

**Quarterly Progress and Performance Indicators Report:**

**Project Number and Title:** 1.8: Enhancing Intelligent Compaction with Passive Wireless Sensors

**Research Area:** Thrust # 1, Monitoring and Assessment for Enhanced Life

**PI:** Ehsan Ghazanfari, The University of Vermont

**Co-PI(s):** Hamid Ossareh, The University of Vermont

**Reporting Period:** 1/1/2022 to 3/31/2022

**Submission Date:** 3/31/2022

**Overview:**

During the past quarter, we started to synthesize the intelligent compaction (IC), pavement quality indicators, and nuclear gauge density data that we collected from field tests in Route 117 (Vermont) reclaimed asphalt pavement project as well as the data collected from another reclaimed stabilized base project in Vermont. In addition, we started to summarize the findings on viable options for the design/ruggedization of the sensor as well as integration options were explored. The performed work in previous months helps us move closer toward completion of the project and to improve the IC performance and facilitate the process of geomaterial compaction and pavement performance monitoring.

**Task, Milestone, and Budget Progress:**

<b>Table 1: Task Progress</b>			
<b>Task Number: Title</b>	<b>Start Date</b>	<b>End Date</b>	<b>% Complete</b>
Task 1: IC in sub-base/asphalt	07/01/2018	08/30/2020	100%
Task 2: Passive sensor	06/01/2019	09/30/2021	95%
Task 3: Integration options/performance eval.	09/01/2020	12/31/2021	95%
Overall Project:	07/01/2019	12/31/2021	95%

<b>Table 2: Milestone Progress</b>			
<b>Milestone #: Description</b>	<b>Corresponding Deliverable</b>	<b>Start Date</b>	<b>End Date</b>
The project is almost completed	Final report to TIDC	12/1/2021	3/31/2022

<b>Table 3: Budget Progress</b>		
<b>Project Budget</b>	<b>Spend – Project to Date</b>	<b>% Project to Date (include the date)</b>
\$254,732	\$292,396	112.4%

**Is your Research Project Applied or Advanced?**

**Applied** (The systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.)

**Advanced** (An intermediate research effort between basic research and applied research. This study bridges basic (study to understand fundamental aspects of phenomena without specific applications in mind) and applied research and includes transformative change rather than incremental advances. The investigation into the use of basic research results to an area of application without a specific problem to resolve.)

**Education and Workforce Development:**

Answer the following questions (N/A if there is nothing to report):

1. Did you provide any workforce development or training opportunities to transportation professionals (already in the field)? If so, what was the training? When was it offered? How many people attended?

N/A

Did you hold meetings with any transportation industry organizations or DOTs? If so, what was the meeting’s purpose? When was it offered? How many people attended?

N/A

2. Did you host/participant in any K-12 education outreach activities? If so, what was the activity? What was the target age/grade level of the participants? How many students/teachers attended? When was the activity held?

N/A

**Technology Transfer:**

**Table 4: Presentations at Conferences, Workshops, Seminars, and Other Events**

Type	Title	Citation	Event & Intended Audience	Location	Date(s)
i.e. Conference, Symposium, DOT/AOT presentation, Seminar, etc.	Presentation Title	Full Citation	Name of event (i.e. TIDC 1 <sup>st</sup> Annual Conference) or who was the presentation given to?		
N/A	N/A	N/A	N/A	N/A	N/A

**Table 5: Submitted/Accepted Publications, Technical Reports, Theses, Dissertations, Papers, and Reports**

Type	Title	Citation	Date	Status
i.e. Peer-reviewed journal, conference paper, book, policy paper, magazine/newspaper article	Publication title	Full citation		i.e. Submitted, accepted, under review (by org. submitted to)
N/A	N/A	N/A	N/A	N/A

Answer the following questions (N/A if there is nothing to report):

1. Did you deploy any technology during the reporting period through pilot or demonstration studies as a result of this work? If so, what was the technology? When was it deployed?  
  
N/A
2. Was any technology adopted by industry or transportation agencies as a result of this work? If so, what was the technology? When was it adopted? Who adopted the technology?  
  
N/A
3. Did findings from this research project result in changing industry or transportation agency practices, decision making, or policies? If so, what was the change? When was the change implemented? Who adopted the change?  
  
N/A
4. Were any licenses granted to industry as a result of findings from this work? If so, when? To whom was the license granted?  
  
N/A
5. Were any patent applications submitted as a result of findings from this research? If so, please provide a copy of the patent application with your report.  
  
N/A

6. Did industry organizations or DOTs provide cost-share (cash or in-kind) to your research during the reporting period? Who was the organization? Please provide an in-kind support invoice from the organization with your report (this is kept confidential and used for record keeping purposes only).

Yes, Vermont Agency of Transportation

**Outputs:**

Research is ongoing.

**Outcomes:**

Research is ongoing.

**Impacts:**

Research is ongoing

**Participants and Collaborators:**

<b>Table 6: Active Principal Investigators, faculty, administrators, and Management Team Members</b>				
<b>Individual Name &amp; Title</b>	<b>Dates involved</b>	<b>Email Address</b>	<b>Department</b>	<b>Role in Research</b>
Ehsan Ghazanfari	1/1/2021-present	Ehsan.ghazanfari@uvm.edu	Civil & Environmental Engineering	Principal Investigator
Hamid Ossare	1/1/2021-present	Hamid.Ossareh@uvm.edu	Electrical and Biomedical Engineering	Co-Principal Investigator

**Table 7: Student Participants during the reporting period**

Student Name	Start Date	End Date	Advisor	Email Address	Level	Major	Funding Source	Role in research
Bijay K-C	1/9/2021	Cont.	Ghazanfari		Ph.D.	Civil & Environmental Engineering	TIDC	Graduate Research Assistant

**Table 8: Students who Graduated During the Reporting Period**

Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
N/A	N/A	N/A	N/A

**Table 9: Industrial Internships**

Student Name	Degree/Certificate Earned	Graduation/Certification Date	Did the student enter the transportation field or continue another degree at your university?
N/A	N/A	N/A	N/A

**Table 10: Research Project Collaborators during the reporting period**

Organization	Location	Contribution to the Project				
		Financial Support	In-Kind Support	Facilities	Collaborative Research	Personnel Exchanges
N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 11: Other Collaborators**

Collaborator Name and Title	Contact Information	Organization and Department	Date(s) Involved	Contribution to Research
Callie Ewald, Geotechnical Engineering Manager		Vermont Agency of Transportation	1/1/2021-present	Technical Advisory Committee Chair

**Table 12: Course List**

<b>Course Code</b>	<b>Course Title</b>	<b>Level</b>	<b>University</b>	<b>Professor</b>	<b>Semester</b>	<b># of Students</b>
N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Changes:**

None

**Planned Activities:**

Prepare and submit the final report