



# ACCELERATOR

*Putting your ideas in motion*



Traffic engineers would like more guidance on how to slow down traffic approaching roundabouts at high speeds. Pictured is a roundabout at Highway 13 and County Road 2 in Scott County before enhancements were made. (Photo courtesy of Scott County)

## 20 studies chosen for '17

**New Research** — MnDOT's latest crop of transportation research projects have been identified. This year, researchers were asked to pay special attention to how their work could benefit the public and be put into real-world practice

MnDOT's Transportation Research Innovation Group (TRIG) and the Minnesota Local Road Research Board recently announced their Fiscal Year 2017 funding awards after hearing proposals from researchers at multiple universities. The two bodies chose 20 research proposals totaling about \$2.9 million that will study new and innovative approaches to improving the environment, making transportation systems safer, improving construction methods and operating in more cost-effective ways.

According to MnDOT Research Management Engineer Hafiz Munir, MnDOT Research

Services made some key changes to its annual requests for proposal that will help ensure research makes a difference to the agency's bottom line. This year, researchers were asked early on in the proposal process how they would quantify their results, what benefits the research could achieve and how their research could be implemented in the future.

"Now we'll be able to track those metrics and that will help MnDOT not only quantify the potential benefits of the projects, but also implement the results," Munir said. "The bottom line is that we will be able to not only save money, but also improve the way MnDOT does business."

Several of the 20 newly funded projects deal with improving transportation safety, Munir said, and many others are focused on implementing cost-saving practices, innovations and new technologies.

### FY 2017 Research Projects

- Alert system for lane departure
- Warning app for roadway curves
- Learning which roadway turfgrasses are best suited for specific regions of the state
- Design guide for fish-friendly culverts
- Determining how social media can engage diverse community groups in state
- State's first glass fiber reinforced polymer (GFRP) reinforced bridge deck
- Slowing traffic approaching roundabouts
- Gathering truck reliability data to identify bottlenecks and provide mitigation solutions
- Determining why anchor bolts become loose on overhead signs and light towers
- System and smartphone app for capturing and reporting work zone intrusion data
- Advanced sensor system to estimate vertical displacements on the I-35W bridge
- Investigation of the necessity of pavement markings on low-volume roads
- Compare fiber performance in thin concrete overlays
- Evaluate four performance test methods that predict asphalt mix cracking behavior
- Investigate link between transportation investment and job creation
- Refining a pothole repair compound
- How using permeable pavements can decrease the need for salt use
- Capturing toxins from roadway runoff
- Integrating data on highway bus operations, park-and-ride facilities and urban parking
- Estimating traffic from mobile device data

## Advances in Road Research

### Savings from MnROAD pavement research approaches \$900 million

**Materials & Construction** — Since 1994, MnDOT has operated the MnROAD test track along I-94 in Albertville to conduct research that will help MnDOT improve pavement construction, design and maintenance. Phase I research, from 1994 to 2007, resulted in \$33 million in annual savings in Minnesota and up to \$749 million nationwide, with increases in pavement performance and service life resulting in reduced maintenance, user delays and congestion.

MnDOT recently evaluated expected benefits of Phase II research, conducted from 2007 to 2016 and consisting of more than 20 projects addressing asphalt and concrete construction, pervious pavements, maintenance, full-depth reclamation, recycled materials and the impacts of heavy farm equipment on pavements. A conservative estimate of cost savings for Minnesota alone is \$104 million over the next 10 years for a benefit-cost ratio of 3.8, with increases in pavement performance and service life resulting in reduced maintenance costs, user delays and congestion.

[Technical Summary 2015-19](#)

### Determining rolling resistance improves fuel efficiency

**Materials & Construction** — Understanding the contribution of rolling resistance to vehicle fuel consumption will help MnDOT design pavements with more fuel-efficient surface textures, reducing both operating costs and environmental effects.

In a recent study, MnDOT partnered with FuelMiner, Inc., which has developed an accurate mechanistic model of fuel consumption to determine how rolling resistance and other factors contribute to fuel consumption by heavy duty trucks. Results showed that rolling resistance accounts for 10 to 13 percent of fuel consumption.

Vehicle fuel consumption is affected by numerous factors, from aerodynamics to tire-pavement interaction. One important factor is rolling resistance, the non-frictional dissipation of energy as rubber tires undergo repeated cycles of deformation and recovery in response to road surfaces.

[Technical Summary 2015-39](#)

“We want to do research that can be used by a wide range of customers throughout the world.”

— Glenn Engstrom  
NRRRA Executive Chair



MnROAD's outdoor test tracks include this low-volume, 2.6-mile closed loop that simulates city and county conditions.

## MnROAD forms national pooled fund to oversee next round of research

**Road Research** — After two decades of groundbreaking road research, the MnROAD pavement test track is ready for the next stage of its journey. The Minnesota Department of Transportation will begin \$2.5 million of MnROAD construction in 2017. MnROAD has invited departments of transportation nationwide, as well as industry professionals and academics, to help determine its next phase of pavement research by participating in a new pooled fund called the National Road Research Alliance (NRRRA).

