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April 2023

Study recommends biodiversity when planting roadside vegetation

A recent U of M study found that turfgrass plantings tend to do better when they are both biodiverse and carefully matched to their ideal growing conditions. Researchers designed a tool that agencies can use to pick the best plant species for a given site.

Short Films, Big Vision: Transportation-themed films spark conversation about community connections

CTS was one of the hosts of "Short Films, Big Visions: A Series on Transportation and Community." The virtual event featured short films produced by the Redford Center for its "Community Power" series, including one featuring U research on transportation and happiness, followed by a panel discussion.

Surge pricing for rides influences customer evaluation of driver performance

Surge pricing in rideshare apps leads to more complaints from customers, which ultimately eats away at drivers' incomes, according to new U of M research. Researchers say the findings highlight the importance of adapting platforms to better serve both customers and service providers.

Helping automated vehicles 'see' through fog and snow

While fully automated vehicles have not yet reached the roads, the work to get them market-ready is moving forward. One of the technologies these vehicles rely on is lidar, but it's less accurate in bad weather. U researchers evaluated lidar's capabilities and recommended solutions to improve it.

New methods to determine safe bridge loading will help keep Minnesota's truck freight moving

Detours around bridges on critical freight routes increase fuel and labor costs for the trucking industry—and eventually hit consumer pocketbooks, too. U of M researchers investigated three Twin Cities bridges to determine if the load ratings and overweight permitting process could be updated.

Tech Fest sparks kids' interest in engineering, technology

After a several year hiatus, CTS was happy to be back at Tech Fest at The Works Museum in Bloomington earlier this month. The interactive family event offers a variety of STEM activities to kids ranging in age from pre-K to third grade.

Future of Mobility: Decarbonized transportation

What's next in transportation? The Future of Mobility series collects the perspectives of top U researchers and other national experts. In 17 articles, the authors scan the horizon and reflect on critical transportation topics. This month, we explore ways to decarbonize transportation.

CAV Career Pathways Camp open for applications

Do you know any high school students interested in vehicles and the latest technology? Encourage them to apply for our free 2023 CAV Career Pathways Camp, scheduled for August 7–11 on the U of M Twin Cities campus. Campers will learn about connected and automated vehicle (CAV) technology and explore related career opportunities.

In the News

UMN students discuss public transportation use post-COVID
Minnesota Daily, April 14, 2023

Solving public transportation needs in rural America
Harvest Public Media, April 10, 2023

Environmental experts voice concern on road salt pollution in Minnesota waterways as snow melts
KSTP-5 TV News, April 7, 2023

What could the future of downtown Minneapolis look like?

Minnesota Public Radio, April 3, 2023

Study recommends biodiversity when planting roadside vegetation

April 24, 2023

Traditional practices for planting and maintaining roadside turfgrass in Minnesota have generally focused on finding a few plant species that do well in combination and blanket-prescribing them across the state. A recent U of M study, however, finds that plantings tend to do better when they are both biodiverse and carefully matched to their ideal growing conditions.

Roadside research site in October 2018. Photo: UMN Turfgrass Science

Roadside turfgrass serves the important roles of reducing soil erosion, pollutant runoff, and the spread of invasive weeds, as well as adding visual appeal. Maintaining it in Minnesota, however, is difficult because of the harsh climate and maintenance practices (such as salting and plowing).

A team of U of M researchers set out to find a more stable, cost-effective approach to establishing roadside turfgrass vegetation.

“Developing tools for practitioners to make better decisions on revegetating roadsides will save financial resources for MnDOT, practitioners, and local communities,” says Eric Watkins, professor with the Department of Horticultural Science and principal investigator for the project.

The researchers set up 14 test plots along Minnesota roadways and tested 44 treatments—

some monocultures and some mixes. What they found matched up with existing literature from other systems: Biodiversity correlates to better vegetation cover and a decrease in weeds.

“The use of species mixtures, compared to monocultures, has been shown to have multiple benefits,” Watkins says. “These include more coverage of the seeded species, reduced disease frequency and severity, and extended green color.”

The reason this happens, Watkins explains, is likely because within the diverse species mix, the plants have a variety of adaptations and tolerances and can survive a wider array of conditions than a single species could.

The immediate downside of biodiversity, Watkins says, is the complicated nature of it. Every plant species and subspecies can have wildly different germination rates, rooting depths, and moisture and temperature tolerances; interaction among species can change things even further.

To make it easier for practitioners to implement biodiverse seed mixes, the researchers broke Minnesota into three “seeding clusters”—regions based on growing conditions such as temperature, moisture, and soil quality. Two of the seeding clusters are geographic (north Minnesota and central/south Minnesota), and the third is categorized as “poor soil quality” (soil that is sandy, low in organic matter, etc.).

