



ACCELERATOR

Putting your ideas in motion

Knowing While Mowing

In-cab location technology keeps maintenance workers out of the weeds

Thanks to a research project that installed GPS devices in tractor cabs, MnDOT Metro District maintenance workers have a better sense of exactly which areas they need to mow and which areas should be left alone. Five Metro District tractors were tested in 2015. This year, more than 40 tractors were fitted with the automated vehicle location (AVL) technology, which includes a GPS antenna, an on-board central processing unit (CPU) and an in-cab screen with a user interface.

Trisha Stefanski, Metro District asset management engineer, expects the project to significantly reduce herbicide use. Maintenance crews use herbicide to control the spread of noxious weeds that sometimes get spread during mowing operations. Mapping exactly where noxious weeds are, and providing that information to operators on a real-time, in-cab screen and user interface helps them mow around those areas.

“We’re really hoping it will reduce the amount of herbicide that we’re putting on our roadways by 50 percent,” Stefanski said. “We’re not certain that will be the number, but that’s what we’re hoping for. We think just not mowing those areas will not spread as



Automated vehicle location systems in mowing tractors could lead to a 50 percent reduction in the amount of herbicide use simply by informing operators where noxious weeds sit in the path of their mower blades.

many noxious weeds and so we don’t have to apply as much herbicide.”

Metro District operator Jesse Lopez said the AVL technology feels similar to playing a video game.

“You can see what you shouldn’t mow and what you should mow. So, it makes it easy for me,” Lopez said.

In addition, the AVL technology helps maintenance supervisors keep tabs on where their operators are in real time.

It also helps them complete reports by automatically providing the geographic areas where mowing was completed.

Stefanski hopes collecting more data over another mowing season will show real savings on herbicide use. In the meantime, she is thinking of other ways AVL technology could be applied to maintenance operations.

— Watch a video of the GPS-equipped mowers: mntransportationresearch.org.

Wetland Creation in Gravel Pits Shows Potential But Requires Care

Environmental — When road construction impacts wetlands, the Minnesota Wetland Conservation Act requires certain activities to mitigate these effects. Creating wetlands in new sites gives only partial mitigation credit because it may not adequately replace what was lost. Using new research, the project team created wetlands in abandoned gravel pits to see if they would be as successful as restoring wetlands drained during construction or other activity.

Results were mixed: Most of the 14 sites monitored for this project had good water level characteristics and ample native plant populations, but several had high levels of invasive species that reduced their potential as mitigation sites. This research clarified certain lessons in how to manage such a wetland: implement early invasive species control, plant trees on drier areas and respond quickly to changes in site conditions as the wetland develops.

Technical Summary 2016-11



Wetland created and monitored for the research project.

Do You Have An Information Gap? We Can Help

Transportation Research Syntheses (TRSs) are short-term research reports that summarize research activity or state of practice for a topic. They can include interviews and surveys.

To view TRSs or request one to address your research need, visit mndot.gov/research/transportation-research-syntheses.html.



Investigators take measurements from tube infiltrometers at highway test sites to validate the model developed in the swales study.

Calculators Make It Easier, Less Expensive to Manage Runoff

Minnesota Dry Swale Calculator Validates Lower-Cost Pollution Prevention

Environmental — Previous research established that grassed swales, such as roadside drainage ditches, are an inexpensive and effective way to handle stormwater that might otherwise carry pollutants from the road into a nearby stream or lake. A newly developed calculator helps show that a swale can do its job without a more expensive strategy like a filtration basin.

From laboratory and field tests of water flow and absorption, investigators identified nearly a dozen factors that affect a swale's effectiveness. They were then able to design a calculator that accurately estimates infiltration using just four factors: the swale's width, the width of the road, the location's typical rainfall volume or depth, and the saturated hydraulic conductivity of the soil. These findings will be shared with the American Association of State Highway and Transportation Officials (AASHTO) Stormwater Working Group to give agencies nationwide the benefit of MnDOT's work.

Technical Summary 2016-15

New Method for Determining Impervious Area Saves Time and Money

Environmental — Another calculator, funded by the Minnesota Local Road Research Board, developed a practical method to determine the effective impervious area of a watershed using readily available data instead of more time-consuming and expensive methods, enabling more accurate stormwater modeling and cost-effective investments.

To enable the stormwater control that helps decrease pollutant levels in waterways, planners estimate how much impervious area the runoff passes across before reaching sewers.

Past methods of estimating impervious areas have included more area than necessary—surfaces leading directly to the storm system (the effective impervious area) as well as nearby impervious surfaces (the total impervious area).

