

Quarterly Progress and Performance Indicators Report:

Project Number and Title: Durability of Modified Helical Piles under Lateral and Torsional Loads: Embracing Efficient Foundation Alternatives to Support Lightweight Transportation Structures

Research Area: Thrust 3

PI: Aaron Gallant, Assistant Professor, University of

Co-PI(s): Maine Keith Berube, Associate Professor, University of Maine; Aaron Bradshaw, Associate Professor, University of Rhode Island

Reporting Period: 7/1/2021-9/30/2021

Submission Date: 9/30/2021

*****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**

- TIDC and Hubbell finished full-scale field testing of the instrumented helical piles with the collar vane (CV) technology at Hubbell Headquarters in Centralia, MO.
- Final design of the test frame (lateral and torsion) was successfully implemented during testing. (Fig. 1)
- Relationship between Load vs Lateral displacement and bending moment profiles, for the lateral test, and Torque vs Angle of Twist, for torsional test, are obtained using the instrumented pile and the DAQ system.

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.

- Using results from field testing will help us to inform how the CV technology increase the lateral and torsional capacity of Helical Pile.

Accomplishments:

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

- A total of 54 test were performed using 9 different sizes of collar vanes. All these test includes: Lateral monotonic and cyclic test, torsional monotonic and cyclic test

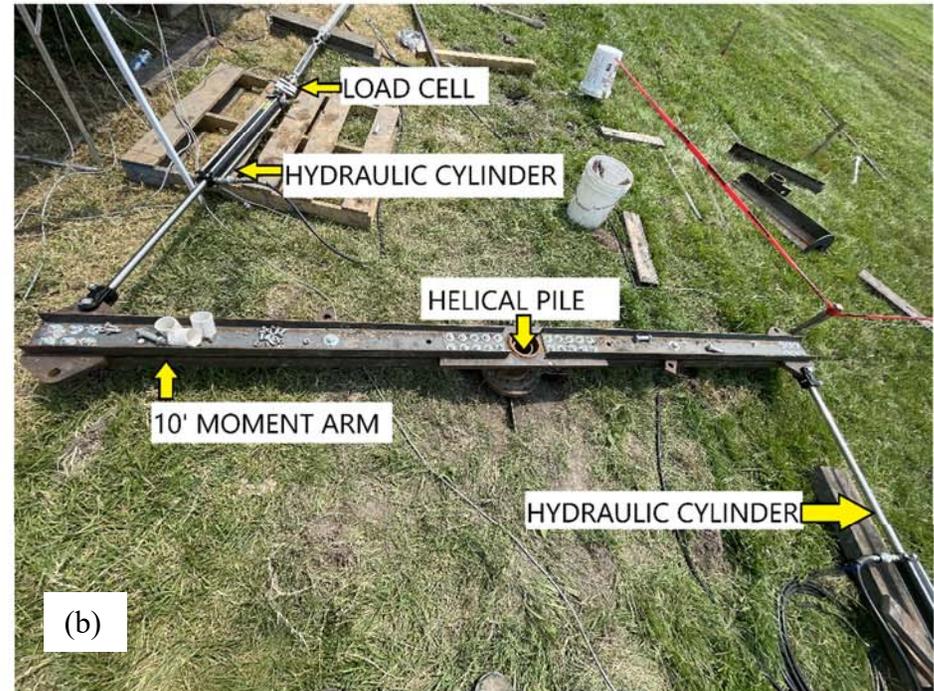
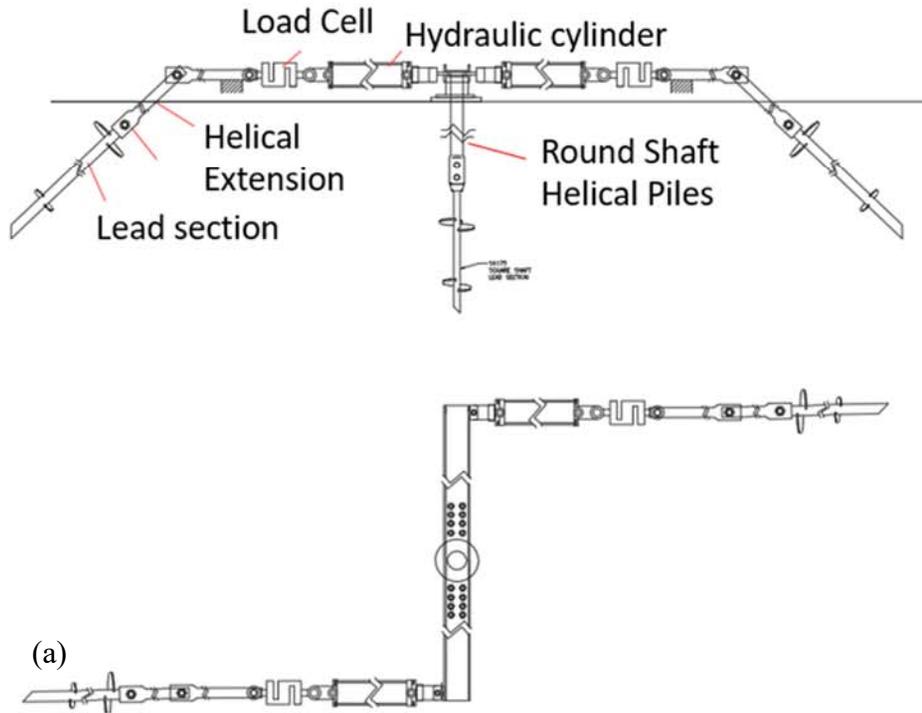


