

0-6610: Impact of Changes in Profile Measurement Technology on QA Testing of Pavement Smoothness

Background

For quality assurance testing, the Texas Department of Transportation's (TxDOT's) Item 585 ride specification includes pay adjustment schedules that are tied to the average international roughness index (IRI), and a procedure to locate defects based on measured profiles. The acceptance criteria in Item 585 are based on measurements collected with traditional single-point lasers. Since its implementation, profilers with multi-point and wide-footprint lasers have become available. The impact of these new lasers on ride quality assurance tests needs to be investigated.

To identify defects, Item 585 implements a methodology that checks the deviations between the average profile and its 25-ft moving average against a specified threshold. However, some districts have taken the additional step of using a bump rating panel to select the bumps and dips to be corrected based on the panel's opinion of defect severity. A standard methodology needs to be developed to maintain consistency in ride quality assurance testing. This project:

1. Established the impact of multi-point and wide-footprint lasers on the department's implementation of its existing ride specifications (Phase I).
2. Investigated the existing methodology for evaluating localized roughness (Phase II).

What the Researchers Did

In Phase I, researchers conducted a comparative evaluation of different lasers using test data on non-ground pavement sections covering a wide range of pavement surfaces. Researchers

analyzed the data from these tests to develop recommendations on available options to accommodate the use of inertial profilers with wide-footprint lasers for ride quality assurance testing. In Phase II, researchers conducted bump rating panel surveys to investigate relationships between profile characteristics and road user perception of localized roughness. Based on this evaluation, researchers recommended modifications to the existing methodology for identifying defects and the need for corrective work.

What They Found

From Phase I, researchers found:

- On the hot-mix asphalt sections tested, the single-point laser IRIs compared reasonably well with the corresponding reference IRIs from SurPRO measurements. The IRIs determined from Roline measurements in bridge mode significantly underestimated the reference IRIs on permeable friction course (PFC) surfaces.
- On continuously reinforced concrete pavement (CRCP) sections, the single-point laser IRIs were significantly lower than the corresponding SurPRO IRIs on transversely tined and carpet dragged surfaces. On

Research Performed by:

Texas A&M Transportation Institute

Research Supervisor:

Emmanuel G. Fernando, TTI

Roger S. Walker, The University of Texas at
Arlington

Project Completed:

8-31-2013

longitudinally tined CRCP sections, the single-point laser IRIs were significantly higher than the SurPRO reference values.

- On flexible base and inverted prime sections, the differences between SurPRO reference IRIs and the IRIs computed from single-point, 19 mm, and Roline laser profiles were not statistically significant.
- Statistically significant linear relationships were found between corresponding SurPRO and laser IRIs.

From the bump rating panel surveys conducted in Phase II, researchers found statistically significant relationships between surface profile characteristics and road user perception of the need for corrective work. These relationships are based on evaluating localized roughness by wheel path to assess the defect type, location, width, and magnitude, and the contribution of the given defect to IRI.

What This Means

Based on the Phase I findings, researchers recommend the following:

- For ride quality assurance testing with the Roline laser, use the free mode settings determined in this project to reduce the negative IRI bias found in the Roline bridge mode IRIs on PFC surfaces. Alternatively, TxDOT should consider introducing a +5-in./mile offset to take out the average bias of -4.7 in./mile between Roline bridge mode and SurPRO reference IRIs on PFC surfaces.
- For measuring ride quality on CRCPs, use Roline lasers on

longitudinally tined pavements to provide IRI measurements that are repeatable and comparable to SurPRO reference values.

- Use the free mode settings determined in this project for testing CRCPs with Roline lasers. Alternatively, TxDOT should consider introducing IRI offsets to address the negative IRI bias exhibited by single-point, 19 mm, and Roline bridge mode lasers on CRCP sections with transverse tines and carpet drag imprints. On CRCP sections with conventional transverse tines, the applicable offset is +5 in./mile.
- With respect to quality assurance tests conducted under TxDOT's flexible base ride specification (SP 247-011), continue to use the single-point and 19 mm lasers for testing flexible base projects.
- With respect to the angle at which the Roline laser footprint should be oriented for collecting data with this laser, the recommended settings are based on the 0° scan orientation, which is the common angle used for testing all surface types in this project. The 45° angle was only used for testing CRCPs in accordance with the work plan.

From Phase II, researchers recommend a follow-up implementation project to revise TxDOT's Ride Quality program to include the defect correction index (DCI) developed in Phase II. The revised program should then be pilot-tested on a number of TxDOT projects to get additional data with which to make sound decisions on implementing the DCI analysis procedure.

For More Information

Project Manager:

Kevin Pete, TxDOT, (512) 416-4738

Research Supervisor:

Emmanuel G. Fernando, TTI, (979) 845-3641

Technical reports when published are available at <http://library.ctr.utexas.edu>.

Research and Technology Implementation Office

Texas Department of Transportation

125 E. 11th Street

Austin, TX 78701-2483

www.txdot.gov

Keyword: Research