“Establishing these test plots with seed mixes that vary by region was an important step in finding the most effective and climate-resistant roadside turfgrass,” says Dwayne Stenlund, erosion control specialist with MnDOT’s Erosion Control and Stormwater Management unit and the study’s technical liaison.

The researchers then designed an Excel budgeting tool that local and state officials can use to determine which plant species will be most cost-effective for a given site. The tool takes factors such as the cost of labor, water, seed, and maintenance into account as well as the predicted performance of a given seed mix.

Moving forward, Watkins says, the researchers plan to make a web-based version of the budgeting tool so it’s easier for local agencies and MnDOT to use. They also plan to do more long-term studies at the test plots (the current studies only ran two years), and future seed testing will need to take climate change into account.

“Implementing these mixtures will reduce soil erosion, improve aesthetics, save local communities' financial resources, and improve the overall environment we occupy," Watkins says.

The project was funded by the Minnesota Local Road Research Board.

Writer: Sophie Koch

Short Films, Big Visions: Transportation-themed films spark conversation about community connections

April 4, 2023

Dozens of community members and transportation advocates tuned in to "Short Films, Big Visions: A Series on Transportation and Community" on February 23. Co-hosted by CTS and the Humphrey School of Public Affairs, the virtual event featured a screening of short films produced by the Redford Center for its "Community Power'' series followed by an engaging panel discussion.

"Community Power Minnesota: Transportation and Happiness" features the research of University of Minnesota professor and CTS scholar Yingling Fan. Created by Minneapolis filmmaking team Sebastian Schnabel and Cici Yixuan Wu, the film showcases Fan's decade-long, community-based research that supports the idea that the way we commute can have a significant impact on our feelings of well-being.

"Transportation is an unavoidable emotional landscape in everyday life," Fan says. "In any urban area, significant portions of land area are devoted to streets, parking, public transit, bicycle lanes, and sidewalks."

The screening included a video welcome and introduction by Redford Center Executive Director Jill Tidman. Following the screening, CTS Director Kyle Shelton moderated a half-hour panel discussion about Fan's work, issues raised by the films, and transportation policy. In addition to Fan, the panelists were Mariia Zimmerman, strategic advisor for technical assistance and community solutions, US Department of Transportation; Margaret

Anderson-Kelliher, public works director, City of Minneapolis; and Emily Smoak, active living coordinator, Minnesota Department of Public Health.

MnDOT, Metro Transit, Move Minnesota, Move Minneapolis, and the Bicycle Alliance of Minnesota sponsored the event, and staff from these organizations provided questions and joined community members in the discussion. Topics included improving access to transportation options and deepening connections between transportation infrastructure and communities.

The five films in the Community Power series each focus on different areas of the country and different aspects of the future of transportation, sustainability, and community empowerment. They can all be viewed online through the Redford Center's website. Founded in 2005 by Robert Redford and his children, the Redford Center harnesses the power of film, video, and new media to increase public engagement on frontline issues and support like-minded community efforts.

Writer: John Siqveland

Surge pricing for rides influences customer evaluation of driver performance

April 13, 2023

Surge pricing in rideshare apps leads to more complaints from customers, which ultimately eats away at drivers' incomes, according to new U of M research.

Photo: Getty Images

Rideshare platforms commonly use surge pricing to balance supply and demand by increasing ride prices when there's a large number of requests at the same time in a certain area. By setting higher rates, the platforms encourage more drivers to serve that area.

Carlson School associate professors Linli Xu and Yi Zhu and University of Southern California assistant professor Yanhao "Max" Wei investigated the relationship between surge pricing and customer complaints in their research paper forthcoming in *Management Science*. The researchers reviewed data from millions of rides from China's largest ride-hailing platform, which accounts for 60 percent of worldwide ride-hailing users. They determined:

- Surge pricing significantly increases the probability of the driver receiving a complaint.
- Customer complaints decrease a driver's future income. About 23 percent of a driver's immediate income boost from surge pricing is offset by the future income loss from rider complaints.
- Capping surge prices can reduce surge-induced complaints, which increases overall app

usage and limits the negative impact on drivers.

“Platforms often look at the pricing and the review systems separately,” Xu says. “Our research shows companies need to think about the interplay between the two. In this case, the surge pricing somewhat defeats the purpose of the higher immediate income for drivers because of the later losses from complaints.”

Xu explains that the study’s takeaways are especially important for new rideshare drivers, who are still building their reputation. Chasing surge pricing, she says, could be a double-edged sword and hurt their overall rating more drastically if they don’t have enough rides under their belts.

