

Quarterly Progress 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: 10/1/2020 to 12/31/2020

Submission Date: 12/29/2020

Overview:

During the past quarter, we continued to analyze 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. The reliability of IC measurement values (ICMVs) and utilization of ICMVs as a function of vibration amplitude and frequency in the control system to optimize the compaction process and minimize the spatial variability of the ICMVs were investigated. The preliminary testing of the pressure sensor in underway and exploring viable options for the design/ruggedization of the sensor to survive the extreme pressure and temperature during compaction process is ongoing. The performed work in previous months helps us move closer toward the next steps of the project and to improve the IC performance and facilitate the process of geomaterial compaction and pavement performance monitoring.

| Table 1: Task Progress | | | |
|---|-------------------|-----------------|-------------------|
| Task Number | Start Date | End Date | % Complete |
| Task 1: IC in sub-base/asphalt | 07/01/2018 | 08/30/2020 | 90% |
| Task 2: Passive sensor | 06/01/2019 | 09/30/2021 | 65% |
| Task 3: Integration options/performance eval. | 09/01/2020 | 12/31/2021 | 15% |
| Overall Project: | 07/01/2019 | 12/31/2021 | 65% |

| Table 2: Budget Progress | | |
|---------------------------------|--------------------------------|---------------------------|
| Project Budget | Spend – Project to Date | % Project to Date* |
| \$254,732 | \$170,115 | 64.7% |

| Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events | | | | |
|---|---|--------------------------------------|-----------------|----------------|
| Title | Event | Type | Location | Date(s) |
| Presentation title | Name of event (i.e. TIDC 1 st Annual Conference) | i.e. Conference, Symposium, Seminar, | | |
| Improving performance of intelligent compaction | TIDC Annual Student Poster Contest | Symposium | Virtual | 9/25/2020 |

| Table 4: Publications and Submitted Papers and Reports | | | | |
|---|--------------|-----------------|-------------|---------------|
| Type | Title | Citation | Date | Status |
| The revised version of the submitted conference paper (4 th International Conference on Transportation Geotechnics), reported in previous quarterly report, is under review. | | | | |

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 |
| Hamid Ossareh | Hamid.Ossareh@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 |
|------------------|---------------|-------|---------------------------------------|-----------------------------|
| Maziar Foroutan | | Ph.D. | Civil & Environmental Engineering | Graduate Research Assistant |
| Ahmad Ghazanfari | | M.S. | Electrical and Biomedical 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 |
|-----------------------------|---------------------|-----------------------------|--------------------------|
| | | | |

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:

(i) analysis of the collected data from IC field tests aiming at IC performance improvement

(ii) continue sensor testing and improving the design and ruggedization of the sensor in IC compaction