Quarterly Progress Report:
Project Number and Title: 3.14 FRP-Concrete Hybrid Composite Girder Systems: Web Shear Strength and Design Guide Development
Research Area: Thrust Area 3
PI: W. Davids, UMaine
Reporting Period: 10/1/2020 – 12/31/2020
Submission Date: 12/31/2020

Overview: (Please answer each question individually)

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

During the reporting period, web shear tests have been performed for some of the 24 sandwich panel specimens by ASTM D8067-17. In the most recent test, the specimen was loaded to the fixture capacity of 30,000 lbs before failure, at which point a large stainless steel fixture pin failed. This indicates that the fixture – which was ordered from and designed by Wyoming Test Fixtures – still does not have sufficient capacity. Further, this indicates that these specimens possess much higher shear strength than was initially anticipated. A different, and hopefully stronger, pin has been ordered. Remaining testing will help to confirm the observation of stronger-than-expected shear strengths and quantify the effects of face sheet architecture and core thickness. However, testing will be delayed as detailed below in the "Changes" section.

Significant progress has been made toward drafting a Composite Tub (CT) girder design guide specification. Many of the guide's sections have been drafted with advanced and/or simplified design methodologies, and work is ongoing to develop methodologies for others.

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

Testing of ASTM D8067-17 specimens directly moves toward the goals of the project. By testing these specimens, the shear strength and behavior of CT girder webs can be better characterized and predicted, and finite element (FE) models verified. By drafting parts of the CT girder design specification, future structures' designs will be greatly simplified and streamlined, with additional structures being designed and constructed.

Describe any accomplishments achieved under the project goals…

Some of the test specimens required for Task 1 have been tested, with the remainder being prepared for testing. Numerous sections of the design specification have been drafted, with simplified and/or advanced design methodologies.

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:	6/1/2020	5/31/2021	35
Task 2:	6/1/2020	5/31/2022	50
Overall Project:	6/1/2019	5/31/2022	43

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*
$98,775	????	????

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

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

No opportunities for training or professional development have yet arisen as a result of this project.

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)**
N/A				

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

No results have yet been disseminated.

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

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	Conduct and coordinate testing, modeling, report results, design guide drafting

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		

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 have 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.)

No additional contacts or collaborators have been involved with the project to date.

Who is the Technical Champion for this project?
Name: Anthony Diba
Title: Engineer
Organization: AIT Bridges
Location (City & State): Brewer, Maine
Email Address: anthony@aitbridges.com

Changes:

Discuss any actual or anticipated problems or delays and actions or plans to resolve them…
Numerous unforeseen problems have been experienced which have prevented a larger number of D8067-17 specimens to have been tested. First, after receiving the updated testing fixture, it was found that specimens consistently failed in bearing at the fastening screws rather than experiencing shear failures or buckling. This is being resolved by attaching doubler plates, and this approach appears promising based on the ability to recently load a specimen to the fixture capacity of 30,000 lbs. However, the most recent pin failure represents another setback. Finally, we have been short-handed due to many competing demands on project staff, and getting time on a testing frame has also been challenging.

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

We will pause testing for the next few months, and take it up again this summer. A new Engineer I hire will finish the testing, and the project grad student (Andrew Schanck) will focus on data analysis, modeling, and writing. The picture frame may not allow loading specimens to failure, but can still serve as proof-load tests that give a lower bound on web material shear strength. 3D FEA conducted as part of this project will help quantify web shear buckling response, which is a very critical element of behavior as well.

Planned Activities:

Description of future activities over the coming months.

The design specification will also progress in light of the results from testing to-date and increased FEA investigating web shear buckling behavior. Testing will resume next summer as noted above.