

ELEVATING THE IMPACT

20 21

ANNUAL REPORT



CENTER FOR
TRANSPORTATION STUDIES

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM



What We Do

CTS IS THE HUB FOR TRANSPORTATION RESEARCH, EDUCATION, AND ENGAGEMENT AT THE UNIVERSITY OF MINNESOTA.

RESEARCH

CTS manages a coordinated research program funded by local, state, regional, and national organizations. It creates connections between researchers and funders, practitioners, and policymakers to ensure research meets real-world needs; strengthens University expertise by attracting and supporting faculty and researchers; and initiates and coordinates interdisciplinary research on critical and emerging issues.

EDUCATION

CTS promotes transportation-related education in several disciplines and supports current U of M students through research funding, student awards, and networking opportunities. It conducts programs to inspire K-12 students to consider careers in transportation and attend the U of M. It also offers continuing education and training opportunities for current practitioners.

ENGAGEMENT

CTS links researchers and stakeholders in various ways to produce solutions to societal issues. It convenes University thought leaders and the transportation community in a broad participatory framework; holds events that bring national figures to Minnesota to broaden perspectives; disseminates research findings through seminars and communications; and provides access to information through extensive electronic resources and library services.

In addition to its core mission, CTS manages a portfolio of programs with partners and sponsors, such as the Minnesota Local Technical Assistance Program and the Airport Technical Assistance Program. This allows us to reach and meet the needs of a wide range of audiences, cross-pollinate views, and leverage resources.



FY21 REVENUES: \$13.8M

- Federal 23%
- State of Minnesota 43%
- Regional/Local 19%
- University of Minnesota 8%
- Other 7%

Director's Message



Measuring and broadening impact is a critical goal of any institution. The University of Minnesota System is committed to this goal through its MPact 2025 plan. Via this effort, the University is working to ensure that all research, outreach, and service work undertaken improves the quality of life for Minnesotans and that we share

insights created at the U with the world.

At CTS, we wholly embrace the MPact commitment and work every day with our partners to ensure that each project is directly addressing critical transportation issues. Our impacts take multiple forms, and these are visible in the projects highlighted throughout this report.

You'll see examples of researchers working with agencies to improve services and reduce environmental impacts and others sharing research insights directly with Minnesota legislators. There are also examples of University researchers learning with and from communities about pressing transportation priorities and providing ideas that help address them, such as the work of Greg Lindsey and John Hourdos with the Mille Lacs Band of Ojibwe.

And, you'll find examples of CTS education and engagement efforts, such as those in the MnCAV Ecosystem work, preparing current and future transportation-sector workers to respond to changing trends and technologies.

Crucially, CTS's work addresses challenges that are both short and long term. Much of it deals with immediate, pressing needs, and our outputs contribute directly to implementation projects. Other efforts are foundational research projects that provide platforms from which to launch broader, forward-looking initiatives that will help prepare Minnesota for future transportation challenges and opportunities. The ability of CTS and our partners to address transportation needs in both the present and future is a unique strength of university-based research, one we intend to build up in the years to come.

My thanks to all our partners and the CTS team for contributing to another successful year of impactful work, especially given the tumultuous and trying times we all confront. We are glad to share this small view of our impact with you and look forward to working together toward more in the years ahead.

– Kyle Shelton, CTS Director

FY21 By the Numbers



RESEARCH

- 5 patent/license applications; 5 granted
- 22 proposals secured by interdisciplinary research teams
- 61 research reports published
- 98 faculty and staff with research projects
- 124 active projects



EDUCATION

- 23 students participating in CTS-facilitated internships
- 98 U students participating in research projects
- 3,567 participants in customized training and technical assistance programs

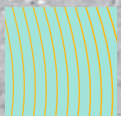
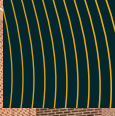
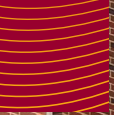


