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Driver-Assist System Keeps Plows on Road

Maintenance & Operations — Years of research developing a system that helps snowplow operators navigate during low visibility are paying off in MnDOT District 7, which has the highest wind speeds in the state.

District 7 is piloting a snowplow driver-assist system (DAS) developed by University of Minnesota researchers to combat the blowing snow and fog that often cause zero visibility. In February, one plow driver used the technology to traverse a bad winter storm and help rescue more than a dozen motorists and a state trooper stranded in southwestern Minnesota.

"We have more days when the wind blows than when it doesn't," said Chase Fester, MnDOT District 7 transportation operations supervisor, who drove a pickup behind DAS-equipped snowplow operator Darryl Oeltjenbruns to reach motorists stranded on a 12-mile stretch of Highway 60.

The DAS was developed and refined over the past 20 years under multiple research projects funded by MnDOT and the U.S. Department of Transportation's University Transportation Center program. In addition to plows, the DAS technology has also been applied in other specialty vehicles, such as patrol cars, transit buses and ambulances. Numerous vehicles using the system have been deployed in both Minnesota and Alaska.

Driver-assist technology developed in Minnesota was used by a snowplow operator to rescue stranded motorists during a winter storm. The technology is also used by specialty vehicles, such as patrol cars and transit buses. (Photo by Dave Gonzalez)

The DAS uses GPS technology and a front-mounted radar to provide an image of the road and any obstacles in front of the operator. The image is displayed on a monitor inside the cab of the plow. The operator's seat vibrates if the plow veers too close to the centerline or fog line.

The DAS helps snowplow operators see the road alignment and features, such as turn lanes, guardrails and road markings. Even in less extreme winter weather, snowplow operators gain assurance of their lane location using the system.

Learn more about the District 7 pilot project at mntransportationresearch.org

Scholarship Fund Established in Honor of Pavement Scholar Eugene Skok

Road Research — During February's National Road Research Alliance (NRRA) Pavement Conference in St. Paul, Eugene Skok was recognized for his contributions to pavement engineering. A scholarship fund has been established in Skok's name in honor of his leadership and pioneering research, which led to the development of Minnesota's asphalt pavement design procedure and other advances.

"Gene's technical innovations were timely and timeless," said David Newcomb, senior research engineer, Texas A & M University.

Skok helped guide the development of MnROAD, the state's pavement testing facility, and taught many of today's leaders in transportation. Read more about his career at mntransportationresearch.org.

Eugene Skok, left, speaks with one of his former students, MnROAD Operations Engineer Ben Worel, at the NRRA pavement conference.

Transportation Research Syntheses Detail Latest Practices in Asset Management

Maintenance & Operations — Have you ever needed to know how other states were addressing an emerging issue in your field?

MnDOT Research Services recently compiled such information about key asset management challenges in a series of Transportation Research Syntheses (TRSs) presented at Minnesota's Transportation Conference on March 10 by MnDOT's Erik Baxstrom, Josh Pearson and Shaker Rabban. The session was entitled "What are We Missing? The State of Practice for Managing and Maintaining Culverts, Bridges and Ancillary Pavements."

The TRSs came out of a recommendation by Kirby Becker, former Asset Management planning director, to keep MnDOT's first Transportation Asset Management Plan (TAMP) moving forward after its publication in 2014. The TAMP is a comprehensive document that lays out how the agency is managing the state's multibillion dollar investments in pavements, bridges, culverts, tunnels and traffic signs.

Becker wanted to take the TAMP to the next level by gathering the best information available from around the country on asset management challenges. He turned to the TRS process, available on request through MnDOT Research Services & Library. The TRSs, which can be produced in just a few months, summarized information on these topics:

- Managing Ancillary Pavements (TRS 1507)
- Managing, Maintaining and Operating Culverts (TRS 1508)
- Quantifying the Impact of Bridge Maintenance (TRS 1509)

"With this information, we'll be able to fine-tune how we manage our assets and make more effective use of taxpayer dollars," Becker said.

To request a TRS, visit mndot.gov/research/transportation-research-syntheses.html.

"MnDOT will be a very different agency in 50 years time, and sooner. Many of the problems that dominate our conversations today, like traffic safety, pollution, energy use and congestion, should diminish as issues such as automation, electrification and road pricing are introduced and adopted. New problems will undoubtedly emerge."

— David Levinson
Professor, University of Minnesota

The Google self-driving car brings fully autonomous vehicles to today's roads.

