VERMONT
AGENCY OF TRANSPORTATION

FACT SHEET

2019 Research Showcase & STIC Annual Meeting

Enhancing Intelligent Compaction with Passive Wireless Sensors

PROJECT TITLE

Enhancing Intelligent Compaction with Passive Wireless Sensors

STUDY TIMELINE

July 2018 – June 2020

INVESTIGATORS

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Fact sheets can be found for additional projects featured at the 2019 Symposium at http://vtrans.vermont.gov/planning/research/2019showcase

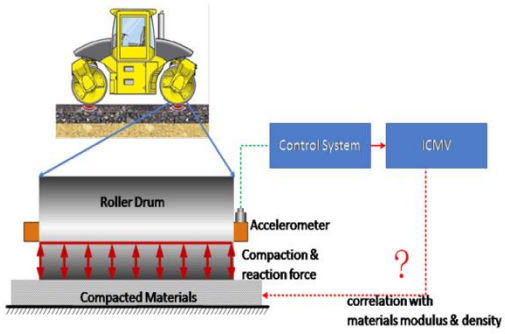
Additional information about the VTrans Research Program can be found at http://vtrans.vermont.gov/planning/research

Additional information about the VTrans STIC Program can be found at http://vtrans.vermont.gov/boards-councils/stic

Additional information on this project can be found at http://www.tidc-utc.org

Introduction

Intelligent compaction (IC) is an innovative technology that has the potential to significantly improve the consistency of compaction, extend the pavement life service, and reduce the maintenance costs. Despite recent advancements, the correlations between the intelligent compaction measurement values (ICMVs) and the material stiffness involve substantial uncertainty and need further improvement. IC performance can be improved by (i) integrating passive wireless sensing system with IC, (ii) utilizing ICMVs as a function of vibration amplitude and frequency in the control system, followed by adjustment of these parameters to optimize the compaction process, and (iii) designing filters to improve consistency of ICMVs in order to minimize compaction variance. In this project, we will explore the aforementioned options to improve IC performance for geomaterial compaction.



Mechanism of ICMV (source: Nieves, 2017)

IC compaction field testing in Route 117, VT

Action Taken

During IC compaction of a reclaimed base project in Route 117 in Vermont, IC and spot-test data were collected and analyzed to evaluate the uncertainty associated with ICMVs with respect to spatial distribution of pavement stiffness. In addition, cost-effective in situ passive-based sensing systems were identified.

Next Steps

The next steps include (i) collecting additional field data aiming at IC performance improvement via utilizing feedback from the control system, and (ii) exploring viable options for design and ruggedization of the pressure sensors to survive the extreme pressure and temperature during compaction process.

Potential Impacts and VTrans Benefits

Improving IC performance provides a system wide stiffness-based inspection practice that allows for real-time monitoring, identification of weak areas, and making informed decisions on proper course of action during compaction, which leads to improved durability of highway/roadway infrastructure.