ENGAGEMENT

- 60 committees, councils, task forces, and other stakeholder groups convened
- 200 media stories referencing U transportation research and outreach
- 1,184 participants at events
- 24,005 subscribers of publications and social media



Read the annual impacts report online for links to more information:
cts.umn.edu/2021annualreport



Cultivating Discovery

State-of-the-art vehicle to drive CAV research, education

The University's MnCAV Ecosystem launched operations with the arrival of its fully outfitted autonomous vehicle in July 2021. The collaborative program will facilitate research and testing of sensing technologies, vehicle control, platooning, traffic patterns, and other topics related to connected and autonomous vehicles (CAVs).

The centerpiece of the MnCAV Ecosystem's research facilities is a 2021 Chrysler Pacifica Hybrid minivan that will serve as a customizable, experimental testbed. A suite of sensors allows the vehicle to "see" the world surrounding it, detecting objects and pedestrians and tracking their motion over time.

The MnCAV Ecosystem, established by CTS in 2020, will draw on its unique strengths to conduct research in the areas of cold weather conditions, equity, public perception and trust, the connected environment, and vulnerable road users. The program also offers educational activities to prepare the future workforce.

Program Director: Gina Baas, CTS. Sponsors: Thirteen partners, including a major contribution from the U's Office of the Vice President for Research.



The CAV Career Pathways Camp was held August 9-13 at the White Bear Lake Area High School. During the free camp, students explored CAV technology and discovered a variety of career opportunities in an industry that is helping to shape the future of transportation.

The students were among the first to see the U of M's new MnCAV Ecosystem research vehicle, equipped for level 2 automation, as part of a campus tour.

Campers also rode an AV shuttle bus, took field trips to organizations working on CAV technology, and attended information sessions with practitioners and U of M researchers. A diverse mix of 18 high school students from the Twin Cities metro participated.

William Heise, a White Bear 11th grader, was impressed with the camp. "It really showed me a lot of different career paths that I can take."

The camp was funded by the Federal Highway Administration and administered by MnDOT, with additional financial sponsorship from SICK Sensor Intelligence.



National study aims to improve US transportation system with accessibility data



The Accessibility Observatory, a nationally recognized research unit within CTS, will be building on the success of its National Accessibility Evaluation and Access Across America work after securing support for an expanded second phase of the project.

With support from MnDOT, the Federal Highway Administration, and 14 other state DOTs, the second phase of the study, covering 2020–2024, will continue annual updates of national job access data and, critically, will expand the studied

destination types to include education and health care.

In addition, the Observatory will provide study partners support with integrating accessibility data and concepts into transportation planning and performance management. By adding other destinations to the accessibility evaluation, the second phase will provide partners with an even more comprehensive look into regional transportation systems.

The new destinations are essential components of many people's daily lives. Understanding how residents do or do not have easy access to these destinations can aid agencies in making decisions about how to adjust existing systems or target new investments in ways that open opportunities to a wider population.

Principal investigator: Andrew Owen, CTS/ Accessibility Observatory. Sponsor: National Accessibility Evaluation, a multi-year pooled fund led by the Minnesota Department of Transportation.

Model factors short trips into the spread of COVID-19

Modeling the spread of the COVID-19 pandemic is a critical part of controlling it. Previous models based on movement patterns mainly used long-distance travel to predict the spread of the virus, but new research is looking to include short-distance commutes as well.

U of M researchers are part of an initiative aiming to incorporate short-distance transportation data into viral spread models. They worked in tandem with contacts from Purdue University and the KTH Royal Institute of Technology on the effort.

Their model started with a basic SEIR model (Susceptible, Exposed, Infected, Recovered), which uses factors such as incubation time and duration of disease to predict the rate at which people transition from one of the SEIR categories to the next. Then, using a data aggregator, they gathered cellphone data on the number of trips people made from county to county in Minnesota.

