

**Quarterly Progress and Performance Indicators 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:** 10/01/2021-12/31/2021

**Submission Date:** December/2021

**\*\*\*IMPORTANT:** Please fill out each section fully and reply with N/A for questions/sections with nothing to report. For ease of reporting to the USDOT, please do not remove, or change the order of, any sections/text. You may remove/add each rows in tables as needed. Thank you! \*\*\*  
The report is due on the last day of the reporting period in .doc format to tidc@maine.edu.

**Overview:**

Provide **BRIEF** highlights 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 at no more than 1 sentence each** ....

During the reporting period the following activities were performed:

- Experimental testing program planning and coordination with the ADSC-IAF.
- Analytical elasticity analysis of micropile coupling.

**Meeting the Overarching Goals of the Project:**

How did the previous items help you achieve the project goals and objects? Please give one bullet point for each bullet point listed above.

- The experimental testing program constitutes the second phase of the research project. It’s planning determines the overall development of the project itself.
- Development of an analytical model for estimation of micropile coupling strength is the overall goal of the project

**Accomplishments:**

List any accomplishments achieved under the project goals in bullet point form...

- Experimental testing program designed. Starting date on February 2022.

**Task Progress and Budget:**

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: Title	Start Date	End Date	% Complete

Task 1.1: Phase 1 – Numerical modeling	09/01/2019	09/30/2021	100
Task 1.2: Phase 1 – Data analysis	09/01/2019	09/30/2021	100
Task 1.3: Phase 1 – Final Technical report (phase I)	09/01/2019	09/30/2021	100
Task 1.4: Phase 1 – Conference paper	01/01/2021	09/30/2021	100
Task 2.1: Phase 2 – Experimental program planning	07/01/2021	10/30/2021	100
Task 2.2: Phase 2 – Experimental program execution	11/01/2022	05/30/2022	0
Task 2.3: Phase 2 – Literature review	09/01/2020	05/30/2023	60
Task 2.4: Phase 2 – Data Analysis	01/01/2022	04/30/2022	0
Task 2.5: Phase 2 – Code programming	03/01/2022	03/01/2023	0
Task 2.6: Phase 2 – Final project technical report	05/01/2022	08/30/2022	0
Task 2.7: Phase 2 – Paper 1	05/01/2022	09/30/2022	0
Task 2.8: Phase 2 – Paper 2	10/01/2022	02/30/2023	0
Task 2.9: Phase 2 – Paper 3	03/01/2023	05/30/2023	0
etc.			
Phase 1 Overall	09/01/2019	09/30/2021	100
Phase 2 Overall	07/01/2021	05/30/2023	10
Phase 3 Overall	Enter Phase 3 Actual Start Date	Enter Phase 3 Planned/Actual End Date	Enter Phase 3 % Complete

**Table 2: Budget Progress**

<b>Project Budget</b>	<b>Spend – Project to Date</b>	<b>% Project to Date (include the date)</b>
Enter Phase 1 Full Budget	Enter Phase 1 Full Spend Amount (Federal + Cost Share)	Enter Phase 1 % Spent
Enter Phase 2 Full Budget	Enter Phase 2 Full Spend Amount (Federal + Cost Share)	Enter Phase 2 % Spent
Enter Phase 3 Full Budget	Enter Phase 3 Full Spend Amount (Federal + Cost Share)	Enter Phase 3 % Spent

**Is your Research Project Applied or Advanced?**

- Applied** (*The systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.*) Applicable to Phase I.
- Advanced** (*An intermediate research effort between basic research and applied research. This study bridges basic (study to understand fundamental aspects of phenomena without specific applications in mind) and applied research and includes transformative change rather than*

incremental advances. The investigation into the use of basic research results to an area of application without a specific problem to resolve.)  
 Applicable to Phase 2.

**Professional Development/Training Opportunities:**

Describe any opportunities for training/professional development that have been provided. Did you provide a training to a State DOT/AOT or industry organization? What was the training? When was it offered? How many people attended? Did you meet with a State DOT/AOT or industry organization to inform them of your findings and how these findings could help their organization? When? How many attended the meeting?

