

ACCELERATOR

mndot.gov/research
Putting your ideas in motion

MnDOT'S AUTONOMOUS BUS: COLD-WEATHER TESTING



Members of the public get a chance to ride the autonomous shuttle on Nicollet Mall, during a free tour held the weekend before the Super Bowl. The bus has performed well in both snow and night tests at MnROAD, pictured below.

In November, MnDOT began road testing a self-driving shuttle bus in Minnesota's cold-weather conditions. The shuttle is designed to carry six to 12 people at low speeds on premapped routes.

The project is a partnership with EasyMile, a high-tech company headquartered in France with an office in Colorado. EasyMile's EZ10 electric shuttle bus has already transported 160,000 people more than 60,000 miles in 14 countries, operating crash-free in various environments and traffic conditions. EasyMile has conducted cold-weather tests in Finland and Norway; Minnesota is the company's first cold-weather test site in the U.S.

Testing is taking place at the MnROAD pavement test facility near Monticello.

"We have learned a great deal in a short time about how the vehicle performs in these adverse weather conditions," says MnDOT project manager Michael Kronzer. "Blowing and falling snow has proven to

be the biggest challenge as the sensors on the vehicle are very sensitive. However, EasyMile has been able to make adjustments to its system, and we have seen noticeable improvements."

The driverless shuttle is just one of several autonomous and connected vehicle research projects underway in Minnesota. These efforts are not just about driverless technology, but also about communication technologies that alert cars with drivers about other vehicles, roadside infrastructure and traffic information such as speed limit changes and work zones.

Learn more at mndot.gov/autonomous.



Snowplow Fuel Reduction Among 27 New Research Picks



By analyzing data that many snowplow trucks already collect, MnDOT hopes to optimize plow routes and reduce fuel consumption.

A research proposal for this analysis was among **27 new research projects** selected in December for FY2019 funding. Governing boards for MnDOT and the Local Road Research Board selected the funded projects.

To identify “hotspots” for high snowplow fuel usage, researchers will analyze data from the Maintenance Decision Support System, which provides in-cab, real-time weather information to snowplow drivers for decision-making, along with vehicle performance information collected by plow trucks. They will also consider strategies to reduce fuel usage:

identifying possible snow fence locations and making routing and equipment changes, such as adjusting routes to reduce the weight of deicing material a truck is hauling on a particular route.

Other notable funded projects (available at mndot.gov/research/awards.html):

- A methodology to assess old MnDOT bridge barriers for replacement or rehabilitation.
- Evaluation of the economic impact of rural transit service in Greater Minnesota.
- Testing of a wayfinding smartphone application for the visually impaired at signalized intersections operated by MnDOT in downtown Stillwater.
- Test site to determine life cycle of different sign sheeting materials.

More Winter Research

- **A salt brine study** showed that truck traffic makes deicers more effective. The study was part of an ongoing effort to evaluate deicer effectiveness, plowing effectiveness, anti-icer persistence in traffic and drains, and pavement deicer shedding. [TECHNICAL SUMMARY 2017-45](#)
- **Living snow fences:** Training materials for district staff were developed to promote this program, which pays landowners to plant trees or corn rows along roadways to reduce the amount of drifting snow reaching the road. Using these barriers could save the state \$1.3 million annually in plowing costs. [TECHNICAL SUMMARY 2017-42](#)
- **Software in development** will allow snowplow dispatchers to use Twin Cities metro area highway loop detector and weather station data to more accurately determine when road conditions have recovered from a snow event, supporting fleet efficiency. [TECHNICAL SUMMARY 2018-01](#)



TRANSPORTATION RESEARCH SYNTHESIS

Alternatives to Chloride Deicers?

A *Transportation Research Synthesis (TRS)* is a short-turnaround research project that summarizes research activity and/or practice among state departments of transportation. If you need answers, [request a TRS from MnDOT Research Services & Library today.](#)

MAINTENANCE OPERATIONS & SECURITY —

Most roadway deicing treatments include chlorides. Since there's no natural process for breaking down chlorides, they accumulate in the environment. After conducting a literature review and a survey of state departments of transportation about alternative deicers, investigators found a trade-off: All of the alternatives (acetates, formates, glycols and succinates) are more expensive than salt. They also may corrode infrastructure and may be toxic in the short term to aquatic species. Potassium succinate (KSu) is one promising, noncorrosive option; laboratory tests are underway to gauge its deicing performance compared to salt brine and acetate.



