

Investigating Methods to Enhance Intelligent Compaction Performance

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Introduction

The correlations between the Intelligent Compaction Measurement Values (ICMV) and the material stiffness involve substantial uncertainty and needs further improvement (Fig. 1). IC performance can be improved by (i) integrating passive wireless sensing system with IC, and (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. In this project, we explore methods to improve IC performance.

Results

Semivariogram models were generated to capture the geo-spatial structure of the IC data and in-situ spot measurements. Figure 3 shows the semivariograms of ICMVs for the first and second reclaimed phases. No statistical dependence between the ICMVs separated by a distance larger than 48 feet for the first reclaimed phase and 68 ft for the second reclaimed phase exists. Exploring viable options for design and ruggedization of the pressure sensors (Fig. 4) to survive the extreme pressure and temperature during compaction process is the next step.

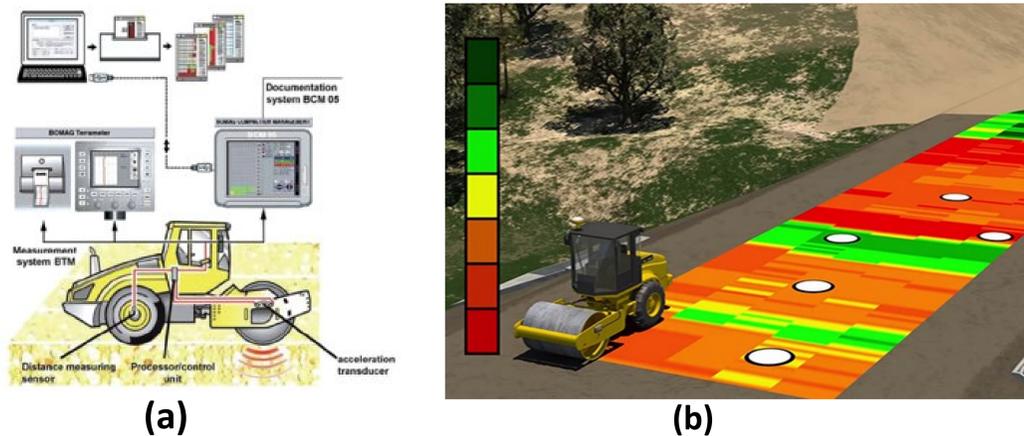


Figure 1. (a) Schematic of IC, and (b) color-coded map using ICMV (Source: Bomag)

Methodology

IC and spot-test data were collected during IC compaction of a reclaimed base project in Route 117 in Vermont (Fig. 2), and the data were analyzed to evaluate the uncertainty associated with ICMVs and utilizing ICMVs as a function of vibration amplitude and frequency in the control system. In addition, cost-effective sensing systems are identified to be integrated with the IC.

