With the aim of reducing congestion on the Twin Cities’ highly traveled I-35W corridor between the Minnesota River and I-94, the Minnesota Department of Transportation (MnDOT) began a major set of I-35W improvements in 2009 as part of the Federal Highway Administration’s Urban Partnership Agreement (UPA). Among the improvements was the addition of a priced dynamic shoulder lane (PDSL) on parts of the 17-mile stretch of highway; however, following the opening of these improvements, the frequency of rear-end crashes increased in certain sections—especially in the PDSL regions.

Turfgrass continued on page 5

Untangling the safety impacts of Minnesota’s I-35W improvements

Keeping Minnesota’s roadsides green is about more than just aesthetics—healthy turfgrass can improve water quality, reduce erosion and road noise, and provide animal habitat. However, harsh conditions such as heat, drought, and salt use can make it difficult for roadside turfgrass to thrive.

In 2014, as part of a study funded by the Minnesota Local Road Research Board (LRRB), researchers in the Department of Horticultural Science identified a new salt-tolerant turfgrass

New recommendations aim to help turfgrass thrive on Minnesota roadsides

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The U of M’s HumanFIRST Laboratory has received a 2017 Research Infrastructure Investment Program award of just over $186,000 from the U’s Office of the Vice President for Research (OVPR).

The lab is a facility of the Department of Mechanical Engineering. It conducts research to collect, analyze, and understand driver behavior generated during driving simulation studies and field tests of enhanced human-machine interfaces designed to reduce risky driving behaviors.

The lab houses two advanced driving simulators, which together host most of its research experiments. Funds from the award will be used to overhaul components of both simulators. One-to-one match funding will be provided by the lab’s own accumulated funds gathered through usage fees.

The laboratory’s immersive simulator will see a replacement of its 2002 Saturn full-vehicle cab with a modern sedan and an upgraded three-axis motion system. The existing discrete, five-panel projector system will be replaced with five high-resolution projectors onto a smooth, cylindrical display and will include LCD-embedded side mirrors. The new vehicle cab will facilitate research into driver human-computer interaction with its glass dash and large touchscreen display. Finally, the computer systems operating the immersive simulator and its companion portable simulator used for off-site and interdepartmental collaborations will be replaced with the latest-generation computing hardware and graphical software for creating the simulated driving worlds.

“When it was originally installed, the immersive simulator was state-of-the-art and among the best in the country,” says mechanical engineering professor Max Donath, who, with HumanFIRST Lab director Nichole Morris, submitted the funding request. “However, competing institutions have now surpassed our capabilities and many primary components of both simulators were nearing the end of their life.”

This upgrade is expected to re-engage Minnesota as a national leader in driving behavior research. “As automated vehicle technology continues to advance, it will be critical to test machine-driver handoff between automated and manual driving modes in simulated settings,” Donath says. Demand for research in automated vehicles is only expected to grow, he adds.

HumanFIRST continued on page 7

CATALYST HAS A NEW LOOK.
It’s designed to show VIBRANCY, CONNECTION, AND COLLABORATION. We’re excited to offer a fresh perspective through our new design and in our stories of transportation research and activities at the U of M.
This summer, civil engineering undergrads put what they’ve learned in the classroom to work in a professional environment as part of the 10-week Summer Transportation Internship Program.

Working in a variety of offices at the Minnesota Department of Transportation (MnDOT), interns gained hands-on experience in roadway engineering, bridge design, roadside vegetation and erosion control, bicycle and pedestrian safety, and more.

This year’s participants, and their internship offices, were:

- Christoph Brostrom, Regional Transportation Management Center
- Helena Cassino Thomaz, Bridge Maintenance and Inspection Unit, Metro Division
- Maranatha Hayes, Office of Traffic Safety and Technology
- Katrina Hilton, Office of Environmental Stewardship, Air and Noise Unit
- Connor Mills, Bridge Office, Design
- Kevin Olm, Design Office, Metro Division
- Cody Sedbrook, Bridge Office, Hydraulics Unit
- Kaitlin Spomer, Office of Traffic Safety and Technology, Pedestrian and Bicycle Safety
- Xiafein Teo, Office of Project Management and Technical Support
- Erik Tungland, Metro Construction, Inspection Unit

Hilton is studying at Case Western Reserve University in Ohio, and the other nine interns are students at the University of Minnesota.

Interns say they appreciated the opportunity to gain professional experience, enhance their technical skills, make connections with MnDOT staff, and work on real-world projects being conducted across the state.

“I was able to design actual plan sheets that will be used in the development of state projects in the coming months,” Olm says. “The knowledge that my work will be directly influencing future construction left me excited and engaged in a way that I have never been in any other professional or educational environment.”

