Research Summary

Implementation of Data Quality Assurance (QA) for Innovative Technologies at MoDOT

The Missouri Department of Transportation (MoDOT) has observed quality improvements in the intelligent compaction-paver-mounted thermal profiler (IC-PMTP) field projects since 2017. Based on the success of the IC-PMTP implementation projects, MoDOT is working towards the full implementation of intelligent construction technologies (ICTs) in place of conventional spot testing. MoDOT is one of the leading DOTs attempting to implement ICT QA to meet CFR requirements, and one of the first DOTs to pilot verification of contractor measurements for IC and PMTP data.

This research project's main objective was to advance MoDOT's data QA solutions for ICT. The project included reviewing existing ICT QA programs, developing or improving new ICT QA program materials, developing training resources, and conducting training and field trials of the new methods. MoDOT uses pass count coverage as an acceptance tool to quantify roller compaction consistency, and magnetic-mounted solar-powered RTK GPS tracking devices to verify IC rollers' pass count coverage. The QA data is transmitted to cloud storage via a cellular connection. A Daily Use Gateway (DUG) was implemented under this project to reduce data loss that was common from using cellular hotspots in earlier seasons. The research team and MoDOT headquarter staff provided the project inspectors with technical support and training as just-in-time training (JITT) or project field support.

> *"This research project's main objective was to advance MoDOT's data QA solutions for ICT."*

The data collected by the IC data QA device closely matches the IC roller data. Using Veta software, a time filter was used to randomly extract and export IC and QA pass count data for comparison. An Excel® macro tool was developed and optimized under this project to compare the exported results from Veta. The mean, standard deviation, coefficient of variance (COV), and variance were used as the pass/fail criteria for the comparison. Overall, this IC QA method effectively verified the contractor's IC data. In addition to the improvements of DUG, further recommendations were provided to minimize data loss.

PMTP temperatures were verified using infrared camera measurements taken from the roadside. Under this project, the QA data collection procedures were improved, and the analysis was simplified. During the field QA operation, a 2 ft.

x 2 ft. piece of plywood was placed on the edge of the pavement as an event marker. The event marker was captured by contractor PMTP equipment and with an infrared camera. Using Veta software and the thermal image's time stamp, the event marker's location could be found in the contractor data. The event marker was used to align the contractor and QA data for comparison. An Excel® macro tool was developed and optimized under this project to crop the contractor's PMTP data to match the infrared camera's field of view (FOV). Then, the matched temperature data from the PMTP and thermal camera were compared to determine pass/fail based on the mean temperature. Training materials and videos were developed and deployed under this project to successfully assist the MoDOT inspectors in collecting the thermal camera data.

The ICT data QA processes for IC pass count and PMTP temperature effectively verified contractors' data. The QA data collection procedures improved under this project, and the QA analysis tools were enhanced and simplified. The QA analysis efforts can be further minimized if the automated data QA modules are implemented in Veta. Further improvements could be made to the IC QA device to simplify data transmission, and QA pass/fail criteria may be refined in the future. The frequency of data comparison and methods for random sampling may also be considered in future research. Training for MoDOT inspectors should be continued for successful QA data collection.
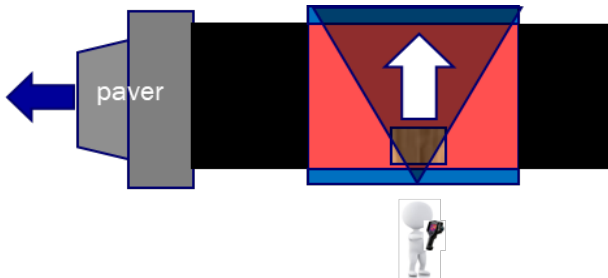

Figure 1: Illustration of taking a PMTP data QA thermal image.

Project Information

PROJECT NAME: TR202114—Implementation of Data Quality Assurance (QA) for Innovative Technologies at MoDOT

PROJECT START/END DATE: April 2021-November 2022

PROJECT COST: $85,895

LEAD CONTRACTOR: The Transtec Group, Inc.

PRINCIPAL INVESTIGATOR: Dr. George K. Chang

REPORT NAME: Implementation of Data Quality Assurance (QA) for Innovative Technologies at MoDOT

REPORT NUMBER: cmr 22-012

REPORT DATE: November 2022

Project Manager

CONTACT INFORMATION:

Scott Breeding
Senior Research Analyst
Missouri Dept. of Transportation
1617 Missouri Blvd.
Jefferson City, MO 65109
(573) 526-4325
Scott.Breeding@modot.mo.gov