



ACCELERATOR

Putting your ideas in motion

MnDOT, LRRB Announce New Research Projects

New transportation research projects will aim to reduce crashes through the use of traffic signal data, improve worker safety with GPS technology and explore a range of other issues.

MnDOT's Transportation Research Innovation Group and the Local Road Research Board announced funding for 24 new research projects for Fiscal Year 2015. Descriptions of all approved projects are available on the joint MnDOT–University of Minnesota Crossroads blog at mntransportationresearch.org.

“All of these research projects started as ideas submitted by MnDOT or city and county practitioners who are looking to address a problem in their respective fields,” said Research Services & Library Director Linda Taylor.



An ongoing research effort approved for new funding uses automated traffic monitoring data to develop a crash prediction model. Here, lab workers at the Minnesota Traffic Observatory monitor real-time traffic conditions on I-94.

Each year, MnDOT and LRRB solicit ideas for new transportation research. MnDOT-submitted ideas are reviewed by TRIG, which is made up of MnDOT district engineers and office directors, while the LRRB reviews ideas submitted

by local agencies. Ideas for future transportation research projects can be submitted at any time via the [Minnesota Transportation Research Collaboration Website](http://MinnesotaTransportationResearchCollaborationWebsite.com) at mndot.gov/research.

This year's approved projects will:

- Create a GPS-based construction worker safety system to provide construction vehicle operators and passing drivers better awareness of the locations of workers.
- Study the safety effects of I-35W improvements made under the Urban Partnership Agreement.
- Assess the economic impact and health benefits of bicycling in Minnesota.
- Compare the life-cycle costs of pavements using recycled concrete aggregates to costs of pavements built with conventional virgin aggregates.

Robotic Arm Paints Signs on Pavement



MnDOT District 3 launched research that has created a robotic spray-painter to draw turn arrows, crosswalk stripes and other designs on roadways. The robot can be mounted on the front of a maintenance vehicle and controlled via laptop computer. The project's goal is to save manpower and keep crews safer. Read more about this project and watch a video demonstration in our Crossroads blog at mntransportationresearch.org.

Winter Maintenance Research



Clear Roads Study Ranks Deicer Toxicity

Maintenance Operations & Security — Thanks to a recently completed project funded through Clear Roads, MnDOT winter maintenance personnel now know the relative toxicity of eight common deicing agents. These agents were rated according to their overall chemical toxicity as well as by their acute and chronic impacts, which can have significant implications for different types of waterways. Acute impacts are more critical in rivers and streams where chemicals dilute quickly, while chronic impacts are more important in lakes where chemicals remain for longer periods. The research also identifies the effects of several corrosion inhibitors on deicer toxicity.

Minnesota is the lead state for the Clear Roads pooled fund, which conducts rigorous testing of winter maintenance materials, equipment and techniques. Other recent and upcoming research includes a winter maintenance cost-benefit analysis toolkit, snow removal techniques at extreme temperatures and environmental factors that cause fatigue in snowplow operators. [Technical Summary 2012-TPF-5\(218\)](#)

Assessing the Performance Benefits of Deicers and Anti-Icers

Maintenance Operations & Security — Enhancing MnDOT’s already notable snow-fighting operations is at the heart of a follow-up study assessing the performance benefits of salt compounds used on Minnesota’s winter roadways. Field tests now underway expand on lab results from the project’s first phase. Researchers are evaluating the influence of factors such as pavement type and age, traffic volume, weather conditions and plow configuration to characterize the benefits and costs (labor, equipment and materials) of different approaches to deicing and anti-icing. Armed with a better understanding of available treatments and techniques, MnDOT winter maintenance staff can select the most cost-effective and efficient snow and ice treatments for a wide range of winter weather and road conditions. Learn more about the first phase of this project in [Technical Summary 2012-20](#).

New Video Explains Frost Damage in Pavements

Maintenance Operations & Security — Minnesota’s annual freeze-thaw cycle wreaks havoc on our roadways, as illustrated in graphic detail by a new video from the Local Road Research Board. Using time-lapse photography and animation, “Frost Damage in Pavement” explains how water infiltrates the soil beneath pavements and weakens the road base by freezing, expanding and then melting away, leaving the pavement susceptible to damage from traffic loading. The video also highlights a range of strategies to help public works professionals design and build pavements that resist frost damage. Both a full-length and an abbreviated “executive summary” version of this video are available via



MnDOT’s YouTube channel at the LRRB and MnDOT Research Services & Library websites. To request DVD copies, contact MnDOT Research Services & Library at research.dot@state.mn.us. YouTube videos: [Full-Length](#), [Executive Summary](#).