Driverless Electric Cars? Agencies Plan for Transportation Changes

Policy & Planning — Google's self-driving cars log almost 1.7 million miles of service. E-shopping transforms delivery traffic. Telecommuting grows. As trends like these continue experts expect transportation systems to change more in the next few decades than in the entire century before. MnDOT and the Local Road Research Board (LRRB) turned to the University of Minnesota's David Levinson for help anticipating what that future could hold for Minnesota.

Levinson, a professor in the University of Minnesota's Civil, Environmental and Geo-Engineering department, assembled a group of specialists to explore how technology will impact transportation systems. Their findings are presented in The Transportation Futures Project: Planning for Technology Change, which contains eight groundbreaking chapters, each on an individual theme in technology.

By midcentury, electric vehicles will account for most new car sales, and autonomous vehicles may be the only cars on the road. Speed limits will rise on major roadways as fatalities drop 90 percent. Automated car services will reduce private car ownership.

"These technologies may profoundly impact how we think about and deliver transportation services," explained Kenneth Buckeye, program director, MnDOT Office of Financial Management. "This has far-reaching impacts."

Highways will carry smaller cars and bigger freight-carrying trucks, parking will no longer shape street design, and gas taxes will no longer drive transportation funding.

If change is the future of transportation, MnDOT and LRRB are positioning themselves to face it. If soon people will be buying self-driving cars with touch screens instead of steering wheels and brake pedals, transportation systems will have to adapt to significant road use changes.

Technical Summary 2016-02

Maintaining Our Bridges

New Procedures Align Bridge Data Reporting Practices with Federal Guidance

Bridges & Structures — The federal Moving Ahead for Progress in the 21st Century Act (MAP-21) highway funding authorization bill changed the requirements for reporting bridge inspection data.

MnDOT already collects element-level bridge data as required by MAP-21, but there are some cases where the data collected is not compatible with new Federal Highway Administration requirements. This project developed new procedures to align MnDOT's practices with the new federal formats. For example, the American Association of State Highway and Transportation Officials' new guide specifies four possible condition states for each element, while MnDOT's prior system has three or five for some elements. MnDOT is offering training seminars around the state to prepare for the new procedures, which will be implemented April 1.

Technical Summary 2015-47

One of the timber bridge rehabilitation procedures detailed in the manual involves concrete pile jackets, which are concrete-filled steel shells installed to strengthen timber piles.

Manual Gives Cost-Effective Techniques to Extend Life of Timber Bridges

Bridges & Structures — Minnesota has more than 1,500 timber bridges that have performed well at low cost. Many of these bridges are now aging and deteriorating, however. More than 1,000 have load restrictions, which increase freight costs by forcing trucks to take detours.

This project developed a manual of timber bridge repair and maintenance techniques that can reduce costs by extending a bridge's functional life. In addition to documenting several procedures for strengthening and rehabilitating bridges, the report offers a procedure for calculating the cost of truck detours. This formula can help determine whether it is more cost-effective to repair a bridge or reconstruct it.

Technical Summary 2015-45

Girder bed with prestressing strands before casting.

Accounting for the Effects of Temperature in the Construction of Concrete Bridge Girders Will Help Ensure Bridge Durability

Bridges & Structures — During the construction of concrete bridge girders, steel prestressing strands lose some of their force because the curing concrete surrounding them heats up and causes them to expand. Because this force is important to girder durability, engineers need to know how much of it is lost so that they can offset it during girder fabrication.

Consequently, researchers investigated the time and temperature at which strands bond to concrete, since bonding prevents any further losses. To do so, they evaluated both laboratory specimens and full-scale girders being constructed in a plant. They found that 4.5 percent of strand forces are lost before bonding occurs, which in mild summer weather is six to eight hours after casting, at 100°F.

Technical Summary 2015-50

Travel Time, Station-Area Sidewalks, Affordable Housing and Commercial Activity Keys to Transit Use

Multimodal — MnDOT expects to see up to six transit corridor sections built in the next 10 years in the metro area, but building transit lines and stations does not ensure that people will use these facilities.

Researchers were tasked with identifying strategies that would encourage drivers to switch to modes like buses and light rail. They studied experiences from around the country and analyzed data from the Twin Cities and similar areas. Their findings showed that transit travel time remains key to encouraging the public to switch from cars to transit. Public policy that encourages affordable housing, sidewalk systems and commercial activity near transit stations also greatly enhances transit uptake and will be critical to transit success in suburbs.

Technical Summary 2015-49

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Calendar

4/21	University Master RFP proposals due
5/19	Minnesota Roadway Maintenance Training Demo Day
May 6	National Cooperative Highway Research Program (NCHRP) panel member nominations due
6/22-23	LRRB summer meeting, Duluth

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