Quarterly Progress and Performance Indicators Report:
Project Number and Title: Flexural Strength of Micropile Threaded Connections
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: *01/01/2022-03/31/2022*
Submission Date: *March/2022*

Overview:

*Provide **BRIEF** highlights of activities performed during the reporting period.*

During the reporting period the following activities were performed:

- Experimental testing program planning and coordination with the ADSC-IAF.
- Instrumentation of testing specimens.
- Training of graduate student on the testing equipment and procedures.
- Podium presentation at Geo-congress 2022 on the flexural strength of micropile threaded connections.

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 core of this research project. Careful planning and coordination of the testing program is crucial to ensure the project goals are achieved.
- Instrumentation is required to obtain the necessary data and represents the first step of the testing program (i.e., in the critical path).
- Training is required to operate the testing equipment.
- Conference presentation contribute towards dissemination of results.

Accomplishments:

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

- Experimental testing program started on March 2022.
- Podium presentation at Geo-congress 2022.

Task Progress and Budget:

Complete the following tables to document the work toward each task and budget

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 design	07/01/2021	03/31/2022	95
Task 2.2: Phase 2 – Experimental program execution	03/01/2022	07/31/2022	5
Task 2.3: Phase 2 – Literature review	01/01/2022	05/30/2023	50
Task 2.4: Phase 2 – Data Analysis	04/15/2022	08/30/2022	0
Task 2.5: Phase 2 – Code programming	01/01/2022	03/01/2023	5
Task 2.6: Phase 2 – Final project technical report	08/01/2022	10/30/2022	0
Task 2.7: Phase 2 – Paper 1	07/01/2022	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
Phase 1 Overall	09/01/2019	09/30/2021	100
Phase 2 Overall	07/01/2021	05/30/2023	15

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date (include the date)**
Phase 1 Full Budget: $85,647	$85,647	100%
Phase 2 Full Budget: $313,145	$0.00	0%

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.

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 Presentations	Online	June / 2021
Presentation	Flexural Strength of Micropile Threaded Joints		GEO-CONGRESS 2022	Charlotte, NC	March 21st 2022

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. Flexural Strength of Micropile Threaded Connections. In Geo-Congress 2022 (pp. 218-227). DOI: 10.1061/9780784484029.021	March/2022	Published.
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". *Final Report*, MaineDOT, Under review.	September, 2022	Submitted.

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?

   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?

   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?

   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?

   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.

   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.

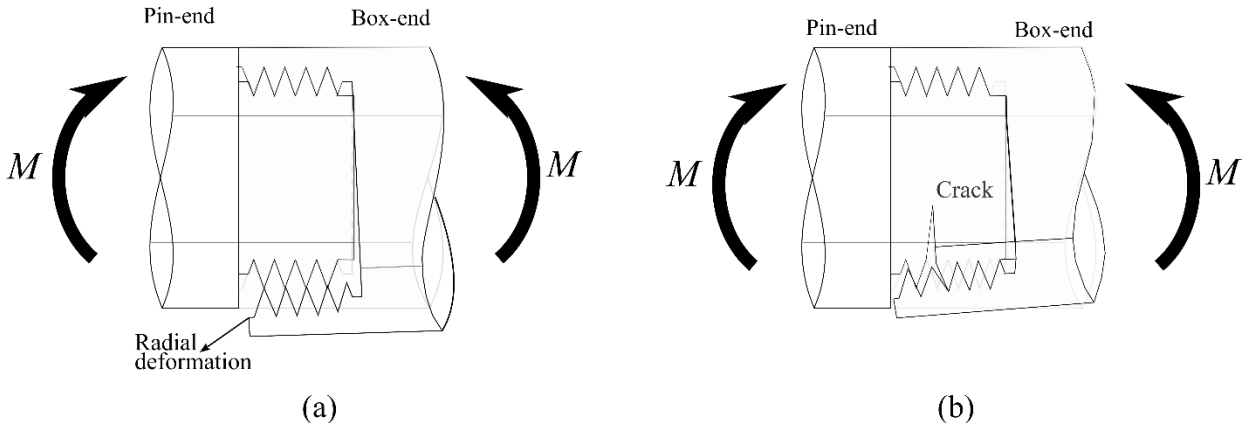

Figure 1 Failure modes of micropile threaded joints subjected to flexural loads

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.*

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members

Individual Name & Title	Dates involved	Email Address	Department	Role in Research
Aaron Gallant	09/01/2019-09/30/2021	aaron.gallant@maine.edu	CIE	PI
Bill Davids	09/01/2020-09/30/2021	william.davids@maine.edu	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		Master	Civil Engineering	TIDC, ADSC-IAFD	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?**
N/A	N/A	N/A	N/A

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?**
N/A	N/A	N/A	N/A

*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 Association of Foundation Drilling (ADSC-IAFD)	Pennsylvania	X				
OCI	Pennsylvania		X			
Nucor	Pennsylvania		X			
GMS	Pennsylvania		X			
Maine Drilling and Blasting			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		ADSC-IAFD	December 2020-March 2022	Head of micropile technical committee

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?
N/A	N/A	N/A	N/A	N/A	N/A	N/A

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.

- Execute the testing program at the ASCC.
- Fabricate micropiles for testing.