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 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.
Improving the Environment

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**

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.

**Technical Summary 2016-41**

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.
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.

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.

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 multiorridor 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.”

Technical Summary 2016-10

Workshops Demonstrate LiDAR Traffic Analysis Applications

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Technical Summary 2016-19
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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