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: *Winter 2019-2020*
Submission Date: *March-2020*

Overview: (Please answer each question individually)

Describe any accomplishments achieved under the project goals…

During the reporting period, computational modeling of thermal expansion/contraction of an integral abutment bridge (IAB) was performed. The computational model was elaborated using the finite element software PLAXIS 2D which can represent effects such as 2-dimentional (plane strain) non-linear behavior of supporting soil, temperature induced deformations on superstructure and shrinkage of concrete deck of the bridge. The model was calibrated by reproducing the measurements reported in the technical literature for an IAB supported on HP steel section piles driven at a shallow bedrock site. Then, a parametric analysis was performed on which bridge length (span length), total pile length, as well as, rock embedment length was varied looking for the influence of these variables on the induced stresses on the substructure and total thermal deformation of the superstructure. The following findings are highlighted:

- 2D Model captures the main features of the substructure behavior (pile and abutment displacements) under thermal deformations imposed by the superstructure. Although there are limitations in the 2D model due to the inner three-dimensional nature of the problem, the model results were in good agreement with measurements reported in the literature, showing similar deformed shape and order of magnitude (see Figure 1).
- Pile length, as well as, rock embedment length has little influence on the bridge thermal deformations. These deformations were found to be mainly controlled by the total bridge span length. However, pile length and rock embedment have big influence on the settlement of the structure.
- Pile length, as well as, rock embedment length has little influence on the maximum stresses imposed on the substructure. These stresses were found to be mainly controlled by the bridge span length and are in its majority bending stresses.

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1: Finite Element model setup	December 27th 2020	January 31st 2020	100
Task 2: Model calibration	February 1st 2020	February 15th 2020	100
Task 3: Python programming	February 16th 2020	February 21st 2020	100
Task 4: Parametric Analysis	February 22nd 2020	February 29th 2020	100
Overall Project:	*September 3rd 2019*	*May 2021*	40%

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*
$186,480	$24,650	13.2% (3/31/2020)

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)**
Presentation title	Name of event (i.e. TIDC 1st Annual Conference)	i.e. Conference, Symposium, Seminar,		

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)…

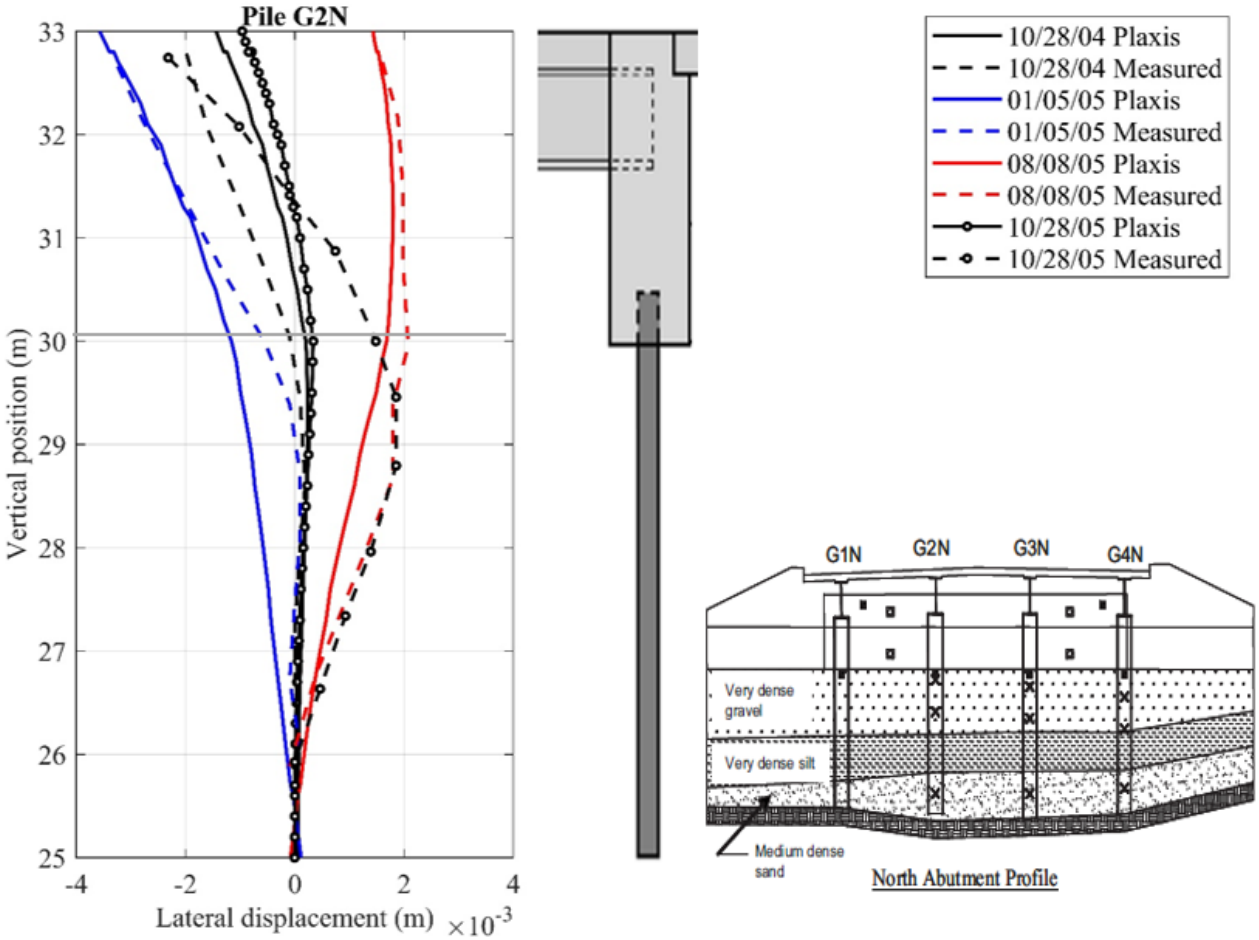

Figure 1 Computational model results comparison with measurements reported by Davids et al (2010)

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**
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**
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**
N/A			

Who is the Technical Champion for this project?
Name: Laura Krusinski and Dale Peabody
Title:
Organization: MaineDOT
Location (City & State): Augusta, ME
Email Address:

Changes:

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

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

Planned Activities:

Description of future activities over the coming months.

3-dimentional finite element analysis will be performed in the following months. It includes activities such as model set-up, calibration and validation. Then a parametric analysis for IAB supported on micro-piles will be performed and variables such as rock embedment length, rock bearing capacity and bridge skew will be the focus of the analysis