- N/A

**Technology Transfer:**

Complete all of the tables below and provide additional information where requested. Please provide ALL requested information as this is one of the most important sections for reporting to the USDOT. **ONLY provide information relevant to this reporting period.**

Use the table below to complete information about conference sessions, workshops, webinars, seminars, or other events you led/attended where you shared findings as a result of the work you conducted on this project:

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events					
Type	Title	Citation	Event	Location	Date(s)
Poster	Flexural Strength of Micropile Threaded Connections	-	TIDC 2020 Student Poster Contest	Online	September/2020
Poster	Flexural Strength of Micropile Threaded Connections	-	TIDC 2021 Student Poster Contest	Online	December/2021
Presentation	Flexural Strength of Micropile Threaded Joints		TIDC Showcase Presentatons	Online	June / 2021

Use the table below to report any publications, technical reports, peer-reviewed articles, newspaper articles referencing your work, graduate papers, dissertations, etc. written as a result of the work you conducted on this project. Please list only completed items and exclude work in progress.

Table 4: Publications and Submitted Papers and Reports				
Type	Title	Citation	Date	Status
Conference paper	Flexural Strength of Micropile Threaded Connections	Montoya-Vargas, S., Gallant, A., Davids, W.G. (2022). “Flexural Strength of Micropile Threaded Joints”. <i>Geo-Congress 2022</i> . Accepted.	March/2022	Accepted.

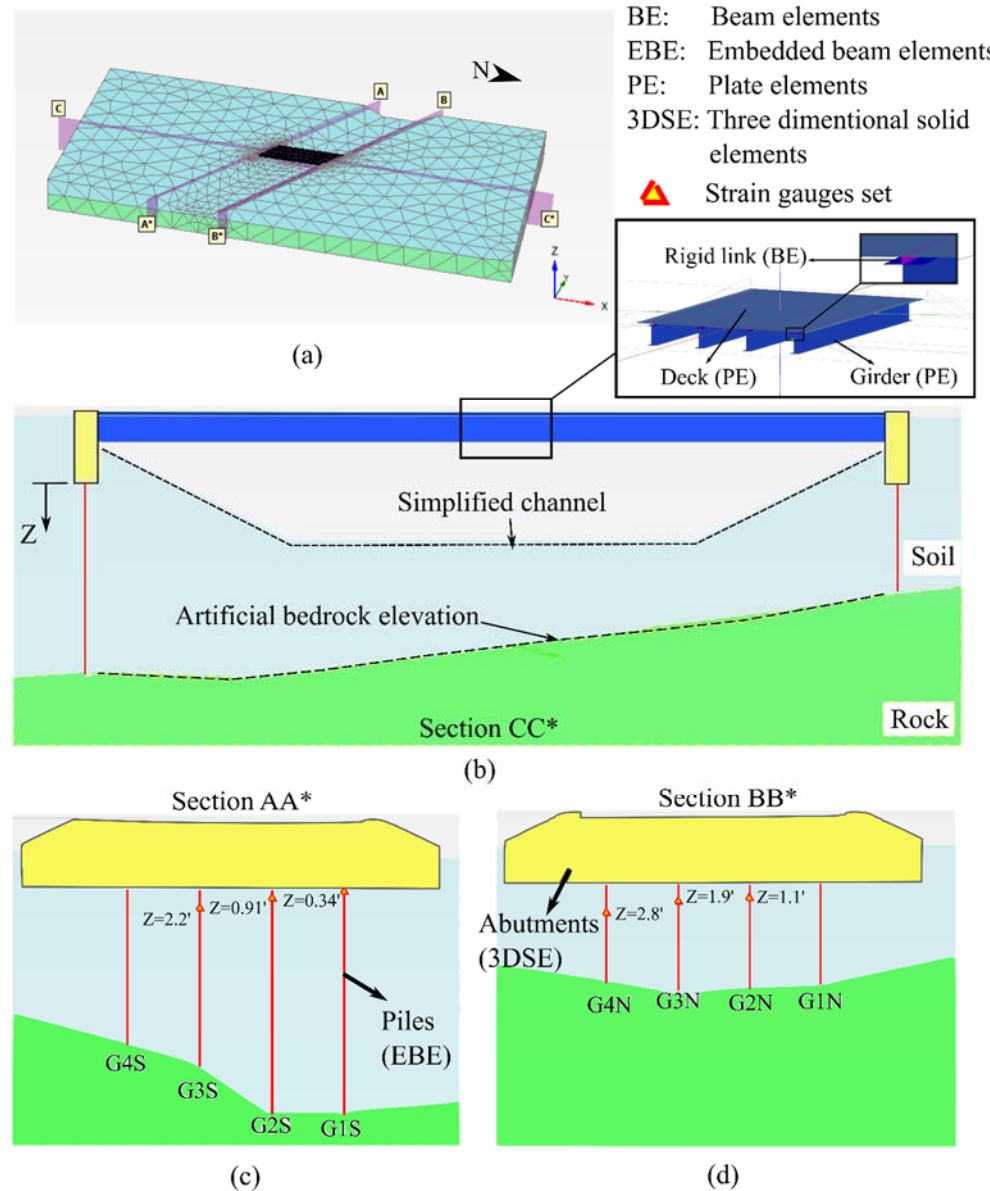
Technical Report	Assessment of Micropile-Supported Integral Abutment Bridges	Montoya-Vargas, S., Gallant, A., Davids, W.G. (2021). “Assessment of Micropile Supported Integral Abutment Bridges”. <i>Final Report</i> , MaineDOT, Under review.	September, 2022	Submitted.
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Answer the following questions (N/A if there is nothing to report):