By adding this travel data to the basic model, the researchers were able to create a new set of

predictions for the spread of the virus and gain an understanding of how reducing travel affects viral spread. To check their work, they used county-to-county travel data for each week in 2020, as well as publicly reported infection data, and compared their model performance to the actual viral spread observed. The researchers then compared the resulting pattern with actual case numbers. They found that the model did a good job of capturing the virus spread—particularly because it incorporates the additional trips.

Investigators: Raphael Stern and Michael Levin, Department of Civil, Environmental, and Geo-Engineering. Sponsor: National Science Foundation.



Serving Minnesota—and Beyond

What's behind the transportation workforce shortage—and what should public agencies do about it?

The transportation industry is facing a growing workforce shortage, especially within the public sector. A U of M study identified causes of the shortage and strategies public agencies can implement to attract and retain staff.

According to the study, shifting demographics are a major reason for the workforce shortage. The US labor force is aging rapidly and baby boomers are retiring. The labor force is also becoming more diverse, and immigration remains a key driver of population growth. Jobs in rural areas—which have older and less diverse populations—tend to be harder to fill than those in

urban areas.

The research team developed recommendations for public transportation agencies, such as cutting hiring red tape and offering mentorships. Researchers also say organizations should focus on career mobility and paths for advancement—and, given pandemic impacts, take a strategic and flexible approach to planning for recruitment, retention, and development of employees.

Principal investigator: Kenneth Bartlett, Department of Organizational Leadership, Policy, and Development. Sponsor: Minnesota Local Road Research Board.



'Expanding the Transportation Workforce' project creates tools for local agencies

Many local public works agencies have an approved construction program—and constituents demanding improvements—but lack qualified staff to deliver the work. The Minnesota Local Technical Assistance Program (LTAP), housed within CTS, led the creation of tools to help expand the transportation workforce and fill open positions.

"The ... project has created and identified tools that transportation industry professionals can use to excite and inspire individuals to work in our industry."

— Chris Byrd, County Engineer, Benton County

Continued on next page



The tools take a two-pronged approach: One set helps local agencies attract and retain workers in the short term, while another set helps agencies promote career opportunities to students and feed the longer-term worker pipeline. The tools include:

- Recruitment Toolkit for Local Agencies
- Training Roadmap for Civil Engineering Technicians
- Community Outreach and Communication Guide
- Local Agency Careers in Minnesota brochure

Principal investigator: Stephanie Malinoff, CTS/ Minnesota LTAP. Sponsor: Minnesota Local Road Research Board.

Study helps improve pedestrian safety on reservations

The Minnesota Department of Transportation implemented a new signal system based on crossing-volume data requested by the Mille Lacs Band of Ojibwe and collected in collaboration with U of M researchers.

Minnesota's Native American population is among the priority populations identified in MnDOT's statewide pedestrian system plan. The agency turned to U of M researchers to learn more about pedestrian behavior on reservations across the state and help identify potential safety countermeasures. This work is part of a larger MnDOT-funded study of pedestrian travel behavior and safety in rural settings.

The new signal—a high-intensity activated crosswalk, or HAWK—began operation in December 2020 at a pedestrian crossing near Grand Casino Mille Lacs. Mille Lacs Band staff had suggested a HAWK, which costs less to build than traditional traffic signal systems, to MnDOT after seeing it in operation at other locations.

A key lesson of the Mille Lacs project is the importance of early engagement with collaborators. And although rural pedestrian crossing volumes are low relative to urban volumes, researchers say investments on reservations are warranted to redress historical marginalization of tribes and existing disparities in traffic safety.

Principal investigator: Greg Lindsey, Humphrey School of Public Affairs. Co-investigator: John Hourdos, Minnesota Traffic Observatory. Sponsor: Minnesota Local Road Research Board.

“We knew the site was a problem area for pedestrian crossings and had asked MnDOT to make it a priority.”