Figure 1. (a) Test frame schematic for torsion test (b) Actual test frame for torsion test.

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: Model development	January	November 2021	40%
Task 2.1: Instrumentation	February 2021	June 2021	100%
Task 2.2: Collar Vane and HP Manufacturing	February 2021	August 2021	100%
Task 2.3: Field testing	June 2021	August 2021	90%
Task 3.1: Data Analysis	September 2021	-	
Task 4.1: Final Report	December 2021	-	

Table 2: Budget Progress		
Project Budget	Spend – Project to Date	% Project to Date (include the date)
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.)*
- 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.)*

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?

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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)
i.e. Conference, Symposium, DOT/AOT presentation, Seminar, etc.	Presentation Title	Full Citation	Name of event (i.e. TIDC 1 st Annual Conference) or who was the presentation given to?		

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
i.e. Peer-reviewed journal, conference paper, book, policy paper, magazine/newspaper article	Publication title	Full citation		i.e. Submitted, accepted, under review

Answer the following questions (N/A if there is nothing to report):

- 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?

Novel collar vane was implemented during test field program at Hubbell headquarters.
- 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?

N/A
- 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?

N/A
- Were any licenses granted to industry as a result of findings from this work? If so, when? To whom was the license granted?

N/A
- 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.

N/A
- 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?

N/A

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.





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:

- Novel collar vane was implemented during lateral and torsional load test with the objective of improve the lateral and torsional resistance of helical piles.

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:

- N/A

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:

- N/A

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	1/13/2021-	aaron.gallant@maine.edu	Civil and Environmental Engineering	PI
Keith Berube	1/13/2021-	keith.berube@maine.edu	Mechanical Engineering	Co-PI
Aaron Bradshaw	1/13/2021-	abrads@uri.edu	Civil Engineering	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 Carvajal	1/13/2021		Dr. Aaron Gallant	<hr/>	Master's	Civil Engineering	TIDC University of Maine	Student research assistant. Performing field testing and developing p-y model.

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
Hubbell Power Systems, Inc	Centralia, MO	x	x	x		
Helix Mooring Systems, Inc	Cumberland, ME	x	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

Gary L. Seider, Engineering Manager	glseider@hubbell.com	Hubbell Power System Inc		Technical champion
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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

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.

- Processing all data obtained during the field testing and the development of simplified models to predict lateral and torsional capacity of the helical pile with CV.