The goal of the NRRRA is to help agencies nationwide reap similar benefits as Minnesota from real-world road research, including issues related to cold climates, and to provide industry and academia a testbed for evaluating cutting edge pavement technologies.

Research will focus on extending pavement life, preventative maintenance practices and

improving pavement design.

“Partnerships will be essential to determining MnROAD research needs, direction and funding for the future,” said MnDOT’s Glenn Engstrom, NRRRA Executive Chair.

Led by an Executive Committee of state DOT members, the NRRRA will plan and oversee the entire lifecycle of MnROAD research, from the selection of research topics to communication and implementation of the results. Member states will participate financially in the pooled fund, taking advantage of matching funds from

Minnesota.

The NRRRA replaces a collaborative organization called the Transportation Engineering and Road Research Alliance (TERRA), which ended in June 2015. The NRRRA pooled fund was established to build a more robust road research and implementation program.



### Research discovers cost-effective new snow fence

**Maintenance Operations** — Living snow fences—rows of plants that catch snow blowing across fields onto roadways—can significantly reduce the need for winter plowing and road salt. However, dogwood and cranberry shrubs, types of snow fences used by MnDOT, can take as long as 20 years to grow into effective snow-catching barriers along highways and cost about \$50.50 each to plant.

Researchers experimented with a variety of fast-growing willow-shrub hybrids, including some native to Minnesota, at a high snowdrift site. In just three to four



seasons of growth, these shrubs became effective at trapping all the snow from an average snowfall at an installation cost of only \$3.60 per plant.

[Technical Summary 2015-46](#)



From left: Lt. Governor Tina Smith, MnDOT Associate Legal Counsel Tara Kalar, MnDOT Commissioner Charlie Zelle, MnDOT Deputy Commissioner Tracy Hatch, MnDOT Bridge Inspection Engineer Jennifer Zink, Collins Engineering Regional Manager Barritt Lovelace, and MnDOT Research and Implementation Program Development Engineer Bruce Holdhusen.

### Governor recognizes drone research for bridge inspection

**Bridges & Structures** — Bridge Inspection Engineer Jennifer Zink and her team were honored in January at a ceremony with Lt. Governor Tina Smith for their work on MnDOT's ongoing drone bridge inspection research project. Minnesota is the first state to use specialized new drone technology for inspecting bridge infrastructure. In addition to improving safety for inspectors, state researchers have found that drones reduce the time for a bridge inspection from eight to five days. MnDOT was one of four agencies to receive a Continuous Improvement Award from the governor.

### Minnesota makes mark at annual Transportation Research Board conference

**Transportation Research Board** — Nearly 13,000 transportation professionals gathered for a week-long conference in Washington, D.C. in mid-January to learn about the latest in transportation research from around the country. University of Minnesota researcher Brian Davis, who helped develop a low-cost system

for mapping fog lines, gave one of nearly 90 panel presentations from Minnesota at the annual Transportation Research Board meeting. Other MnDOT projects highlighted included a culvert repair guide for best practices, drone technology for bridge inspections and the I-35E MnPASS express lane project.

## Transportation Research Syntheses

*Transportation Research Syntheses are short-term research projects that summarize research activity and practices among state departments of transportation. To view any of these documents or request a TRS from MnDOT Research Services & Library to answer your questions about a transportation topic, visit [mndot.gov/research/transportation-research-syntheses.html](http://mndot.gov/research/transportation-research-syntheses.html).*

### Best repair and rehabilitation practices for large culverts

**Bridges & Structures** — Much of the research-oriented literature on rehabilitation methods for corrugated metal pipe culverts is focused on smaller-diameter pipes. But MnDOT was interested in learning more about the effective practices and costs to structurally rehabilitate bridge-size, large diameter (10 feet or greater) pipes. What are the current practices for extending the life of a deteriorating pipe via a repair or rehabilitation that provides continued structural support for traffic?

A literature review and a survey of cold-weather states gathered information about repair techniques, potential environmental concerns, structural issues to consider before and after repair, and the life-cycle cost-effectiveness of various repair techniques.

[Transportation Research Synthesis 1510](#)

### Survey shows few DOTs measure impact of culvert maintenance

**Bridges & Structures** — To estimate the service life of a culvert, MnDOT generally relies on predictions of the durability of the pipe materials with which culverts are constructed, but this method is not always accurate. MnDOT wanted to know about other factors that affect service lives and how to quantify the benefits of various culvert maintenance activities on service life.

Phone interviews with representatives at other state departments of transportation about their methods of tracking culvert deterioration showed that most states do not yet use deterioration models for culverts or attempt to quantify the effects of maintenance.

[Transportation Research Synthesis 1508](#)



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## Calendar

- 2/10 MnDOT Research Implementation Ideas Due
- 2/15 NCHRP Synthesis of Highway Practices Topics Due
- 2/18 2016 NRRA Pavement Conference, St. Paul
- 3/1 NCHRP IDEA Proposals Due
- 3/9-10 2016 Minnesota's Transportation Conference, St. Paul
- 3/14 LRRB RIC Meeting, McLeod County
- 3/16 LRRB Meeting, Golden Valley

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TERRA becomes NRRA

