Catalyst

CENTER FOR TRANSPORTATION STUDIES
UNIVERSITY OF MINNESOTA

September 2022

Year-one reflections on a road traveled and the journey ahead

The work of Drive MN—a statewide connected and automated vehicle (CAV) data collection project—is a great reflection of all CTS achieved throughout 2022. Here, CTS Director Kyle Shelton shares how our CAV efforts illustrate the three pillars of CTS's mission: research, engagement, and education. He also reviews other key topics and programs from the past year—and talks about what's coming next.

Does your commute make you happy? Short film showcases U happiness research

When you think of your daily commute, what feelings come to mind? Would "happiness" be at the top of your list? U of M professor Yingling Fan has developed a Transportation Happiness Map that captures the positive emotions tied to biking, reliable public transportation, safe and scenic paths, and avoiding traffic behind the wheel. Her research is the centerpiece of a new short film—*Community Power Minnesota: Transportation and Happiness*—from the Redford Center.

Drive MN tour collects data, engages stakeholders on CAV readiness

In August, CTS led Drive MN, a four-day, 1,000+ mile driving tour that brought connected and automated vehicles (CAVs) to communities across Minnesota. A team of Drive MN partners piloted two research CAVs to collect terabytes of data about the state's roadway infrastructure. This data will be used to assess readiness for CAVs on many types of roadways, and the results will be published in a full report

later this year.

CAV campers embrace advances in automated transportation technology

This summer, a group of 18 high school students participated in our free, weeklong CAV Career Pathways Camp on the Twin Cities campus in Minneapolis. During the camp, students explored connected and automated (CAV) technology and discovered career opportunities in an industry that is helping to shape the future of transportation.

At high-risk rural intersections, smart warning systems may reduce dangerous right-angle crashes

Smart intersection-warning systems may help prevent the most severe crash types at rural intersections, according to a new study by U of M researchers. Crashes at rural two-way stop intersections make up 65 percent of all the state's fatal crashes, even though most vehicle crashes happen in urban areas. The team analyzed before-and-after data to see if intersection conflict-warning systems were having the intended effect—and found promising results.

Public works staff discuss careers at youth summer camps

Transportation agencies in Minnesota and elsewhere are facing a growing workforce shortage. Building awareness of exciting career opportunities for students—and getting them in the education pipeline—is an important action to address this issue. This summer, representatives of several transportation agencies and companies participated in two University of Minnesota youth summer camps.

Save the date: 25th Annual Freight and Logistics Symposium

Mark your calendar for the 25th Annual Freight and Logistics Symposium, scheduled for December 2, 2022, in Minneapolis. The event, focused on future trends in freight and supply chain resiliency, will feature a keynote presentation from USDOT supply chain advisor Andrew Petrisin. Registration and more information will be available soon.

Reminder: Register for the 2022 CTS Transportation Research Conference

Don't forget to register for the CTS Transportation Research Conference, scheduled for November 3, 2022, at the Graduate Minneapolis Hotel on the U of M's Twin Cities campus. You won't want to miss keynote presentations from Peter Norton (on the transport transformation) and Shelley Francis (on equity and electrification)—or all of our other great sessions!

In the News

- Minnesota's transition to electric vehicles is long and bumpy
  Star Tribune, September 24, 2022
- Minnesota closes out one AV shuttle project, opens two more
  Government Technology, September 22, 2022
- Why deer crossing signs have disappeared from Minnesota highways
  Star Tribune, September 18, 2022

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Year-one reflections on a road traveled and the journey ahead

September 20, 2022

KYLE SHELTON, CTS DIRECTOR

Phil Magney (VSI Labs) and Kyle Shelton with the MnCAV Ecosystem vehicle at the closing Drive MN event.

In mid-August, just after my one-year anniversary as CTS's director, I stood at a gathering of about 50 folks to celebrate the successful completion of Drive MN—a statewide connected and automated vehicle (CAV) data collection effort. Alongside partners from MnDOT, VSI Labs, and Bolton & Menk, the CTS MnCAV Ecosystem team discussed the effort and its aims.

The 1,000+ mile drive in two CAV-ready vehicles allowed the team to collect troves of sensor and camera data from all corners of the state. The data collected will provide critical information about how these vehicles interpret and operate in our current roadway system. The importance of such data collection for the future smooth operation of CAV technologies cannot be understated.

As I listened to the presentation, I was struck by how this work was a great reflection of all CTS has achieved throughout the past year. Our contributions to the Drive MN tour serve as an apt example of where we are going in the years ahead.

Within the University, our MnCAV Ecosystem team and strong cohort of CAV researchers

have been putting our own vehicle to great use investigating a range of challenges about this cutting-edge mobility technology. Researchers have also played a critical role in documenting the rollout, public perception, and performance of CAV shuttles in multiple Minnesota cities through work alongside MnDOT's CAV office. We've built upon our strong relationships with CAV partners through the Drive MN effort, my appointment to the Governor's CAV Advisory Council, and participation with the Innovation Alliance. Our CAV vehicle was also a centerpiece of our second annual CAV Career Pathways Camp held for high school students in the summer of 2022.

Research. Engagement. Education. The three pillars of CTS's work, all captured in just our CAV efforts.

Our daily work on other key topics and programs—from safety, to equity, to workforce development—reinforces these pillars. And each of these areas comes with a consistent through line embodied by each member of our staff—delivering impactful results.