Investigators developed a method for accurately estimating only the effective area and showed that the calculations enabled by this method closely matched actual rainfall runoff data from 40 gauged watersheds. This could make new stormwater management projects less costly without sacrificing the environment.

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Low-Cost Weigh-in-Motion Sensors Could Yield More Traffic Data

Traffic & Safety — Most weigh-in-motion systems utilize crystalline quartz piezoelectric sensors, which provide good quality data but at a high cost—about \$27,000 per lane. Piezoelectric polymer film sensors, also known as brass linguini (BL) sensors, cost only \$2,000 per lane to install and have a longer working life due to their installation method. BL sensors, however, are sensitive to temperature.

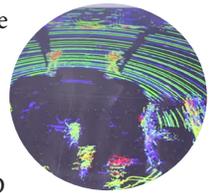
Investigators developed a mathematical approach to correct BL sensor weight measurements based on pavement temperature. While probably not accurate enough for weight enforcement applications, the BL sensor could significantly increase the amount of traffic data available for planning purposes at the same cost.

[Technical Summary 2016-10](#)

Workshops Demonstrate LiDAR Traffic Analysis Applications

Traffic & Safety — LiDAR, or light detection and ranging (like radar but with light), is a new technology that can produce 3-D images of both stationary and moving objects. Workshops in February showed off some of the newer applications of this technology, and MnDOT and local agencies are considering which applications could be most useful.

For example, a portable LiDAR system can analyze intersection traffic, displaying the position and speed of moving vehicles on a 3-D map. Units can range from



\$9,000 to \$80,000 (the unit used in the workshops) to multicorridor mapping systems that can cost \$1 million. More work is needed to improve the accuracy of intersection modeling and to find hardware and software solutions that will cost less.

To learn more about LiDAR applications, check out [Research Services' YouTube channel](#) or go to mndot.gov/research/videos.html and look for "Applying LiDAR to county transportation systems."

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Northwest Passage Update

The screenshot shows the Northwest Passage website interface. At the top, there are input fields for Trip Start Location (Seattle, WA), Waypoint (Milwaukee, WI), and Trip Destination. Below this is a navigation menu with options like RESET PAGE, MOBILE APP, RESOURCES, DATA INFO, ABOUT, SHARE ROUTE, CONTACT, FEEDBACK, and HELP. The main content area features a map of the Northwest Passage corridor, showing routes through North Dakota, Minnesota, South Dakota, Wisconsin, and Michigan. Below the map, there are two summary cards for different route options, each showing length, estimated drive time, and specific weather alerts for the dates of August 18, 2016.

At RoadsToSafeDiscovery.com, travelers can check weather conditions, road work and other route information along the I-90 and I-94 corridors, from Wisconsin to Washington state.

Minnesota Partners with Neighboring States to Improve Traveler Information

Traffic & Safety — To help make winter travel easier, since 2003 MnDOT has led the North/West Passage Corridor Pooled Fund Study (nwpassage.info), which includes eight states along Interstate 90 and Interstate 94 running from Wisconsin to Washington state, a major corridor for commercial and recreational travel. Current projects include maintenance of the Operations and Traveler Information Integration Sharing (OTIIS) website, which offers traveler information along the corridor in a single interactive map. Another project is evaluating a program that allows citizens to report driving conditions so that they can be included in traveler information reporting, and another is comparing winter maintenance practices between corridor states.

For more than 30 years, the Federal Highway Administration's (FHWA's) Transportation Pooled Fund Program (pooledfund.org) has provided state departments of transportation and other organizations the opportunity to collaborate in solving transportation-related problems. The program is focused on leveraging limited funds, avoiding duplication of effort, undertaking large-scale projects and achieving broader dissemination of results on issues of regional and national interest.

A Single System to Track All Infrastructure?

Maintenance & Operations — State departments of transportation are increasingly turning their attention to transportation asset management (TAM), a systematic process for tracking the condition of physical infrastructure to make better maintenance decisions.

MnDOT is assisting Minnesota city and county agencies to heighten awareness of the benefits of asset management. The agency is also developing guidance for using asset

management plans, systems and software. A Transportation Research Synthesis to support this effort involved a literature review and interviews with representatives at local agencies across the country.

Results provide information on asset management planning by seven experienced local agencies as well as the benefits and challenges involved in using several TAM software packages.

[Transportation Research Synthesis 1603](#)



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Calendar

- 10/15 NCHRP Domestic Scan Program topic proposals due
- 10/18-19 Minnesota Water Resources Conference, St. Paul
- 10/18 LRRB Outreach Meeting, Minneapolis
- 10/19 LRRB Meeting, St. Cloud
- 11/3 Center for Transportation Studies Research Conference, Minneapolis
- 11/17-18 APWA-MN Fall Conference, Brooklyn Center

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