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RESEARCH SERVICES & LIBRARY

ACCELERATOR

Putting your ideas in motion

Slope Slide Prevention, Drones Among MnDOT's Research Implementation Picks

Flash flooding can cause costly damage to state highways. By identifying slopes that are vulnerable to slides, MnDOT can target areas for embankment work as part of future highway projects. (Photo by Dave Gonzalez)

Deadline May 16 to Submit Ideas for Next Round of Research

Do you have a problem that needs solving? MnDOT Research Services is soliciting ideas for both MnDOT and the Local Road Research Board's next cycle of research projects.

MnDOT awards research funding twice each year - once for implementation and once for traditional research projects.

The deadline to submit a short summary of your research idea at **mndot-lrrb.ideascale.com** is May 16. Research Services staff will help develop your idea into a needs statement.

Two intense storms in recent years have resulted in significant damage to property along state highways. A newly funded research implementation project will use GIS-based modeling to help MnDOT predict which state highways are most at risk for slope failure, so the state can make infrastructure improvements in places where it will count the most.

MnDOT's Transportation Research and Innovation Group, the governing board for the state research program, recently selected a dozen research implementation projects for funding in Fiscal Year 2017. In addition to assessing the vulnerability of slopes in high-risk areas of the state, top initiatives include improving the accuracy of bridge load ratings and furthering MnDOT's pioneering drone research by developing guidance needed to begin using drones for bridge inspections statewide.

Each winter, MnDOT solicits proposals from staff members who want to put local or national research into practice in their day-to-day work. Funds can be used for equipment, consultant services or research assistance.

"Project champions take previously proven concepts and turn them into useful practices and procedures to improve the state's transportation system," said Bruce Holdhusen, MnDOT Research Services senior engineer.

Find more information, including a complete list of recently funded implementation projects, on the Crossroads blog, mntransportationresearch.org.

In-Place Recycling Outperforms Mill-and-Fill

Materials & Construction — Rural roadways get less traffic, but it often consists of heavy loads like farming equipment. Fixing the damage these loads cause typically involves grinding off a few inches of asphalt, hauling it away and laying down new pavement. This "mill-and-fill" method covers the damage but problems can recur quickly, and roads get taller and narrower with each treatment.

MnDOT research found in-place recycling methods more cost-effective. Full-depth reclamation (FDR) removes the asphalt and sometimes the entire base, mixes it with new binder and lays down a recycled pavement. Cold in-place recycling (CIR) takes off a few inches of pavement, remixes it and lays it back down as new asphalt.

FDR and CIR offer significant life-cycle savings over mill-and-fill and perform much like new pavement, but at a lower expense. FDR costs about $70,000 less per mile than new asphalt.

Technical Summary 2016-14

One Step Closer: Site-Specific Mix Designs for Full-Depth Reclamation of Cracked Roads

Materials & Construction — For years, Minnesota has used full-depth reclamation (FDR) to rebuild cracked roads. FDR involves removing the entire pavement, including some or all of the base, grinding it, mixing in new binder and laying it back down—all on-site. Crews then place a fresh, thin surface layer of asphalt over the compacted, stabilized base.

Researchers wanted to better understand the material properties of this kind of base material to optimize the mix design used at different sites where different base materials are available. They tested cores from four sites and modeled performance with MnDOT's in-house software. While further research is needed, the current effort brought MnDOT one step closer to developing a performance-based design for these mixes.

Technical Summary 2016-09

When applying a taconite-based mixture, this truck-mounted microwave unit heats both the pavement and the new patching material, creating a durable bond between pavement and fill.

New Technology May Provide Faster, Longer-Lasting Pothole Repair

Materials & Construction — Every spring, road crews shovel hot-mix asphalt into potholes and tamp it down. This "throw-and-go" method takes about five minutes per pothole, but only lasts a few months—sometimes only a few days. MnDOT explored repair methods that employ mixtures with taconite tailings, a durable iron mining byproduct readily available in Minnesota.

Rapid Patch, a water-activated taconite mix, effectively repairs potholes in concrete pavements. The patch can last years, but mixing the material on-site still takes too long to replace the throw-and-go method. The microwave method uses a taconite-based mixture to repair asphalt pavements. A truck-mounted microwave (pictured above) heats the mixture and the surrounding pavement, binding the materials in a process researchers believe can be whittled down to seven minutes.

