

Quarterly Progress 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 Maine

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

Reporting Period: 04/01/2021

Submission Date: 6/30/2021

Overview: (Please answer each question individually)

TIDC and Hubbell began full-scale field testing of the patent pending collar vane envisioned to improve the lateral and torsional resistance of helical piles. Testing is currently being conducted at Hubbell headquarters in Centralia, MO. Figure 1 illustrates a helical pile instrumented with strain gages and protective covering. The adequacy of strain gage attachment and protection was demonstrated during pilot testing. All strain gages survived installation and testing with and without collar vanes. The piles were also instrumented with sting pots and load cells. All load frames (lateral and torsion) were successfully implemented during pilot testing.

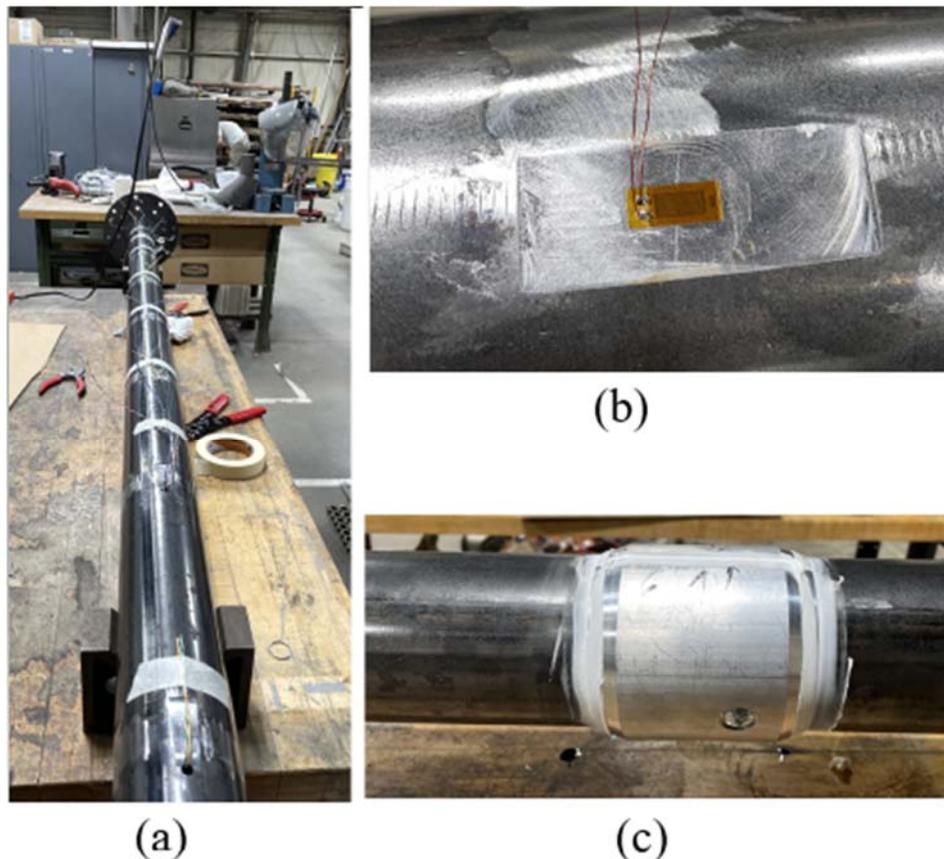


Figure 1. (a) Instrumented HP. (b) Bonded Strain Gauge on HP. (c) Strain Gauge cover.

A total of nine collar vanes (with different dimensions) were manufactured and assembled for testing. Figure 2 illustrates installation of an instrumented pile with the smallest collar vane.