Research Implementation

Reducing Corridor Congestion Using Real-Time Traffic Data

Traffic & Safety — Previous MnDOT research gave us the SMART-SIGNAL system, which makes it possible to quantitatively monitor traffic on signalized arterial streets in real time. SMART-SIGNAL has now been installed at 85 Minnesota intersections. The next challenge was to construct a system that would use this data to reduce freeway congestion by intelligently diverting traffic to arterial streets parallel to the freeway and adjusting signal timings on those streets. Investigators developed a model for managing such congestion and tested it via computer simulations, which predicted a reduction in delay times by up to 30 percent. More research is underway to put the new coordinated system into action. [Technical Summary 2013-17](#)

Other Research

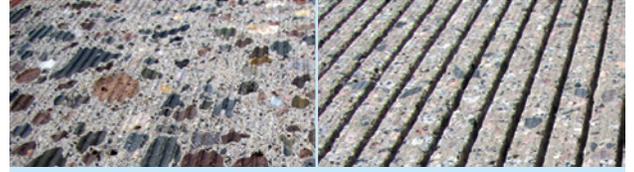
Creating Quieter Concrete Pavements

Materials & Construction — Tire-pavement noise is the most important factor in highway noise pollution, a problem that can be very expensive to mitigate with standard solutions, such as sound barriers alongside highways. Since 2006, MnDOT has led a pooled fund study to develop quieter concrete pavements by optimizing surface textures during construction to create friction and skid resistance. Researchers evaluated the surface characteristics—including noise, friction, ride quality and texture—of various diamond grind treatments created by cutting longitudinal grooves into the pavement surface using closely spaced, diamond-coated saw blades. Results show that the innovative diamond grind surfaces developed in this study can maintain their texture very well in the long run and provide good friction for vehicle tires while significantly lowering tire-pavement noise.

[Technical Summary 2013-18](#)

Reducing Vehicle Fuel Consumption by Optimizing Concrete Pavement Textures

Materials & Construction — One way to reduce the fuel consumption of vehicles is to optimize pavement rolling resistance, the force that resists a tire as it rolls across a pavement surface. Optimizing rolling resistance requires a better knowledge of its relationship with other pavement surface characteristics, including noise, texture and friction. A recent study at the MnROAD pavement research facility brought researchers closer to establishing this relationship by using an innovative line-laser profiler to develop three-dimensional representations of test pavement surface textures. Building on this research, follow-up projects will help MnDOT optimize pavement textures to minimize vehicle fuel consumption, reducing their impacts on the environment and producing significant savings for drivers. [Technical Summary 2013-16](#)



Pavement textures: conventional grind (left) and diamond grind.

“Newer diamond grind textures can reduce noise levels by as much as 6 decibels over the traditional textures, which amounts to an 80 percent reduction in tire-pavement noise.”

—Bernard Izevbekhai, Concrete Research Operations Engineer, MnDOT Office of Materials and Road Research

Comparing Bridge Modeling Techniques to Real-World Thermal Effects

Bridges & Structures — Large annual temperature changes in Minnesota produce thermal stresses on bridges. Modern concrete bridge piers are designed to crack to relieve stress. However, this cracking reduces bridge stiffness, which needs to be considered in bridge design, particularly in bridges with long spans or tall, slender piers. To help understand cracking behavior, researchers created computer models of the Wakota Bridge in South St. Paul and evaluated these models by comparing their predictions to the readings of nearly 100 sensors installed in the bridge (constructed in 2010). The results suggest that MnDOT’s current procedures for calculating temperature effects on these bridges are appropriate. [Technical Summary 2013-11](#)

A New Handbook for Trail Crossing Safety Measures

Multimodal — The intersections between paved trails and roadways account for more than 50 percent of all bicycle crashes annually and for a significant portion of bike and pedestrian fatalities. Investigators conducted a survey to assess this problem in Minnesota, reviewed literature to identify gaps and inconsistencies in relevant Minnesota guidance and laws, and created a decision tree to provide local transportation agencies with guidance about what safety treatments to apply at a problem intersection with a particular road type and condition. The guide, which also includes diagrams, photos and real-world examples, was presented at a workshop attended by MnDOT staff, county staff and planners. [Technical Summary 2013-23](#)





RESEARCH SERVICES & LIBRARY

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Calendar

- 1/21–24 Minnesota County Engineers Association Annual Conference
- 1/29–31 City Engineers Association of Minnesota Annual Conference
- 2/3–5 Road Dust Best Management Practices Conference
- 2/5 2014 TERRA Pavement Conference
- 2/11 APWA Underground Utilities Construction Inspector School
- 3/4–6 Minnesota's Transportation Conference
- 3/12 58th Annual Asphalt Contractors' Workshop/Quality Initiative Workshop
- 3/18 APWA Underground Utilities Inspector School
- 3/20–21 Concrete Paving Association of Minnesota Workshop and Awards Banquet

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