Quarterly Progress Report:
Project Number and Title: Assessment of Micropile-Supported Integral Abutment Bridges
Research Area: Civil Engineering
PI: *Aaron Gallant, Department of Civil and Environmental Engineering*
Co-PI(s): *Bill Davids, Department of Civil and Environmental Engineering*
Reporting Period: *Q4 2020*
Submission Date: *December 31, 2020*

Overview: (Please answer each question individually)
*Provide **BRIEF** overview and summary of activities performed during the reporting period. This summary should be written in lay terms for a general audience to understand. This should not be an extensive write up of findings (those are to be included in the final report), but a high-level overview of the activities conducted during the last three months **no more than 3 bullet points no more than 1 sentence each** ….*

Activities developed during the reporting period include extension of previous parametric FEA to understanding of the impacts of pile yielding on the bridge substructure and superstructure performance. These effects were analyzed by considering: 1) piles remain in the elastic range and full fixity is attained at the pile-abutment connection; and 2) pile develop plastic hinge at the top and eventually rupture due to fatigue takes place, i.e., piles and abutment are disconnected. In the reality, micro-pile supported IABs are expected to lie in an intermediate point, therefore, actual behavior is interpolated from the results obtained for the two extreme scenarios. For both cases, the model set-up was the same with the only difference being the connection between piles and abutment, while in the scenario I the piles are fixed to the abutment, in scenario II a gap is artificially introduced to guarantee disconnection at the foundation system.

Results were analyzed in terms of pile-abutment lateral displacements at maximum temperature change and bridge girders deflections relative to abutments. Main conclusion from this preliminary study on the consequences of pile head yielding are:

- Based on free-head analyses previously performed, pile fixity at the abutment connection may have a negligible effect on thermal super-structure deformations. Expansion contraction will have negligible changes if yielding of micropiles occurs and a substantial majority of the load is arched into the micropile element.
- For free piles, larger abutment rotations were obtained. Thus, yielding at the head will increase abutment rotations (i.e. larger deflection of span and additional lateral movement behind the abutment associated with settlement, though differences were ~0.1 inches for Nash-stream scenario.
- For free piles, larger mid-span deflections and moments were obtained (+15% and +20%, respectively), but still far from failure (i.e., accomplish serviceability requirements). Same effect expected at yielding, but attenuated by the restraint still provided by the micropiles (plastic moment at the head associated with our comment that this is an "intermediate" condition).

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: Parametric FEA	October 1st 2020	December 31st 2020	80
Task 2: Literature review	October 1st 2020	December 31st 2020	90
Overall Project:	*September 3rd 2019*	*May 2021*	80%

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*

Include the date the budget is current to.

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

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)**

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
i.e. Peer-reviewed journal, conference paper, book, policy paper	Publication title	Full citation		I.e. Submitted, accepted, under review

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

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**
Aaron Gallant	aaron.gallant@maine.edu	CIE	PI
Bill Davids	william.davids@maine.edu	CIE	Co-PI

Use the table below to list all students who have participated in the project.

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Sebastian Montoya		Master	Civil Engineering	Research Assistant

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**

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**
Maine Department of Transportation	Maine	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.

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.)

Table 9: Other Collaborators			
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Contribution to Research**
			(i.e. Technical Champion)

Who is the Technical Champion for this project?
Name: Laura Krusinksi
Title: Senior Geotechnical Engineer
Organization: MaineDOT
Location (City & State): August, Maine
Email Address: laura.krusinkski@maine.gov

Changes:

There are no changes since the previous report.

Planned Activities:

Description of future activities over the coming months.

As stated in previous reports, strength and behavior of threaded connections under bending loading is not completely understood. Currently, a testing program is being design in order to attend the gaps in the knowledge, specifically the strain distribution at the connection location and a reliable model for predicting its strength.