

Quarterly Progress Report:

Project Number and Title: 2.12 Evaluation of processed glass aggregate for utilization in transportation projects as a sand borrow

Research Area: Thrust 2 New Materials for Longevity and Constructability

PI: Mandar Dewoolkar, University of Vermont

Co-PI(s): Matthew Scarborough, Gregory Rowangould and Ehsan Ghazanfari, University of Vermont

Reporting Period: 07.01.2021 to 09.31.2021

Submission Date: 09.30.21

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**

- We performed preliminary geotechnical tests on a sample of PGA from CSWD.
- We performed preliminary deleterious material content tests on PGA from CSWD.
- We performed preliminary geotechnical properties tests on a sample of sand borrow provided by VTrans.
- We began deleterious material content control tests on lab-manufactured clean crushed glass.

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

- The geotechnical properties tests provided important information on how similar PGA is to sand borrow, as PGA is being considered as a replacement for sand borrow.
- Preliminary deleterious material content testing ascertained that the proposed deleterious material content tests would work on PGA. They also provided general information on the possible make up of deleterious material in PGA.
- Control tests on the lab-manufactured PGA from clean crushed glass bottles are important for verifying that developed deleterious material content test methods are reliable.

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	Start Date	End Date	% Complete
1. Literature review and surveys	09/01/20	10/15/21	70%
2. Collection of PGA and sand borrow specimens	09/01/20	12/31/21	35%
3. Methods for deleterious material content	01/01/21	12/31/21	10%
4. Engineering properties determination, recommendations for design, and specifications	01/01/21	06/30/22	10%
5. Economic analysis	04/01/21	06/30/22	0%
6. Education, outreach and technology transfer	09/01/20	08/31/22	15%
7. Extending PGA use as a high quality fill	09/01/22	08/31/23	0%
Overall Project:	09/01/20	08/31/23	8%

Table 2: Budget Progress		
Project Budget	Spend – Project to Date	% Project to Date*
\$472,977	\$35,879	7.6%

**Include the date the budget is current to: 09/21/21*

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)
Evaluation of processed glass aggregate for utilization in transportation projects as a sand borrow	VTrans Research and Innovation Symposium	Symposium	Virtual	9/8/21-9/9/21

Table 4: Publications and Submitted Papers and Reports				
Type	Title	Citation	Date	Status
	2021 VTrans Virtual Research & Innovation Poster Symposium			
	Abstract and poster:			
	https://vtrans.vermont.gov/planning/research/2021-symposium/cm7			
	Fact sheet:			
	https://vtrans.vermont.gov/sites/aot/files/2021%20FACT%20SHEET%20-%20TIDC%20-%20PGA%20Project%2008-06-21.pdf			
	Presentation video:			
	https://www.youtube.com/watch?v=kiNWR91dNDs			

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
Mandar Dewoolkar	Mandar.Dewoolkar@uvm.edu	Civil and Environmental Engineering	Primary Investigator

Matthew Scarborough	Matthew.Scarborough@uvm.edu	Civil and Environmental Engineering	Co-Primary Investigator
Gregory Rowangould	Gregory.Rowangould@uvm.edu	Civil and Environmental Engineering	Co-Primary Investigator
Ehsan Ghazanfari	ehsan.ghazanfari@uvm.edu	Civil and Environmental Engineering	Co-Primary Investigator

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
Fiona Nutbeam		MS Student	Civil & Environmental Engineering	Graduate Research Assistant
Eric Licho		BS Student	Environmental Engineering	Independent study research
Harrison Lucas		BS Student	Civil Engineering	Independent study research
Brandon Nimberger		MS Student	Civil & Environmental Engineering	Independent study research

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				Personnel Exchanges
		Financial Support	In-Kind Support	Facilities	Collaborative Research	
Chittenden Solid Waste District (CSWD)	1021 Redmond Road, Williston, VT 05495	X		X		
Vermont Agency of Transportation (VTTrans)	219 N. Main St, Barre, VT 05641		X			

Vermont Department of Environmental Conservation (VTDEC)	1 National Life Drive, Davis 1, Montpelier, VT 05620-3702		X			
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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
Callie Ewald, P.E., Manager, Geotechnical Engineer	callie.ewald@vermont.gov	VTrans	TAC member
Dr. Ian Anderson, Manager, HMA Materials	Ian.Anderson@vermont.gov	VTrans	TAC member
Nick Van Den Berg, Materials Manager	Nick.VanDenBerg@vermont.gov	VTrans	TAC member
Dr. Emily Parkany, P.E., Research Manager	Emily.Parkany@vermont.gov	VTrans	TAC member
Tanya Miller, Research Engineer	Tanya.Miller@vermont.gov	VTrans	TAC member
James Surwilo, Environmental Analyst	James.Surwilo@vermont.gov	VTDEC, Solid Waste Management Program	TAC member

Who is the Technical Champion for this project?

Name: Josh Tyler
 Title: Director of Operations
 Organization: CSWD
 Location (City & State): Williston, Vermont
 Email Address: jtyler@cswd.net

Name: August Arles
 Title: Geotechnical Engineer
 Organization: VTrans
 Location (City & State): Barre, Vermont
 Email Address: august.arles@vermont.gov

Changes:

Co-PI Ting Tan left the university. His involvement will be shared by the remaining PIs Dewoolkar, Scarborough, Rowangould and Ghazanfari.

Planned Activities:

Obtain PGA samples and sand borrow samples. Continue lab testing on manufactured PGA and actual PGA, including exploratory tests for determining deleterious content in PGA.