The researchers say the findings highlight the importance of adapting platforms to better serve both customers and service providers. During the study, the rideshare app instituted a surge pricing cap to limit the maximum prices. They found rider complaints decreased and app usage by riders increased after the new policy went into effect.

Overall, the study has implications for other service apps, such as Airbnb and TaskRabbit, that rely on ratings to gauge customer satisfaction and the quality of the service provider. Zhu says it’s important for companies to protect their service providers from circumstances out of their control, like surge pricing.

“Companies need to maintain a good relationship with their service providers so they can have a constant supply to meet the consumer demand, so it’s in the company’s best interest to be vigilant for any unintended negative impacts,” Zhu says.

(Reprinted from How rideshare surge pricing impacts complaints, U of M Research Brief, March 8, 2023.)

Helping automated vehicles 'see' through fog and snow

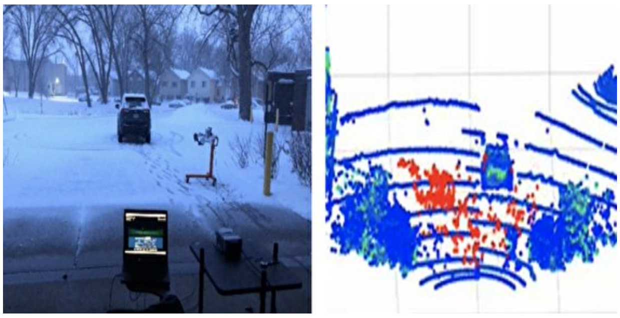
April 18, 2023

While fully automated vehicles (AVs) have not yet reached the roads, the work to get them market-ready is steadily moving forward. One of the essential technologies these vehicles rely on for safety and performance is lidar, which has traditionally experienced a loss of accuracy in bad weather.

To address this challenge, the Minnesota Department of Transportation (MnDOT) enlisted the help of U of M researchers to evaluate lidar's capabilities in adverse weather conditions and recommend solutions to help automated vehicles succeed in any environment—even Minnesota winters.

Lidar—light detection and ranging—is a critical but relatively new component of AV technology. It uses mounted lasers to continuously scan and collect data that's then processed to create 3-D maps of vehicles' vicinities in real time. "While lidar works well on clear days, it can be unreliable in foggy, rainy, or snowy weather—creating a potential hazard for all road users," says Will Northrop, professor in the Department of Mechanical Engineering and the project's principal investigator.

To identify enhancements that will help AVs become better and safer, the researchers set out to understand lidar's challenges and find improvements that will increase and refine the technology's accuracy in all types of weather. They began with a literature review, then reached out to leading AV companies to ensure manufacturers could use their research results. This also allowed them to tap into the private sector's experience and cutting-edge equipment for maximum benefit.



View of a snowy street (left) and its 3D lidar image (right).

Next, the team tested lidar's performance in foggy and snowy conditions. Because fog can be difficult to test in nature, the research team created a simulated environment by installing the system in the center of a fog chamber and measuring lidar's signal and performance in dense fog conditions.

For realistic on-road testing of lidar's performance in snowy conditions, team members installed a lidar system from Luminar Technologies Inc. on the roof of the test vehicle. They evaluated the technology while parked in an open outdoor area and while in motion in both moderate snow and a snowstorm.

"Being able to test lidar in real snow conditions was an unusual upside to Minnesota's harsh winters," Northrop says. "Traveling over highways and local roads in these conditions allowed for a realistic assessment of the system's stability, speed, and precision in detecting a variety of objects and pavement markings."

Researchers recommended hardware design changes after ice blocked the lidar's sensor.

According to Northrop, the research produced several groundbreaking results. "We found that lidar technology can 'see' better and further in fog than we can see with a camera system or with our own eyes," he says. "However, because snow particles are more substantial, we don't get that same benefit."

To address the challenges created by snow, the research team developed and tested a mathematical model to help the system recognize and eliminate snow from its collected data. In addition, they recommended hardware design changes after ice accumulation blocked the lidar's sensors.

The team's coordination with public- and private-sector leaders also proved valuable. "The project would not have been possible without the collaboration of Luminar Technologies and Vision System Intelligence Labs," Northrop says. New understanding and solutions are ready for manufacturers to apply to lidar systems.

"While more research is still needed, this project shows that technology may one day be able to detect obstacles in a variety of adverse conditions better than the naked eye is able to," says Robert Chaucierre, transportation program specialist with MnDOT's Office of Traffic Safety, the project's technical liaison.

See also Future of Mobility: Addressing Challenges for Autonomous Vehicles on Winter Roads.

