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RESEARCH SERVICES & LIBRARY

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Financial Benefits Key in FY2016 Research Project Selection

Minnesota's transportation research oversight groups emphasized financial benefits when selecting next year's transportation research projects.

MnDOT's Transportation Research Innovation Group and the Local Road Research Board announced their Fiscal Year 2016 funding awards in December after hearing proposals from researchers in several states. TRIG and LRRB selected 20 research proposals that explore novel approaches to improving the environment, increasing transportation safety, improving construction methods and saving taxpayer dollars.

Two research projects will look at how to use smartphone technology to improve work zone safety.

"We asked the principal investigator to identify expected safety and financial benefits upfront, and how research can be implemented to improve the transportation system and economic viability of Minnesota," said Hafiz Munir, MnDOT research management engineer. "We're making a point early in the process to identify these potential benefits, quantify them and document them in our tracking system."

Researchers will test new technology that could lead to crack-free pavements; create better, faster and less expensive ways to reclaim roads; and even explore how to use waste material from road construction projects as part of the landscaping to absorb water runoff.

"The selected projects (17 of them brand new) cover different aspects of transportation research ranging from planning and design to materials and construction, from safety and maintenance to environment," Munir said.

Selected projects are listed at **mndot.gov/research/RFP/FY2016/awards.html**.

FY2014 Research At-A-Glance

Our yearly summaries of research activity are now available. The *FY2014 MnDOT Research Services & Library At-A-Glance* presents all of our research projects in an easy-to-scan format along with project highlights, an updated staff directory, summary financial information and the basics: who we are, what we can do for you and how to work with us. The *FY2014 Local Road Research Board At-A-Glance* presents all of the projects funded by the LRRB along with the current board members, goals and service offerings. Request a paper copy or download the reports from mndot.gov/research/annual-reports.html.

Research Implementation

MnDOT and district maintenance staff members examine the AF-76 AutoFlagger at MnDOT's St. Cloud Training Center.

"Maintenance people are concerned that standing out on the roadway to flag is getting more and more dangerous because there are more distractions for drivers. They're interested in trying to minimize their exposure on the roadway."

—Tom Dumont, Traffic Engineer, MnDOT District 3

AutoFlaggers Effective, Improve Worker Safety

Traffic & Safety — Like a traditional flagger, the Automatic Flagger Assistance Device directs drivers through work zones and other problem areas, but an AFAD is operated remotely, which not only removes the worker from the flow of traffic, but allows a single worker to operate two AFADs, providing cost savings projected to cover AFAD purchase costs within two years.

MnDOT recently undertook a pilot implementation of three sets of AFADs, introducing them to maintenance staff and identifying the most appropriate situations for their use. Researchers reviewed past AFAD use in Minnesota, observed traditional flagger and AFAD operations in action, interviewed MnDOT maintenance personnel about their experiences and held two hands-on training sessions that were attended by more than 60 people. Results showed that drivers obeyed the AFAD instructions and that AFADs work well for stationary construction projects. These successful demonstrations should encourage the wider use of AFADs and enhance worker safety in a cost-effective way. **Technical Summary 2014-44**

Watch a **video demonstration** on the MnDOT Research Services & Library YouTube Channel (**www.youtube.com/user/mndotresearch**).

Other Research

SMART-SIGNAL Automatically Updates Traffic Signal Timing, Reduces Delay

Traffic & Safety — Traffic delays typically increase by 3 to 5 percent each year solely because of outdated signal timing plans, and retiming signals in Minnesota typically costs about $3,500 per intersection because of the data collection and optimization involved. Over the past several years, however, MnDOT research has developed the SMART-SIGNAL system, which is now installed at over 100 Minnesota intersections and automatically collects the kind of traffic and signal-phase data that signal retiming requires. Investigators developed a framework to diagnose problems that cause delays at traffic signals and an algorithm that automatically optimizes the signal plan to address these problems. At one intersection, on Trunk Highway 13 in Burnsville, the SMART-SIGNAL system reduced travel delays by 5 percent per vehicle. **Technical Summary 2014-38**