In addition, students valued seeing what day-to-day work is like for transportation professionals. For example, Brostrom says he enjoyed seeing how engineers put their knowledge and skills to practical use.

“In school, we’re taught that engineering is all about what we know. But in reality, it’s about being able to adapt and use our knowledge to help further and improve projects, even after they’re initially completed,” he says.

This firsthand glimpse into the transportation profession prompted other students to consider additional related studies—and potentially their own careers in transportation.

“This internship piqued my interest in traffic and transportation engineering and has drawn me to take more classes related to the topic,” says Spomer. “It has also allowed me to make connections in a great organization that I hope to maybe work for some day.”

Now in its sixth year, the internship program is offered jointly by CTS and MnDOT.
International students study transportation during summer exchange

This summer, students from three Chinese universities spent six weeks learning about American transportation and culture as part of a training program offered by the Global Transit Innovations (GTI) Program.

Thirty-two students from Southeast University, Nanjing Tech University, and Northwest University participated in the program, which included courses on GIS, transportation planning, English speaking and writing, and cross-cultural communication. They also attended a variety of transportation-focused seminars both on and off campus, including tours of U of M labs, 3M’s Innovation Center, and the St. Croix River Crossing.

In addition, students participated in cultural activities at locations around the Twin Cities, such as Fort Snelling and the Minneapolis Institute of Arts.

“Our hope is that students leave Minnesota with a greater knowledge of the U.S. transportation system and a deepened curiosity to continue their studies and discover new innovations for global transportation,” says CTS director Laurie McGinnis.

The program, first offered in 2016, was developed by CTS, GTI, and the U of M China Center’s Mingda Institute. GTI is an affiliated program of CTS. Its education component aims to attract bright minds to the transit-planning field.

More about GTI is at gti.umn.edu.

GTI course highlighted on CTS Blog

U of M student participants from this spring’s GTI study-abroad course to China are sharing their experiences in a series of guest posts on the CTS Blog.

Read their thoughts on the course and on Chinese transportation and planning issues at blog.cts.umn.edu.
mixture that could be used on Minnesota roadsides. But, when the Minnesota Department of Transportation (MnDOT) began using the mixture, called MNST-12, the agency experienced a series of installation failures.

Now, led by Professor Eric Watkins, the research team has identified new best management practices for installing and establishing this type of salt-tolerant turfgrass. The study, funded by the LRRB, specifically focused on watering practices, soil amendments, and planting date for both seed and sod.

“Newer improved seed or sod mixes like MNST-12 may have differing requirements for successful establishment compared to other species or cultivars that contractors and other turf professionals are more familiar with,” Watkins says. “Since all of these management practices are prescribed—or not prescribed—in the MnDOT specifications, generating data that can inform future specifications is a valuable outcome of this work.”

The study, which was conducted over several years, included experiments on how water should be applied to new MNST-12 turfgrass installations, the use of soil amendments at the time of establishment, and the effect of the seeding or sodding date on the success of a new planting.

Based on their findings, the researchers recommend these changes to MnDOT specifications:

• No soil amendments are necessary, but adequate seedbed preparation is important.
• Seeding is preferred to sodding between August 15 and September 15.
• Sodding can be permitted throughout the year, but only if the installer is able to supply frequent irrigation.
• When watering in sod, attention should be given to the species being used and local rates of evapotranspiration (evaporation from both the soil and plant leaves). Sod installers can anticipate using between 100,000 and 170,000 gallons of water per acre to ensure a successful establishment.
• Sod can be mowed as soon as sufficient root growth prevents an operator from manually pulling up pieces by hand, but it should not be mowed if wilting from heat or drought.

Currently, the researchers are using the results of this project to develop methods for educating and training stakeholders, including turfgrass installers, on these best management practices. They are also developing systems that could be used by installers in the field to help maximize the success rate of turfgrass installations.

These best management practices can help limit installation failures and reduce maintenance inputs for future installations, providing both an economic and environmental benefit,” Watkins says. “The knowledge and improved specifications we gained through this research will allow us to make our contractors more successful, which makes MnDOT successful,” says Dwayne Stenlund, MnDOT erosion control specialist. Because local agencies often rely on these MnDOT specifications as a guide for their projects, they will also benefit from the improved practices.

Stenlund also says the new specifications—especially those related to watering requirements—could allow for a clearer understanding of the true cost and value of turfgrass installation and maintenance work, which could ultimately improve the accuracy of the project bidding process.

In another project, the research team is exploring other turfgrass stresses, such as ice cover and heat. They are also testing additional turfgrass species and mixtures in an effort to continue improving MnDOT specifications for roadside turfgrass installations.