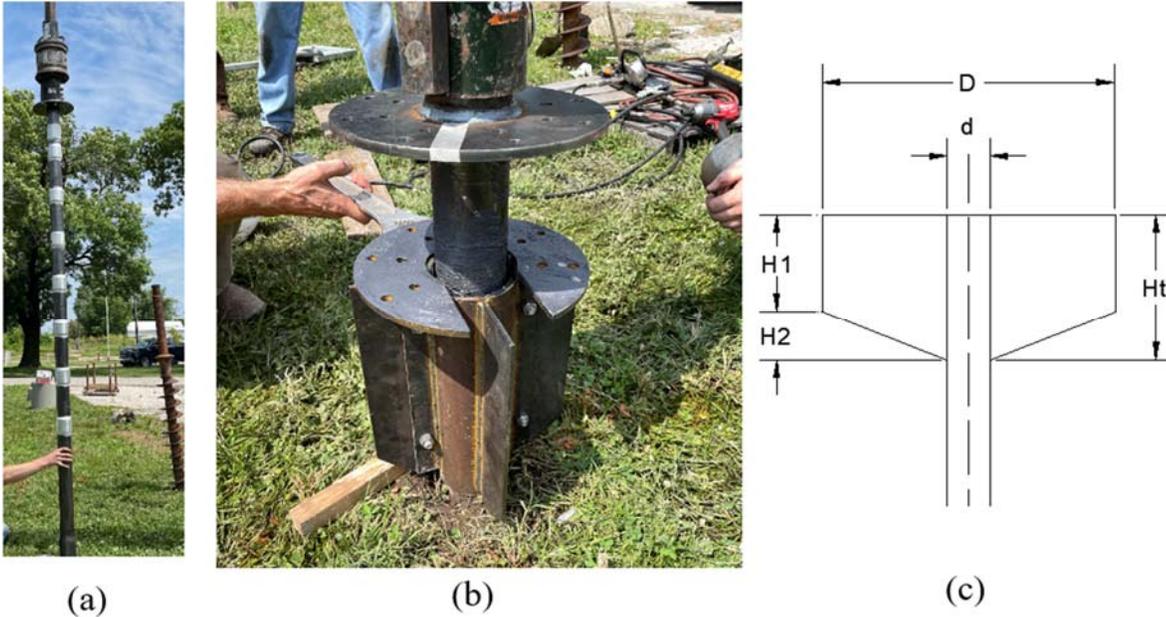


Figure 2. (a) Instrumented HP during installation. (b) CV12-12 adapted to HP. (c) CV adapted nomenclature.

Provide context as to how these activities are helping achieve the overarching goal(s) of the project...

- Field testing by means of pile instrumentation will help us to inform how the CV technology increase the lateral and torsional capacity of HP.

Describe any accomplishments achieved under the project goals

- Data acquisition system (DAQ) is adapted. The system allows for monitoring of 16 independent channels.
- Hydraulic system and test frame used for lateral and torsional load performed as intended.
- Strain gauge covers provided protection to the strain gauges during pile installation.

Table 1: Task Progress			
Task Number	Start Date	End Date	% Complete
Task 1: Model development	January	October 2021	40%
Task 2: Instrumentation	February	June 2021	100%
Task 3: Collar Vane and HP Manufacturing	February 2021	August 2021	80%
Task 4: Field testing	June 2021	August 2021	0%
Task 5: Data Analysis	September 2021		
Overall Project:	01/2021	12/2022	

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)
Presentation title	Name of event (i.e. TIDC 1 st 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)...

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	Civil and Environmental Engineering	PI
Keith Berube	keith.berube@maine.edu	Mechanical Engineering	Co-PI
Aaron Bradshaw	abrads@uri.edu	Civil Engineering	Co-PI

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

Table 6: Student Participants during the reporting period				
Student Name	Email Address	Class	Major	Role in research

Sebastian Carvajal		Master's	Civil Engineering	Graduate 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
Hubbell Power Systems, Inc	Centralia, MO	x	x	x		
Helix Mooring Systems, Inc	Cumberland, ME	x	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: Gary L. Seider
 Title: Engineering Manage
 Organization: Hubbell Power System Inc.
 Location (City & State): Centralia, MO
 Email Address: glseider@hubbell.com

Changes:

N/A

Planned Activities:

Continue field testing to evaluate performance of nine collar vanes under monotonic and cyclic loads at Hubbell test site.