1. Did you deploy any technology during the reporting period through pilot or demonstration studies as a result of this work? If so, what was the technology? When was it deployed?  
R/: NA
2. Was any technology adopted by industry or transportation agencies as a result of this work? If so, what was the technology? When was is adopted? Who adopted the technology?  
R/: NA
3. Did findings from this research project result in changing industry or transportation agency practices, decision making, or policies? If so, what was the change? When was the change implemented? Who adopted the change?  
R/: NA
4. Were any licenses granted to industry as a result of findings from this work? If so, when? To whom was the license granted?  
R/: NA
5. Were any patent applications submitted as a result of findings from this research? If so, please provide a copy of the patent application with your report.  
R/: NA
6. Were any industrial contracts awarded base on furthering planned research and development activities as a result of findings from this work? If so, when? How much was awarded? Who awarded the contract?

The Association of Drilling Contractors and International Association of Foundation Drillers (ADSC-IAFD) have sponsored, in part, the full-scale testing of micropiles to understand flexural weaknesses at the pipe joint connections.

*Please add figures/images that can be included on the website and/or in marketing/social media materials to further clarify your research to the general public.*



**Finite Element Model (not to scale): (a) General view; (b) Simplified soil profile and structural elements; (c) Soil profile at south abutment (looking south); and (d) Soil profile at north abutment (looking south).**

*Describe any additional activities involving the dissemination of research results not listed above under the following headings:*

**Outputs:**

*Definition: Any new or improved process, practice, technology, software, training aid, or other tangible product resulting from research and development activities. They are used to improve the efficiency, effectiveness, and safety of transportation systems. List any outputs accomplished during this reporting period:*

- Phase I constitutes design guidance regarding applicable span length for integral abutment bridges (IABs) supported on micropiles. Consideration of both the geotechnical end-bearing resistance of the end-bearing variant of the micropile, referred to locally as the “spun pile,” and structural resistance of micropiles was considered. Special attention was given to both the intact (gross) section of the steel pipe casing and structural weaknesses at the threaded pipe joint connections and the influence of subsurface conditions, especially bedrock depth and embedment, contributing to loading of micropile elements.

**Outcomes:**

*Definition: The application of outputs; any changes made to the transportation system, or its regulatory, legislative, or policy framework resulting from research and development activities. List any outcomes accomplished during this reporting period:*

- The MaineDOT is currently considering the results of Phase I of this report with respect to design guidance that can be communicated to their engineers internally and to external consultants that design micropile-supported bridges.

