with researchers at UMass Lowell to coordinate installation of sensors for long-term monitoring of the Hampden Bridge.

Table 9: Other Collaborators			
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Contribution to Research**
Tzuyang Yu, Associate Professor	TzuYang_Yu@uml.edu	UMass Lowell, Civil and Environmental Engineering	Sensor installation coordination

Who is the Technical Champion for this project?
Name: Joshua Hasbrouck
Title: Civil Engineer
Organization: Maine Department of Transportation
Location (City & State): Augusta, Maine

Changes:

Discuss any actual or anticipated problems or delays and actions or plans to resolve them…

As mentioned above, a structural defect was discovered in the web of the fifth girder after it was infused. This required both repairs and an investigation as to the defect's cause. This will be ongoing, but is not likely to significantly affect the project schedule.

Discuss any changes in approach and the reasons for the change…

No changes in approach are planned for the foreseeable future.

Planned Activities:

Description of future activities over the coming months.

Over the coming months, additional observation will be made of the girder manufacturing process, as well as the beginning of mobilization for construction. The planning for live-load testing will continue and be finalized, and any required alterations to the finite element model will be made in preparation for analysis.