– Mike Moilanen, Director of Planning and Project Management, Mille Lacs Band of Ojibwe



Building Sustainability

Team recommends less expensive ways to control runoff from low-volume roads



Stormwater runoff from roads can contain an array of contaminants. Standard treatment methods are based on studies of urban roads with high average daily traffic (ADT) counts—tens of thousands and higher. Low-volume roads, in contrast, have rarely been studied.

To fill this knowledge gap, U of M researchers collected and analyzed stormwater runoff from low-volume rural roads to determine how contaminants compared to those of high-volume roadways. They found that overall, low ADT did appear to correlate with lower pollutant levels of solids, phosphorous, nitrate/nitrite, copper, and zinc.

Rural runoff may also contain pollutants from

other sources, such as galvanized farm equipment. Models run by the researchers indicate that simpler mitigation practices, such as ditches and swales, can effectively control these pollutants and meet state standards.

Based on their findings, the researchers recommended ditches with swales as an effective stormwater treatment for low-volume roads. This method is considerably less expensive to install and maintain than other best management practices. Agencies will be able to use the study's data for their future stormwater permits.

Principal investigator: Professor John Gulliver, Department of Civil, Environmental, and Geo-Engineering. Sponsor: Minnesota Local Road Research Board.

“This study shows that low-volume rural road runoff differs substantially from high-volume urban highway runoff and can therefore be treated in ways that are more effective—at a substantially lower cost.”

– John Welle, County Engineer, Aitkin County

U researchers and Edina snowplow drivers team up to reduce salt in Minnesota’s waters

U of M researchers collaborated with the City of Edina on a research project that gathered data and created tools for reducing road salt contamination in Minnesota’s urban waters.

The first step in the project was to gain a better understanding of how chloride moves from roads to watersheds. Researchers collected meltwater samples and measured variables including flow, temperature, and chloride concentrations. They also took core samples from roadside snow piles for chloride testing.

A noteworthy finding is that chloride movement comes in short bursts during a handful of events



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“When operators have the right tools to do their jobs, they can maintain a high level of service and use less salt.”

– Jessica Wilson, Water Resources Coordinator, City of Edina

spread across the year. During both winters studied, around 90 percent of the yearly chloride loading moved off the roads in under eight non-consecutive days of large melt events—particularly “winter mix” events in which snow accumulates, melts, and freezes.

The researchers then developed scenario models to evaluate chloride movement throughout larger watersheds and created the Active Management Toolkit with a training guide and spreadsheet tools for agencies. The team also coordinated workshops with Edina public works staff to share data and knowledge for improving operations.

Principal investigator: Professor Larry Baker, Department of Bioproducts and Biosystems Engineering. Sponsor: Minnesota Local Road Research Board.

Addressing Societal Needs Through Engagement



University researchers provided expert testimony to the state legislature about the future of transportation in a post-pandemic world. The presentations, organized by CTS, were shared in two informational hearings for the Minnesota House Transportation Finance and Policy Committee. Topics included transportation and equity, the role of data and artificial intelligence, shared modes and services, freight and supply chain impacts, vehicle electrification and automation, telecommuting, and transportation finance.



Participants at a MnDOT – U of M Strategic Research Forum agreed to explore opportunities and next steps for **collaboration in transportation equity and transportation sustainability**.



In a special CTS webinar, **experts discussed telecommuting trends driven by the pandemic** and explored how remote work could shape the future of transportation.



The Gender Equity in Transportation Collaborative was formed by Humphrey School researchers and is spurring conversations among leaders and organizations to make transportation planning more equitable and inclusive.



At the annual CTS Transportation Research Conference, an expert panel discussed how **transportation inequities and disparities can (and should) be addressed**.

Executive Committee

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Executive Director, Region Nine
Development Commission

Margaret Anderson Kelliher

Commissioner, Minnesota
Department of Transportation

Gina Buccellato

Technical Director, Transportation
Safety Division, 3M

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