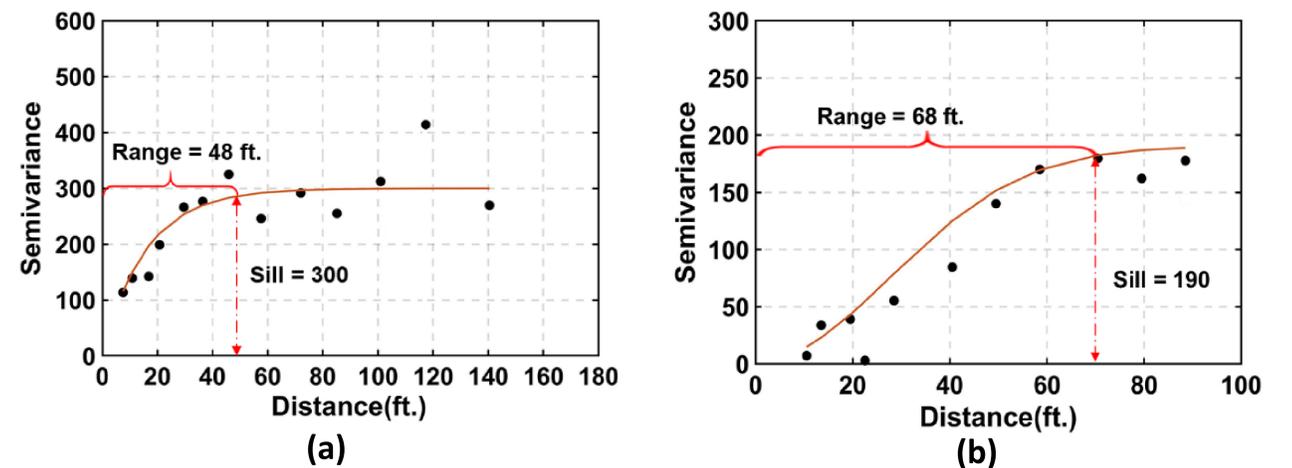


Figure 3. semivariogram of ICMVs for the (a) first, and (b) second reclaim phase

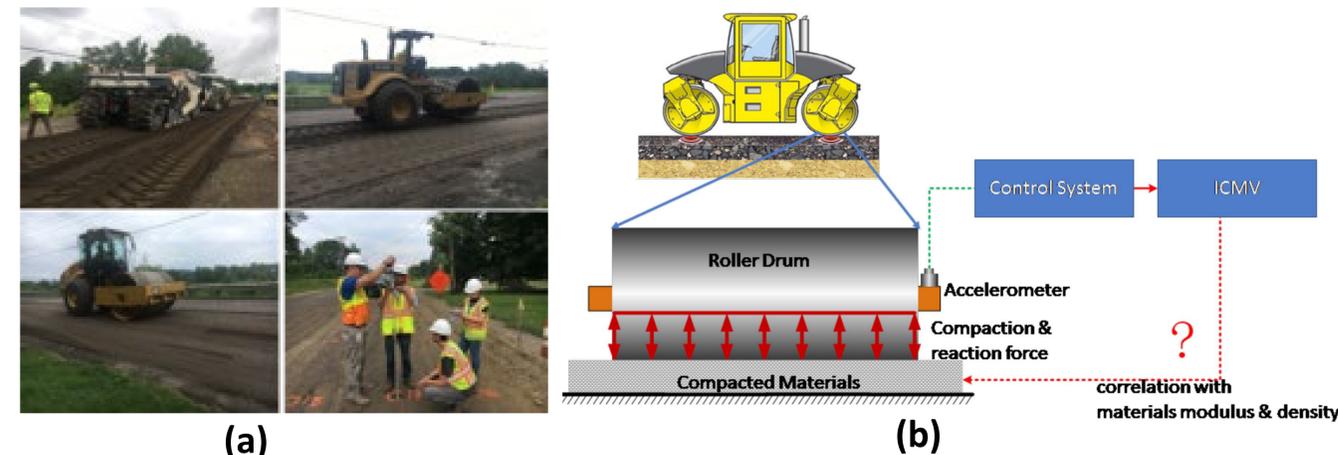


Figure 2. (a) Data collection in the field, and (b) mechanism of ICMV [1]

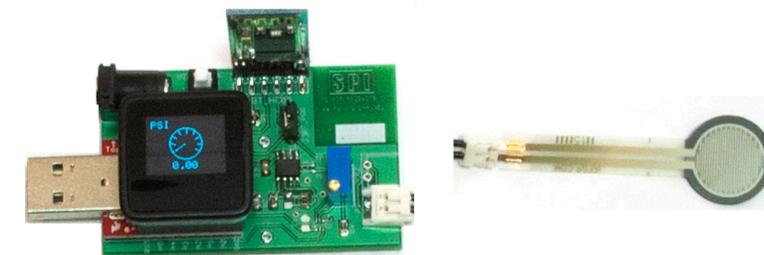


Figure 4. Pressure sensor and platform for IC integration (Source: Tactilus)

Acknowledgements

We would like to thank VTrans and its TAC members and TIDC for their technical and financial support that makes this research a reality.

References

- [1] Intelligent Compaction Measurement Values (ICMV), a road map (2017). FHWA Technical brief # FHWA-HIF-17-046