Texas Department of Transportation

CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY REPORT

0-7060: Measuring Faulting on Jointed Concrete Pavements

Background

As one of the pavement condition metrics proposed in the 2015 notice of proposed rulemaking (NPRM) published at 80 FR 326, faulting is required to be collected and reported by all State DOTs in accordance with practices outlined in the FHWA's Highway Performance Monitoring System (HPMS) Field Manual for all Jointed Concrete Pavement (JCP) sections. A JCP section for which the three relevant metrics are roughness, cracking, and faulting, is rated in Good condition only if all three exceed the thresholds specified in the NPRM. The Field Manual details in Item 51 the requirements for faulting data collection. According to the manual, the practice for faulting data collection should be in accordance with AASHTO Standard R36-13 while reporting should follow the requirements in 23 CFR 490.309 and 490.311. For JCP sections on the Interstate Highways and the non-Interstate NHS, faulting should be measured at every joint in the right wheel-path with the average absolute value reported. To address these requirements, this research project was initiated with the objective to develop a system for TxDOT to collect and verify faulting data of jointed concrete pavements with sufficient accuracy at highway speeds during daylight conditions.

What the Researchers Did

During the project, researchers from the University of Texas at Austin first conducted a thorough literature review and information-gathering effort on technologies currently in use or potentially applicable to measure faulting at the network level. A comparative analysis was then conducted to determine their advantages and disadvantages, as well as their applicability to the JCP sections within the Texas network. The review concluded that no equipment existed to date that could be used directly to address TxDOT's objectives. As a result, the researchers developed the 3-Line Laser equipment. The research team made a series of modifications to the initially developed prototype as real-world situations posed unforeseen challenges or improvements to increase efficiency were identified during the field tests carried out over the course of the project. In addition to the hardware, a set of procedures and specifications were developed to process the raw data collected with the equipment and to calculate faulting.

Early in the project, the research team did a field study on the variability of faulting using a piece of manual measurement equipment, also known as Faultmeter, to better understand the distribution of faulting value along the joint (transverse) and across joints along the direction of travel (longitudinal). Faulting varies both longitudinally and transversely so a single point faulting measurement does not represent the actual faulting of a pavement section. Acknowledging that faulting varies even along a single joint as the transverse position of measurement varies, the research team proposed a verification tool, the Joint Laser Scanner (JLS), capable of covering the span of the entire lane width. Finally, a verification procedure was developed to check the faulting

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value measured by future vendors.

What They Found

While available technologies for measuring faulting at this time were identified, each showed significant limitations in terms of accuracy, effectiveness or efficiency. Keeping the limitations of the existing pieces of equipment in mind, the research team developed a system that can be used to collect faulting data at highway speeds during daylight conditions. The systems is capable of detecting all joints and obtain multiple faulting measurements at each join in a single pass.

The findings from the field study on transverse and longitudinal variability showed that faulting values change as the location of measurement changes, convincing the researchers that single-point measurement are indeed not sufficient to reflect the true level of faulting distributed along a joint, let alone a section with many joints.

Through multiple validation tests of the equipment in the field to ensure accuracy and precision, it was found that the equipment produced repeatable results with standard deviation across runs less than 0.5 mm and high accuracy with an error (as compared to static measurements) of less than 0.5 mm, sufficient to meet the requirements of the FAST Act.

What This Means

The literature review and information gathering stage early in the project demonstrated the lack of an adequate piece of equipment for network-level faulting measurement to fulfill the federal requirement designated by MAP-21 and the FAST Act. The development of the 3-Line Laser System bridges this gap. By utilizing it, TxDOT will be able to monitor faulting at all the joints within the network efficiently and with a high level of accuracy and precision. A much better understanding of the JCP condition and performance across the network will be obtained. Moreover, with the verification method provided, TxDOT will be able to compare results provided by external vendors to a benchmark for data quality control and assurance and ensure the accuracy of future data collected with the equipment.

For More Information

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