TURFED ROADSIDES comprise more than 24,000 ACRES in Minnesota.
To untangle the underlying causes of this increase, MnDOT enlisted the help of researchers in the Department of Civil, Environmental, and Geo-Engineering. “Our primary objective was to determine if these increases were direct effects of the improvements or if they were due to changes in the traffic conditions,” says Professor Gary Davis, the principal investigator. “MnDOT was interested in extending some or all of these improvements to other corridors but needed to know what the safety impacts were to aid its decision making.”

Others on the research team included Jingru Gao, a master’s candidate advised by Davis, and John Hourdos, director of the U’s Minnesota Traffic Observatory.

The researchers began with a preliminary analysis to determine the study region and singled out two specific sections that were experiencing an increase in the rear-end crash frequency after the improvements. Next, these two sections were further divided, and data on crashes, traffic flows, weather conditions, and PDSL activation were compiled for each section. Researchers then analyzed the data to estimate the change in rear-end crash risk following the UPA project while controlling for traffic conditions, weather conditions, and PDSL activations.

The analysis resulted in several significant findings. First, researchers concluded that the operation of the PDSL had no direct effect on likelihood of rear-end crashes. In addition, they found evidence that crashes were most likely when lane occupancies were around 20 to 30 percent, and that crash likelihood tended to decrease for lane occupancies below and above this range. Finally, researchers concluded that the PDSL region experienced a substantial increase in congestion following the UPA improvements due to the removal of a bottleneck in the I-35W/Crosstown Commons; when controlling for this change in traffic conditions, there was no significant increase in rear-end crash risk attributable to the PDSL.

“The PDSL sections showed substantial increases in lane occupancy following the project,” says Davis. “The observed increases in rear-end crash frequency can be explained by increases in higher-risk traffic conditions, and the increase in higher-risk traffic conditions was most likely caused by the removal of the old Crosstown traffic bottleneck.”

“The research study showed us that the design of the PDSL did not increase crashes on this stretch of 35W,” says Brian Kary, MnDOT freeway operations engineer. “Had we not done the PDSL, congestion and ultimately crash rates would have been worse.”

In the future, the methodology demonstrated by this study could be used to evaluate the safety effects of other freeway-related projects because it worked out a way to estimate changes in hourly crash risk while controlling for variations in traffic conditions, Davis says. In addition, the finding that the current implementation of a PDSL did not have an adverse effect on safety can be used to provide guidance to MnDOT as it considers using PDSLs at other highway locations.
Leaders join Executive Committee

The CTS Executive Committee welcomes these new members:
- Gina Buccellato, Global Business Director, Traffic Safety Business, 3M
- Steve Cramer, President and CEO, Minneapolis Downtown Council
- Randy Maluchnik, Commissioner, Carver County
- Ann Mulholland, Vice President of Community Impact, Minnesota Philanthropy Partners
- Katie Rodriguez, Chair, Transportation Committee, Metropolitan Council
- Carissa Slotterback, Associate Dean, Humphrey School of Public Affairs
- Troy Volk, President, Volk Transfer

Nominees sought for Research Partnership Award

CTS is seeking nominations for the 2018 Research Partnership Award. The award honors research projects within the CTS program that have resulted in significant impacts on transportation. The award will be presented at the CTS annual awards ceremony on February 22, 2018.

Please submit your nomination by Monday, November 6, 2017. For more information or to submit a nomination, please visit cts.umn.edu/about/awards/rpa.

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Morris says the lab’s simulators will also allow her research team to safely test impaired driving performance to better understand and deal with drivers who may be fatigued, under the influence of drugs or alcohol, or have mild cognitive impairment. “Impaired driving continues to account for at least one third of fatal crashes on our roadways and little progress in this area has been made in recent years,” she says.

The Research Infrastructure Investment Program awards totaled over $2.5 million from OVPR and matching funds from the supporting colleges or centers. The 13 projects that received funding this year will impact researchers from 2 campuses, 7 colleges, and 21 departments, units, and centers.

A history of human factors research

U of M researchers have studied the human factors elements of transportation for decades. The U’s first wraparound driving simulator was completed in 1995; since then, research areas have included the effects of impairment caused by distraction, age, alcohol, and fatigue, and the unique safety issues of teen and elderly drivers, motorcyclists, cyclists, and pedestrians.

Human-centered technology was also the focus of the Intelligent Transportation Systems Institute and the Roadway Safety Institute, two federal University Transportation Centers based at CTS. Both centers worked to develop systems that are adapted to the driver, rather than forcing the driver to adapt to the technology, with the ultimate goal of reducing crash rates and saving lives.

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Recommendations aim to help turfgrass thrive on Minnesota roadsides.

Students get hands-on experience in transportation in a summer internship program.

Infrastructure award will improve driving simulators in U of M lab.

Untangling the safety impacts of Minnesota's I-35W improvements.