



RESEARCH SERVICES

OFFICE OF POLICY ANALYSIS,
RESEARCH & INNOVATION

TECHNICAL SUMMARY

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PROJECT COST:

\$43,000



The new smoothness specification covers newly constructed concrete pavements like this one as well as asphalt pavements.

Putting Research into Practice: Establishing a Combined Smoothness Specification for Minnesota Pavements

What Was the Need?

To build roads that are both cost-effective and comfortable for driving, Mn/DOT offers payment incentives and disincentives to contractors based on the smoothness of the pavements they construct. Until recently, Minnesota determined whether pavements earn bonuses or penalties by measuring their smoothness using the Profile Index method. This method involves rolling a 25-foot frame across a pavement and measuring the vertical displacements of a wheel located at its midpoint; these displacements, taken together, provide a profile of its smoothness.

However, the profile data provided by this method cannot be used to accurately determine ride quality or how comfortable a pavement will seem to drivers. Consequently, in 2002 Mn/DOT began exploring the use of a more advanced method for measuring roughness on asphalt pavements. Called the International Roughness Index, this method uses an algorithm to convert road profile data into an accurate measurement of ride quality. Because algorithm inputs must be precise, profiles are measured using laser sensors mounted on a profiling vehicle traveling at a typical highway speed of 60 mph.

After a series of pilot projects in 2004 and 2005 confirmed that IRI was more effective than PI, Mn/DOT began requiring its use on all new asphalt projects in 2006 and all new concrete projects in 2007. The two offices modified their current, separate specifications; consequently, contractors had to adhere to two sets of requirements, making the profiling process less efficient.

What Was Our Goal?

The objective of this project was to unify Mn/DOT asphalt and concrete pavement profiling specifications to make the evaluation of the ride quality of newly constructed pavements more efficient and effective. Investigators also set out to develop a certification program for training profile operators in using the combined specification.

What Did We Implement?

This study implemented project 2007-09, "[Implementation of an International Roughness Index for Mn/DOT Pavement Construction and Rehabilitation](#)," which developed a specification for using IRI to measure the smoothness of newly constructed portland cement concrete pavements. The current project combines this specification with a previous IRI specification developed for asphalt.

How Did We Do It?

Investigators began by reviewing past and present pavement smoothness practices in Minnesota and other states. Then they developed a combined smoothness specification detailing profiling equipment, surface testing methods and methods for adjusting contractor pay based on pavement smoothness. The specification also included the following additions for both asphalt and concrete:

Investigators unified Mn/DOT asphalt and concrete pavement smoothness specifications using the International Roughness Index; added new requirements to improve the profiling process; and developed a certification training program for profiler operators.

“Combining specifications will make the profiling process more consistent and efficient for contractors, leading to smoother pavements at a reduced cost.”

—W. James Wilde,
Professor, Minnesota
State University, Mankato

“Using continuous IRI to identify areas of localized roughness will enable contractors to better locate and quantify bumps and dips, which will improve the effectiveness of corrective work and result in smoother pavement surfaces.”

—Tom Nordstrom,
Mn/DOT Pavement
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IRI algorithms for calculating ride quality from pavement profiles use data from inertial profilers, which use laser sensors to take precise measurements per inch of pavement.

- A requirement to profile both right and left roadway wheel paths. Previous specifications required that only right wheel paths be profiled.
- An improved method of identifying areas of localized roughness (roadway bumps and dips).
- The inclusion of segments that have undergone corrective work in adjustments to contractor pay.

Investigators then developed operator certification requirements and training workshops and solicited an external review of the new specification, including from participants in an industry forum in November 2009.

What Was the Impact?

Combining specifications will save Mn/DOT effort by ensuring that future specification changes will not have to be made twice. Further, contractors who construct both asphalt and concrete pavements will not need to conform to two sets of requirements.

Mn/DOT also used this project to implement the Profile Viewer and Analyzer software tool, or ProVAL, developed by the Federal Highway Administration as a new standard for pavement profile analysis. This software implements a uniform, standard computation method that also improves the accuracy and reliability of profile computation and reporting, and can import pavement profiles from a variety of profiling machines.

Finally, Mn/DOT changed its profiling certification requirements to cover equipment and operators; this will dramatically improve data collection and analysis on Mn/DOT pavement construction projects as well as quality control and assurance. Investigators created a workshop to train profiler operators on the combined smoothness specification, ProVAL software and best practices for minimizing measurement errors. A pilot workshop was conducted for Mn/DOT personnel and two full workshops for contractors and other pavement profiler operators. To be certified, participants must pass a written examination upon completion of the workshop.

What's Next?

In the 2010 construction season, Mn/DOT will conduct pilot projects using the new specification and plans to require its use on all asphalt and concrete paving projects by 2011. Going forward, investigators recommend:

- Periodic reviews of the specification's incentive/disincentive levels and thresholds for correcting areas of localized roughness.
- The development of an online certification workshop and examination.
- Continued assessment of changes in paving industry technologies and best practices.

This Technical Summary pertains to Report 2010-15, “Mn/DOT Combined Smoothness Specification,” published April 2010. The full report can be accessed at <http://www.lrrb.org/PDF/201015.pdf>.

The research being implemented via this project can be found in Report 2007-09, “Implementation of an International Roughness Index for Mn/DOT Pavement Construction and Rehabilitation,” published April 2007. This report can be accessed at <http://www.lrrb.org/PDF/200709.pdf>.