Quarterly Progress Report:
Project Number and Title: 3.10 Assessment and Optimization of Double CT Bridge Girder Sections with Longitudinal Precast Decks
Research Area: Thrust Area 3
PI: W. Davids, UMaine
Co-PI(s): H. Dagher, UMaine
Reporting Period: 1/1/2021 – 3/31/2021
Submission Date: 3/31/2021

Overview: (Please answer each question individually)

*Provide **BRIEF** overview and summary of activities performed during the reporting period.*
During the reporting period, significant progress has been made toward the completion of all tasks of this project:

Task1: AIT Bridges designed and detailed two CT girders for use in other tasks in this project. These were delivered to the University of Maine's Advanced Structures and Composites Center (ASCC) for subsequent testing, effectively closing out this task with the exception of manufacturing data compilation.

Task 2: The three remaining shear push-out block specimens were delivered to the ASCC where two were tested in fatigue to 6 million cycles. After these specimens had been fatigue tested, each of the five specimens (four having been previously fatigue tested and one control) were tested to failure, closing out testing for this task. The failure loads of these specimens ranged between 155 kip and 180 kip.

Task 3: One of the girders manufactured as part of Task 1 was set up and instrumented to monitor long-term creep deformation at the ASCC. During the first few days, creep measurements were taken at a high frequency, with the frequency reduced with the passage of time. Measurements continue to be made at regular intervals.

Tasks 4, 5: The double CT girder specimen which will be tested for tasks 4 and 5 was delivered to the ASCC. This is currently staged, and is waiting to be moved into the loading frame for continued processing and testing. In addition, the plans and work instructions describing the lab-related work to be done in these tasks is currently under way.

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

Task1: Design, manufacture, and delivery of the two girder specimens allows the testing required for Tasks 3 through 5 to be carried out. Without these specimens, no progress could be made toward completion of any of these tasks.

Task 2: Fatigue testing of the remaining two push-out specimens allows the connection's long-term service-level behavior to be better characterized and assessed. Failure testing each of the specimens allows characterization of the connection's ultimate load level behavior. Both of these characterizations aid in prediction of the connection's performance for future design.

Task 3: Creep monitoring helps with our understanding of the stiffness of the composite section. Furthermore, this dictates how much creep deflection should be accounted for in engineering the final grade profile and camber of a bridge project.

Tasks 4 & 5: Agreed on the work instructions required to carry out testing will provide proper framework for data analysis and reporting the relevant information.

Describe any accomplishments achieved under the project goals…

Task 1: The two double CT girder specimens have been designed, manufactured, and delivered, closing out this task.

Task 2: Each of the push-out specimens has been fatigue and strength tested and results analyses are ongoing.

Task 3: One of the double CT girder specimens has been set up and instrumented to monitor creep, and monitoring is ongoing.

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: Specimen Design and Fabrication	7/1/2020	8/30/2020	100%
Task 2: Girder Shear Connector Testing	9/1/2020	12/30/2020	90%
Task 3: Girder Creep Testing	9/1/2020	11/31/2020	90%
Task 4: Girder Construction Performance Testing	9/1/2020	2/28/2020	10%
Task 5: Girder Strength Testing	3/1/2020	8/31/2021	10%
Overall Project:	3/2019	8/31/2021	59%

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date***
$240,376	????	????

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.

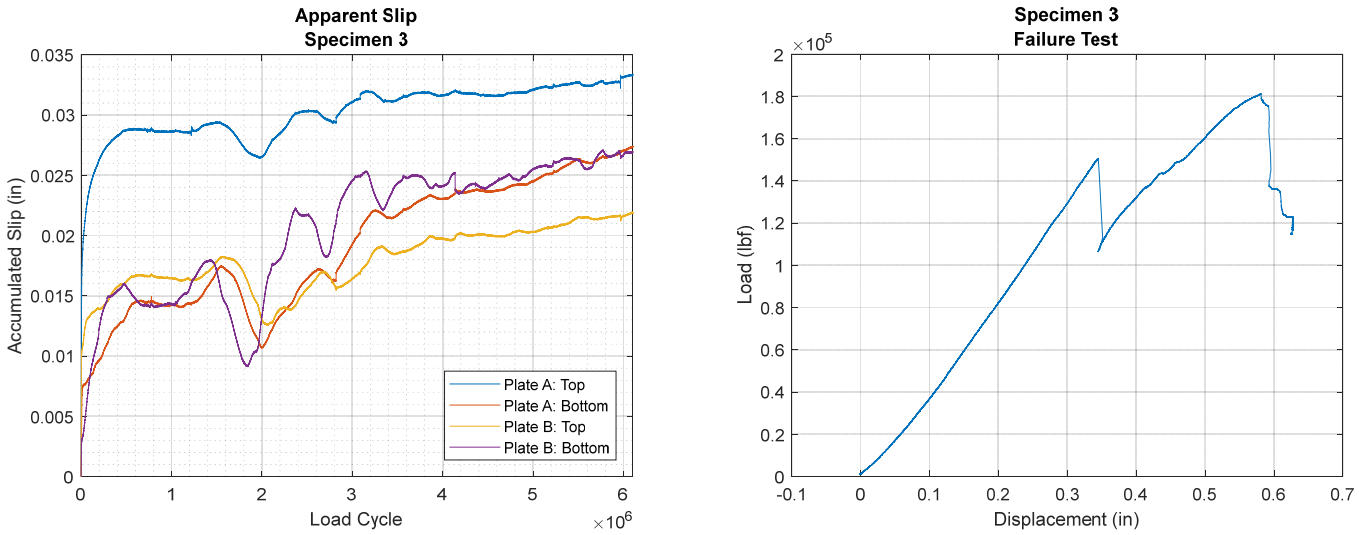
Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of 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)**
N/A				

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)…



Slip Recorded from Specimen 3 during Fatigue Testing and Load-Deflection Data from Strength Testing

Creep Testing Girder Specimen

Staged Strength Testing Girder Specimen

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, report results
Jacob Clark		Senior	Civil Engineering	Lab and planning support

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	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.)

Who is the Technical Champion for this project?
Name: Ken Sweeney
Title: President
Organization: AIT Bridges
Location (City & State): Brewer, Maine
Email Address: ken@aitbridges.com

Changes:

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

The mounting hardware for the creep measuring instrumentation (for Task 3) was found to have moved during the first few days of testing. This was addressed by fabricating a stiffer structure which to-date has caused no additional problems.

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

The project has been delayed due to challenges in fabrication as well as slowed lab activity caused by COVID-19. No changes in approach are planned for the foreseeable future.

Planned Activities:

Description of future activities over the coming months.

Task 1: Fabrication data will be compiled along with QC documents prepared by AIT Bridges.

Task 2: Final analysis of fatigue and strength data will be performed and reporting conducted

Task 3: Creep deflections will continue to be monitored

Tasks 4 & 5 Work instructions will be finalized. The girder specimen will be moved from staging to the load frame when available, and its cast-in-place deck formed and cast. If possible testing will commence.