Writer: Megan Tsai

New methods to determine safe bridge loading will help keep Minnesota's truck freight moving

April 10, 2023

When transportation officials determine which route a heavy truck should take, their aim is maximizing efficiency while ensuring safety. Detours around bridges on critical freight routes increase fuel and labor costs for the trucking industry—and eventually hit consumer pocketbooks, too.

Strain gauges measure the load distribution across the width of the bridge. Photo: Kendall Hill, MnDOT

Until recently, these types of costly detours were often needed around three concrete slab-span bridges over Shingle Creek near Brooklyn Center, Minnesota. Some larger trucks were forced to detour an extra 15 miles or more on congested roadways.

In a MnDOT-funded study, U of M researchers investigated the three bridges to assess whether the calculated load rating reflected actual bridge behavior and determine if the load ratings and overweight permitting process could be updated.

Currently, most bridge load restrictions are calculated using bridge rating software from the American Association of State Highway and Transportation Officials (AASHTO). "Previous testing has found load ratings for many slab-span bridges to be overly conservative," says Ben Dymond, an associate professor with Northern Arizona University (formerly with the University of Minnesota Duluth) and the project's principal investigator.

Load testing while the bridge was closed due to other construction allowed researchers to assess many different truck configurations and load distributions across the bridge's width. Photo: Kendall Hill, MnDOT

Researchers combined field testing with two modeling techniques to explore an alternative method of evaluating bridge load distribution. Their methods included both static and dynamic loading tests on the bridges: They measured the bridges' responses when heavy trucks were parked on them at dozens of points and also when an impact hammer was used to apply force to a bridge deck. They used this data to create and validate two models—one simpler and one more complex—and compared the models and field data with the load ratings calculated by the AASHTO bridge software.

Comparing modeling and field data results to the AASHTO load distribution factors, the team found the AASHTO ratings to be conservative. "The load rating factors produced by our bridge-specific model—and validated with field data—were up to 24 percent greater than the ratings derived through the AASHTO process," Dymond says.

Now, MnDOT can use the new load rating process to evaluate other slab-span bridges in its inventory. "This research gives MnDOT an alternative and more accurate method to evaluate load ratings of slab-span bridges," says Yihong Gao, bridge rating engineer with MnDOT's Bridge Office. "We can now implement a more flexible permitting process for trucks, alleviating costly bottlenecks and detours."

In addition, the agency plans to apply the methods used in this study to other types of bridges and structures such as concrete box culverts, providing MnDOT even more flexibility in managing truck traffic and keeping freight moving efficiently.

Writer: Megan Tsai

Tech Fest sparks kids' interest in engineering, technology

April 25, 2023

After a several year hiatus, CTS was back at Tech Fest at The Works Museum in Bloomington earlier this month. The interactive family event offers a variety of STEM activities to kids ranging in age from pre-K to third grade.

"CTS was thrilled to participate in person at Tech Fest this year," says Gina Baas, CTS associate director. "We try to connect with students of all ages as part of our K-12 outreach, and this event is a great opportunity to get younger students excited about engineering, technology, and transportation."

More than 400 people attended the April 15 event, visiting tables staffed by more than 80 volunteers from 13 organizations.

At the CTS table, attendees experimented with Ozobots—small, desk-friendly robots—either by drawing and color-coding a path for them on paper or by using a more advanced online coding system.

In addition to demonstrating basic robotics and coding concepts, the hands-on activity can help kids understand some of the technology behind connected and automated vehicles (CAVs). The Ozobots detect color codes and use them to follow a specific route, paralleling the way CAVs use pavement striping and roadway signs to navigate.

Check out The Works Museum's video highlights from the event to see the Ozobots in action!

Future of Mobility: Decarbonized transportation

April 26, 2023

What's next in transportation?

The Future of Mobility series collects the perspectives of top U researchers and other national experts. In 17 articles, the authors scan the horizon and reflect on critical transportation topics. Each article recommends action steps for public officials and policymakers.

CTS is highlighting the articles over the course of the year. This month, we explore ways to decarbonize transportation in articles by Will Northrop and Alireza Khani.

In An Equitable Transition to Decarbonized Transportation, Northrop writes that electrifying the entire road transportation sector is an immense challenge that will require technology breakthroughs for both electric vehicles and the infrastructure they travel on. This transition will also require careful consideration of how the system will be deployed equitably to ensure that all communities can benefit from it.

Khani, in Mobility-on-Demand, Battery-Electric Buses May Relieve Transit Woes, suggests that transit agencies use federal dollars to move fleets toward battery-electric buses and to explore the use of mobility-on-demand models within their systems and through coordination with third-party shared mobility services.