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: *01/01/2021*
Submission Date: *3/31/2021*

Overview: (Please answer each question individually)

*Provide **BRIEF** overview and summary 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 no more than 1 sentence each** ….*

Preliminary analyses have begun to inform manufacturing of helical piles (HPs), collar vane technology (CV), and instrumentation/testing equipment requirements for field testing planned in summer 2021.

- P-Y models adapted to consider CV technology (Figure 1) installed at the top of HPs to increase lateral resistance. This analysis is being used to inform load requirements for hydraulic jacks and instrumentation requirements for field testing.
- Preparation of field instrumentation (e.g. strain gauge, string-pot, data acquisition system (DAQ)) for field testing in summer 2021. Helix Mooring (collaborator) has provided UMaine with HPs to facilitate preparation of on-specimen methods during field testing planned in summer 2021.
- HP and CV manufacturing by Hubbell process has started and the initial design is illustrated in Figure 1.

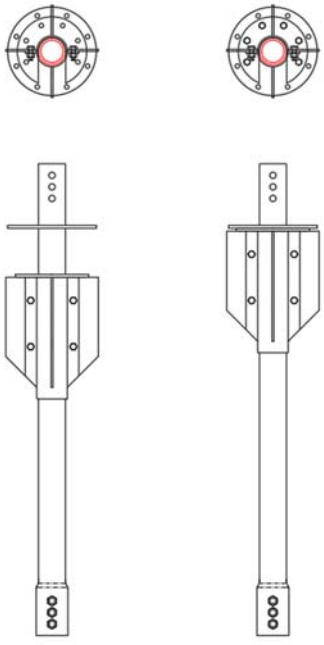

Figure 1. Proposed Tapered Collar Vane on HP.

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

- The p-y model can help us to predict the pile behavior under lateral loads. Field testing in summer 2021 will inform development of appropriate P-Y models in different soil types when CV technology is used to increase the lateral capacity of HPs.

Describe any accomplishments achieved under the project goals

- Charts were developed showing the applied load necessary to move the pile head 1mm and 10mm for a set of different CV dimensions showing the CV geometry influence on the lateral movement of the shaft.

Table 1: Task Progress			
Task Number	**Start Date**	**End Date**	**% Complete**
Task 1: Model development	January	October 2021	40%
Task 2: Instrumentation	February	-	50%
Task 3: Collar Vane and HP Manufacturing	February	-	10%
Task 4: Field testing	June 2021	October 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 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,	Publication title	Full citation		I.e. Submitted, accepted, under review

book, policy paper				

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	

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:

Develop torque and rotation angle (T-θ) relationships for HPs with the CV in soft clays. These initial models will be used to inform testing requirements (e.g. capacity and stroke of hydraulic jack) in summer 2021.