TRS 1706

The Latest from Clear Roads

Clear Roads is a MnDOT-led cooperative effort of 35 agencies to identify the most effective winter maintenance techniques and technologies to save money, improve safety and increase efficiency. clearroads.org

Clear Roads Report 12-04, Plow Operator and Supervisor Training, presents a comprehensive snowplow operator and supervisor training program with 22 modules that cover equipment, materials, techniques and procedures.

Rural Intersection Warning Systems Shown Effective



TRAFFIC & SAFETY – MnDOT has installed systems at more than 50 rural locations to alert drivers approaching stop signs on minor roadways when traffic is approaching on a major roadway. Researchers evaluated the effectiveness of these life-saving systems to help determine when and where to deploy additional systems. Drivers were 50 percent more likely to come to a complete stop at intersections where such a system was present.

TECHNICAL SUMMARY 2017-38

New Guidebook Available for Selecting Stabilizers for Recycled Road Bases

MATERIALS & CONSTRUCTION – New guidance, produced by the Local Road Research Board, will help engineers select the most promising stabilizing additives for individual road reclamation projects. The guide describes base stabilization and its benefits, and includes a process for selecting the best stabilizers for rehabilitating roads. Information for suppliers explains what they must do to ensure their modifying additives can be used as stabilizers in Minnesota.

TECHNICAL SUMMARY 2017RIC02

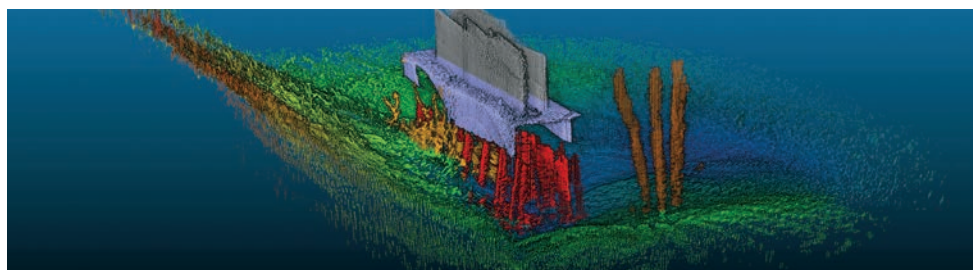


Underwater 3-D Sonar Imaging Effectively Maps Bridges and Riverbeds

BRIDGES & STRUCTURES – MnDOT hydraulics engineers worked with sonar investigation experts to hone practices for using sonar in underwater mapping to collect data from four Minnesota bridge projects. Sonar can identify underwater site conditions and defects, riverbed terrain, debris locations and scour characteristics. This practice improves substructure assessment without the need for under-

water diving, which can be very difficult and dangerous in some locations.

Petra DeWall, MnDOT waterway engineer, will present on the research implementation project at Session 35, March 1, at the Minnesota Transportation Conference (mntransportationconference.org). A video demonstration is available at youtube.com/mndotresearch.



TECHNICAL SUMMARY 2017-40

MnDOT Shares New Practices at TRB



Robert Coughlin (left), MnDOT District 6 water resources Hydrinfra coordinator, presented on the district's award-winning culvert inspection vehicle at the annual Transportation Research Board (TRB) meeting in early January. Coughlin, pictured here with Jeff Vlaminck, District 6 engineer, was among dozens of Minnesota transportation practitioners who attended sessions and presented on topics of national interest at the Washington, D.C., conference.

MnDOT Now Accepting New Ideas for Research and Implementation



The solicitation for new MnDOT research and implementation project ideas

has been combined for the next funding cycle. Submit your ideas at mndot-lrrb.ideascale.com.

- For priority consideration, submit your implementation idea by **Feb. 9**. Implementation ideas submitted after that date may be considered as funding allows.
- All research project ideas must be submitted by **May 11** to be considered for this year's university research RFP.



RESEARCH SERVICES & LIBRARY

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Calendar

- 2/9** MnDOT research implementation ideas due (for priority consideration)
- 2/28-3/1** Minnesota Transportation Conference, Mankato
- 3/1** NCHRP IDEA proposals due
- 3/16** National Transit Cooperative Research Program Synthesis topic ideas due
- 5/11** MnDOT research project ideas due

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