Expanding Multimodal Travel Options in Small Cities and Rural Areas

Multimodal — Providing alternatives to automobile travel to the more than half of Minnesota residents who live outside the Twin Cities metro area is challenging, and MnDOT wanted to investigate how other agencies across the country were addressing this need. Investigators identified 65 promising strategies. For example, in Olympia, Washington, new sidewalk construction funds were approved by linking the project with park enhancement. In North Dakota, a network of buses connects small towns to larger regional centers. In Mesa, Arizona, a nonprofit organization implemented a citywide program that reimburses eligible seniors for car trips provided by friends and neighbors. Many of these ideas are ripe for adoption by Minnesota communities. **Technical Summary 2014-42**

Field Testing Our Winter Maintenance Tools

Maintenance Operations & Security — MnDOT continues to optimize winter plowing materials and techniques to make Minnesota's roads safer with greater efficiency. Following up on previous laboratory testing, researchers conducted on-the-road testing to evaluate current methods. For example, to measure traffic's effect on anti-icer persistence, they monitored chloride concentration in eight drainage points from North Star Bridge (U.S. Highway 169) in Mankato. Results showed that most chloride left the bridge deck quickly, providing only 45 to 60 minutes of protection and then requiring retreatment to prevent refreezing. **Technical Summary 2014-43**

Pole-mounted time-lapse cameras with detachable bases documented deicer and plow testing on side-by-side test tracks.

Safeguarding Our Bridges

Maintaining Bridge Safety with Electronic Monitoring

Bridges & Structures — Electronic monitoring is a useful supplement to bridge inspections to help ensure that bridges get maintenance when they need it. However, engineers need to understand what normal behaviors a bridge is expected to exhibit during loading, temperature changes and long-term changes in concrete to then recognize what behaviors warrant concern. To achieve this, investigators developed a monitoring system for the I-35W St. Anthony Falls Bridge and compared five years of monitoring data with laboratory and computer modeling tests. They were able to develop and test a methodology for interpreting anomalies in the monitoring data, which will help detect potential problems with the bridge bearings and may help identify potential changes in expected long-term behavior of the bridge. **Technical Summary 2014-39**

MnDOT's Concrete Bridge Girder Shear Reinforcement Design: Confirmed!

Bridges & Structures — Transverse reinforcement is required in prestressed concrete girders to resist shear forces. MnDOT's design, which uses straight-legged stirrups, differs from national standards that require bent-legged stirrups to anchor reinforcing steel to the girders, but is less costly to manufacture. Laboratory tests of both partial girder sections and full-scale prestressed girders confirmed that MnDOT's current stirrup design provides more than adequate anchorage and shear resistance. Maintaining this design will allow MnDOT to save significantly on costs while providing Minnesota's traveling public with bridges that are exceptionally safe and durable. **Technical Summary 2014-36**

How Quickly Do Bridge Decks Deteriorate?

Bridges & Structures — Long-term planning for concrete bridge deck repair and replacement activities requires that we be able to estimate how long these bridge decks will last. MnDOT inspects bridges regularly and already has decades of data on their condition, so a new project took up the task of analyzing these data to assess deterioration rates and identify the factors that impact these rates. This information will be incorporated into MnDOT's Bridge Replacement and Improvement Management System and will provide data-driven estimates of funding needed for rehabilitation and replacement efforts. **Technical Summary 2014-40**

Fortifying Our Pavements

Materials & Construction — As concrete pavements age, they can deteriorate near the joints that separate the concrete slabs. MnDOT sometimes uses a process called partial-depth repair, in which damaged concrete at the joints is removed and replaced with a patching material. Researchers tested various concrete mixtures and chemical admixtures for these patches to develop improved partial-depth repair guidelines. This included development of a laboratory testing-based acceptance procedure for evaluating pre-bagged commercial patching mixtures. Both the materials recommendations and some changes in construction technique are being evaluated for incorporation into MnDOT's standard practices. **Technical Summary 2014-41**

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Calendar

1/11–15	TRB Annual Meeting, Washington, D.C.
1/20–23	Minnesota County Engineers Association Annual Conference, Brainerd
1/28–30	City Engineers Association of Minnesota Annual Conference, Brooklyn Center
2/12	19th Annual TERRA Pavement Conference, St. Paul
3/3–5	Minnesota's Transportation Conference, Bloomington
4/15–17	2015 Minnesota Airports Conference, St. Cloud

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