Quarterly Progress Report:
Project Number and Title: 3.12—Lateral Loading of Unreinforced Rigid Elements and Basal Stability of Columns Supported Systems
Research Area: Geotechnical Infrastructure Engineering
PI: *Aaron Gallant, University of Maine*
Co-PI(s):
Reporting Period: *07/2019-09/2019*
Submission Date: *6/30/2020*

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** ….*

This project goal is to assess the basal stability of column supported systems. The systems are divided on two types: embankments and Mechanically Stabilized Earth (MSE wall). In this quarterly report, the basal stability of Mechanically Stabilized Earth (MSE wall) was investigated. Progress was made on the field case scenario at the Council Bluffs Interchange System (CIBS), some of the achievements were:

- Analysis of the field performance via instrumentations that were composed by inclinometers, piezometers, extensometers, and settlement plates. This allows to understand some lateral transfer mechanism that took place during and after filling. An example of the lateral performance is presented in Figure 1.
- Calibration of the parameters of the subsoil at the CIBS were done using the lab test results (i.e. oedometer and undrained triaxial). The model that best fit the response of the CIBS for soft clays was the Hardening Small model considering the small strain deformations.
- Using the calibrated models, the lateral response of two inclinometers was simulated using Plaxis 3D. A good comparison was found between the field case performance and the numerical calculations.

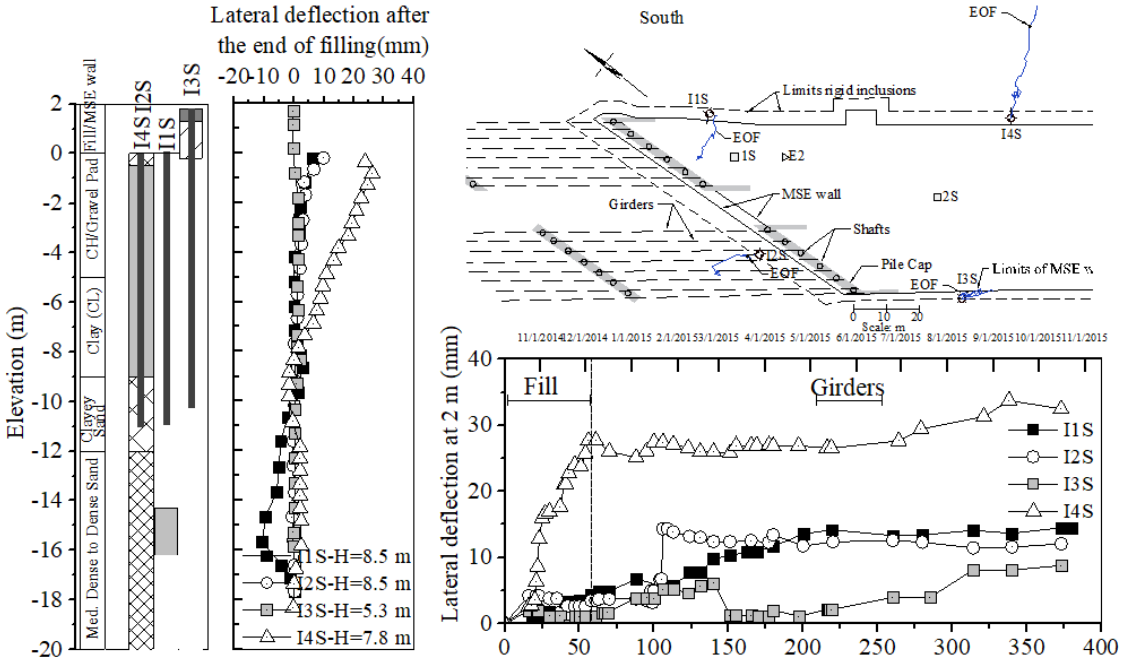

Figure 1. Lateral spreading of the CBIS at South.

Table 1: Task Progress			
Task Number	**Start Date**	**End Date**	**% Complete**
Task 1: Assess stresses in subsoil.	06/2018	06/2019	100%
Task 2: Establish a numerical approach to account for fracture in basal stability.	06/2019	09/2019	100%
Task 3: Calibrate models with field measurements that include lateral and vertical deformations.	06/2019	01/2020	100%
Task 4: Perform parametric study for fill embankments.	01/2020	04/2020	100%
Task 5: Perform parametric study for MSE walls.	06/2020	07/2020	20%
Task 6: Recommended design guidance for industry.	03/2020	05/2020	30%
Overall Project:	06/2018	05/2020	80%

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date***
$33,380	$33,380	100% (6/30/2020)

Include the date the budget is current to.

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	**Event**	**Type**	**Location**	**Date(s)**
2020 TIDC annual Conference	Conference	Annual conference	University of Maine	August 12,2020
45th Annual Conference on Deep Foundations	Online conference	Annual conference	Online	October 27, 2020

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
Journal	Field Observations and Analysis of the Subgrade Response beneath GRCS Embankments at the Council Bluffs Interchange System	Gallant, Aaron, Ehab Shatnawi, and Danilo Botero-Lopez. 2019. "Field Observations and Analysis of the Subgrade Response beneath GRCS Embankments at the Council Bluffs Interchange System." Journal of Geotechnical and Geoenviromental Engineering.	2020	Accepted
Journal	On the basal stability of embankments supported on fractured unreinforced rigid columns over soft soils	**Gallant, A.P.**, Botero-Lopez, D. (2020). "On the basal stability of embankments supported on fractured unreinforced rigid columns over soft soils." *DFI Journal*. *** Awarded 1st place in the DFI Educational Trust's Young Professor Paper Competition (2020)** ***Submitted to DFI Journal**	2020	In 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	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**
Danilo Botero-Lopez		Master	Civil Engineering	Research 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**
N/A			

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**
Deep Foundations Institute (DFI)	Hawthorne, NJ	X				
Jacobs Engineering	Herndon, VA		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**
N/A			

Who is the Technical Champion for this project?
Name: Tanner Balckburn
Title: Chief Geotechnical Engineering
Organization: Hayward Baker
Location (City & State):
Email Address: jtblackburn@keller-na.com

Changes:

N/A

Planned Activities:

Future work will be focused on the parametric study for column supported MSE walls to facilitate creation of design guidelines regarding lateral spread and basal stability of these systems.