These promising taconite-based repair options require further refinement and testing before they can be widely used in the state.

Technical Summary 2016-03

Optimizing Concrete Surface Texture Improves Pavement Performance

Materials & Construction — A standard part of concrete pavement construction is creating narrow grooves in the surface to improve friction and safety. These grooves are made by dragging various materials such as steel tines, rough carpet strips or brooms over the surface of uncured concrete. Diamond-coated saw blades may also be used to cut in the grooves after the concrete has cured. But what is the best shape and orientation for these grooves to reduce tire-pavement noise, maximize friction so that drivers don't skid and provide a smooth ride?

After evaluating several options for cost-benefit and performance over time, MnDOT found that most texture types can be optimized to perform well by adjusting their configurations. The agency is evaluating the implementation of these results in both new construction and rehabilitation.

Technical Summary 2015-48

Understanding Traffic, Improving Safety

In a driving simulator, eye-tracking glasses monitor whether drivers turn their attention to speed enforcement cameras.

Speed Cameras In Work Zones Won't Distract Drivers

Traffic & Safety — More than 100 road construction workers are killed in U.S. work zones each year. Automated speed enforcement cameras are not currently permitted in Minnesota, but some groups have expressed interest in their potential to improve work zone safety. MnDOT wanted accurate information about the impact of speed cameras to inform any future discussions, so researchers replicated a work zone in the HumanFIRST Portable Driving Environment Simulator.

Test participants drove the simulated route four times, each with a different form of speed enforcement. Eye movement tracking data gathered from eye-tracking glasses worn by participants found that speed cameras did not distract drivers by leading them to pay too much attention to their speedometer or the potential for enforcement vehicles.

Technical Summary 2016-06

ATM signs are lane-specific and provide more detailed information about road conditions than standard changeable message signs.

Lane Control Messages Improve Traffic Management

Traffic & Safety — MnDOT has been investigating ways to improve safety near the merge point of Interstate 94 and I-35W in Minneapolis. The agency has considered an active traffic management (ATM) messaging strategy, intelligent lane control signs, to direct drivers to change lanes or take other actions when an accident occurs. This is a fairly new strategy nationally, so researchers analyzed surveillance camera data and determined that these messages are for the most part effective at inducing drivers to select the correct lane during an incident. These results will play a key role in upcoming MnDOT decisions concerning traffic operations infrastructure.

Technical Summary 2016-04

New Way to Calculate Seasonal Events Improves Traffic Counts

Traffic & Safety — MnDOT uses standard seasonal adjustment factors to extrapolate annual traffic levels from short-term traffic counts conducted by portable traffic recorders.

To improve the accuracy of these traffic estimates, researchers developed a new method to calculate seasonal adjustment factors by identifying common traffic patterns and using the professional judgment of local engineers to fit specific sites to the patterns. Traffic pattern categories were developed based on relative spring, summer and fall traffic levels as well as relative weekday and weekend traffic levels during each season.

Implementating this system would require new procedures for short duration counts and collecting a week's worth of data per site in each season.

Technical Summary 2016-05

Improved Modeling Determines How Much Work Zone Will Avert Traffic To Different Routes

Traffic & Safety — To effectively manage the delays caused by road construction, MnDOT uses predictive traffic models. While the reduction in traffic capacity from a lane closure is readily calculated, there had been very little research into measuring work zone diversion—the number of vehicles that take alternative routes to avoid the work zone.

Researchers used data from prior MnDOT projects, traffic simulations and SMART Signal information about alternative routes to develop improved models for estimating traffic diversion rates and improved charts to calculate traffic capacity based on a work zone's geometry.

A future implementation effort will put these insights into practice.

Technical Summary 2016-12

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Calendar

5/11-13	APWA-MN Conference, Nisswa
5/16	Deadline for MnDOT/LRRB FY2018 Research Project Ideas
5/19	Minnesota Roadway Maintenance Training Demo Day
6/22-23	LRRB Summer Meeting, Duluth
8/8-11	MAASTO Conference, Minneapolis
8/28-31	APWA National Conference, Minneapolis

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