Quarterly Progress Report:
Project Number and Title: 3.13: Investigating the Effectiveness of Enzymatic Stabilizers for Reclaimed Stabilized Base Projects
Research Area: Thrust # 3, New systems for longevity and constructability
PI: *Ehsan Ghazanfari, The University of Vermont*
Co-PI(s): *Mandar Dewoolkar, The University of Vermont*
Reporting Period: *1/7/2021 to 9/30/2021*
Submission Date: *9/29/2021*

Overview:

During the past quarter, we prepared, cured and tested sub-base soil specimens stabilized with Xanthan Gum, lignosulphonate, and terrazyme in the laboratory and continued the literature review on using enzymatic stabilizers in reclaimed stabilized base (RSB) projects to improve stabilization outcome. The overarching goal of this project is to evaluate the effectiveness of enzymatic stabilizers in RSB projects in Vermont and the NE region. Three different sub-base materials with different gradations were used in the laboratory testing to evaluate the effect of gradation on the outcome of treatment. In terms of the effectiveness of the tested stabilizers, the preliminary results are mixed. The Xanthan Gum-stabilizes specimens have shown significant strength gain, indicating Xanthan Gum could potentially serve as a promising stabilizer. We are continuing laboratory testing using different stabilizers and various gradations to better understand the mechanism of strength improvement and assess the effectiveness of the stabilizers. The performed work in previous months helps us move closer toward the next steps of the project in evaluating the effectiveness of the enzymatic stabilizers in RSB projects and determining the appropriate enzymatic agent for the type of base/subbase material encountered in different RSB projects.

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1: Prepare specimens with enzymatic stabilizing agents	1/1/2021	11/1/2021	25%
Task 2: Evaluate the strength and stiffness improvement and hydraulic response of prepared specimens	1/1/2021	3/31/2022	15%
Task 3: Investigate the mechanism of strength improvement and develop design parameters	2/1/2022	8/31/2022	15%
Task 4: Perform relatively large-scale laboratory tests and/or field tests to evaluate the performance of enzymatic stabilizers	9/1/2022	8/1/2023	0%
Task 5: Provide a set of recommendations and develop guidelines for implementation	1/1/2023	8/31/2023	0%
Overall Project:	*1/1/2021*	*8/31/2023*	12.5%

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*
$538,278	$67,272	12.5%

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,		

None				

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
None				

Participants and Collaborators:

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	**Email Address**	**Department**	**Role in Research**
Ehsan Ghazanfari	Ehsan.ghazanfari@uvm.edu	Civil & Environmental Engineering	Principal Investigator
Mandar Dewoolkar	Mandar.Dewoolkar@uvm.edu	Electrical and Biomedical Engineering	Co-Principal Investigator

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Bijay K-C	Ph.D.		Civil & Environmental Engineering	Graduate Research Assistant
Ryan van der Heijden		Ph.D.	Civil & Environmental Engineering	Graduate Research Assistant

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**
None			

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**
None						

Table 9: Other Collaborators			
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Contribution to Research**
None			

Name: Callie Ewald

Title: Geotechnical Engineering Manager
Organization: Vermont Agency of Transportation
Location (City & State): Berlin, Vermont
Email Address: callie.ewald@vermont.gov

Changes:
None.

Planned Activities:
continue preparing, curing, and testing sub-base soil specimens stabilized with enzymatic stabilizing agents