**Impacts:**

*Definition: The effects of the outcomes on the transportation system such as reduced fatalities, decreased capital or operating costs, community impacts, or environmental benefits. The reported impacts from UTCs are used for the assessment of each UTC and to make a case for Federal funding of research and education by demonstrating the impacts that UTC funding has had on technology and education. NOTE: The U.S. DOT uses this information to assess how the research and education programs (a) improve the operation and safety of the transportation system; (b) increase the body of knowledge and technologies; (c) enlarge the pool of people trained to develop knowledge and utilize technologies; and (d) improves the physical, institutional, and information resources that enable people to have access to training and new technologies. List any outcomes accomplished during this reporting period:*

- NA

**Participants and Collaborators:**

*Use the table below to list **all** individuals (compensated or not) who have worked on the project.*

<b>Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members</b>				
<b>Individual Name &amp; Title</b>	<b>Dates involved</b>	<b>Email Address</b>	<b>Department</b>	<b>Role in Research</b>
Aaron Gallant	09/01/2019-09/30/2021	<a href="mailto:aaron.gallant@maine.edu">aaron.gallant@maine.edu</a>	CIE	PI
Bill Davids	09/01/2020-09/30/2021	<a href="mailto:william.davids@maine.edu">william.davids@maine.edu</a>	CIE	Co-PI

Use the table below to list **all** students who have participated in the project during the reporting period. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.) **ALL FIELDS ARE REQUIRED.**

Table 6: Student Participants during the reporting period								
Student Name	Start Date	End Date	Advisor	Email Address	Level	Major	Funding Source	Role in research
Sebastian Montoya	09/01/2019	05/30/2023	Aaron Gallant	<hr/>	Master	Civil Engineering	TIDC, Maine DoT	Literature review, algorithm development and programming, technical documents writing

Use the table below to list any students who worked on this project and graduated or received a certificate during this reporting period. Include information about the student's accepted employment (i.e. the student is now working at MaineDOT) or if they are continuing their students through an advanced degree (list the degree and where they are attending).

Table 7: Students who Graduated During the Reporting Period			
Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
			Please list the organization or degree

Use the table below to list any students that participated in Industrial Internships:

Table 8: Industrial Internships			
Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
			Please list the organization or degree

Use the table below to list **organizations** that have been involved as partners on this project and their contribution to the project.

Table 9: Research Project Collaborators during the reporting period						
Organization	Location	Contribution to the Project				
		Financial Support	In-Kind Support	Facilities	Collaborative Research	Personnel Exchanges
		List the amount	List the amount	Mark with an "x" where appropriate		
The International of Foundation Drilling (ADSC-IAFD)	Pennsylvania	X				

Use the table below to list **individuals** that have been involved as partners on this project and their contribution to the project.

(List your **technical champion(s)** in this table. This also includes collaborations within the lead or partner universities who are not already listed as PIs; especially interdepartmental or interdisciplinary collaborations.)

Table 10: Other Collaborators				
Collaborator Name and Title	Contact Information	Organization and Department	Date(s) Involved	Contribution to Research
ADSC-IAFD team	(Peggy Hagerty Duffy) peggy@hagertyengineering.com	ADSC-IAFD	December 2020- December 2021	Revision of testing program

Use the following table to list any transportation related course that were taught or led by researchers associated with this research project:

Table 11: Course List						
Course Code	Course Title	Level	University	Professor	Semester	# of Students
i.e. CE 123		Grad or undergrad?	Where was the course taught?	Who taught the course?	Enter Spring, Fall, Summer, Winter and the year	How many students were enrolled in the class?



**Changes:**

*List any actual or anticipated problems or delays and actions or plans to resolve them (list no-cost extension requests here)...*

*List any changes in approach and the reasons for the change...*

**Planned Activities:**

*List the activities planned during the next quarter.*

- Establishing a testing program (Schedule) at the ASCC in partnership with industry suppliers.
- Fabricate micropiles for testing.