Last year, the CTS Executive Committee and our team undertook a planning process to create a new five-year strategic plan and to lay out our path toward continued impact. Much of our discussion focused on how to best deliver the results of our work, how to deepen our connections with stakeholders, and how to build a central role for the University and CTS in addressing the transportation challenges of today and the future.

Key to this effort was refining our core vision and mission: Collaborating with partners to shape transportation systems that are sustainable, serve the needs of all users, support a strong economy, and improve our collective quality of life.

As we always have, we will strive to achieve that vision through our research, engagement, and education efforts.

Look for CTS to continue to become more proactive in 2023 and the years to come. We will connect with more partners and work with them to identify projects that can help address burning questions or critical needs. We will collaborate ever more closely with our faculty and researchers to pull together innovative, interdisciplinary teams that can tackle complicated, interconnected challenges in topics from sustainable transportation to equitable mobility. We will prepare both the existing and future transportation workforce for the shifts to come. And CTS will host and facilitate critical conversations about transportation in Minnesota and beyond.

I'm looking forward to celebrating many more completed research projects, successful

partnerships, and impactful outputs from CTS and the University. We hope you'll come along with us on this journey throughout the years ahead.

Does your commute make you happy? Short film showcases U happiness research

September 12, 2022

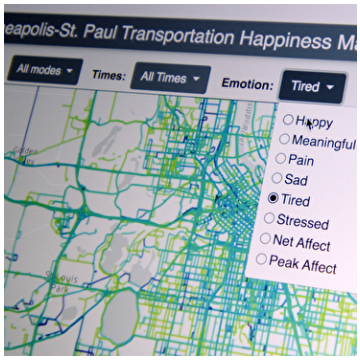
When you think of your daily commute, what feelings come to mind? Would "happiness" be at the top of your list?

Professor Yingling Fan of the Humphrey School of Public Affairs wants to transform the way we experience transportation. With the help of Minneapolis–St. Paul residents, Fan has developed an innovative Transportation Happiness Map that captures the positive emotions tied to biking, reliable public transportation, safe and scenic paths, and avoiding traffic behind the wheel.

Fan's research is the centerpiece of a new short film—*Community Power Minnesota: Transportation and Happiness*—from the Redford Center. Created by Minneapolis filmmaking team Sebastian Schnabel and Cici Yixuan Wu, the film is the final installment in a series showcasing community power in a collective call for civic engagement that redefines clean transportation.

Fan's decade-long, community-based research supports the idea that the way we commute can have a big impact on our feelings of well-being. "Transportation is an unavoidable emotional landscape in everyday life," she says. "In any urban area, significant portions of land area are devoted to streets, parking, public transit, bicycle lanes, and sidewalks."

With the support of local leaders, Fan wants this research to serve as the groundwork in placing human emotion at the center of transportation planning— leading to safer,



healthier, and more accessible transportation and infrastructure design.

"If transportation systems are designed to narrowly focus on efficiency—getting people from point A to point B faster and easier—cities miss out on critical opportunities for fostering human flourishing," Fan says. "It is also about creating equitable, inclusive, and empathic urban spaces. When a city's built environment evokes positive and shared human experiences, we will have a more compassionate society."

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.

"When you put people at the center of designing cities, you empower the community," Fan says. "In the end, our dream is to design *with* the community rather than to design *for* the community."

(Reprinted and adapted from the Redford Center and the Humphrey School of Public Affairs.)

Drive MN tour collects data, engages stakeholders on CAV readiness

September 8, 2022

In August, CTS led Drive MN, a four-day, 1,000+ mile driving tour that brought connected and automated vehicles (CAVs) to communities across Minnesota.

A team of Drive MN partners—CTS, VSI Labs, Bolton & Menk, and project sponsor MnDOT—piloted two research CAVs to collect terabytes of data about the state's roadway infrastructure. This data will be used to assess readiness for CAVs on many types of roadways, and the results will be published in a full report later this year.

Drive MN included stops in eight cities across the state.

The team made stops in eight communities:

- St. Cloud
- Duluth
- Bemidji
- Moorhead
- Marshall
- Mankato
- Winona
- Minneapolis

At each stop, transportation professionals, policymakers, and community representatives gathered to learn about CAV technology, its potential to improve the quality of life for Minnesotans, and how to prepare the state's infrastructure for its widespread use. Attendees also heard real-time observations from the drive and got an up-close look at the two CAVs—CTS's MnCAV Ecosystem Chrysler Pacifica and a research vehicle from VSI Labs.

The effort concluded at an event outside McNamara Alumni Center on the University of Minnesota Twin Cities campus on August 18. CTS Executive Committee members, researchers, practitioners, and other interested attendees heard remarks from MnDOT Commissioner Nancy Daubenberger and learned some initial takeaways about the week's data collection from the Drive MN team.

"We are glad to celebrate this important CAV tour with our partners," said Kyle Shelton, CTS director. "The data collected during the drive is critical to making sure our evolving technology and infrastructure communicate effectively."

CAV campers embrace advances in automated transportation technology

September 14, 2022

A group of 18 high school students with a wide range of interests and backgrounds participated in the free, weeklong CAV Career Pathways Camp on the University of Minnesota Twin Cities campus in Minneapolis.

During the camp, students explored connected and automated (CAV) technology and discovered a cornucopia of career opportunities in an industry that is helping to shape the future of transportation. Campers had hands-on opportunities with automated vehicles, viewed CAV technology in development or in use at various metro locations, and spent time discussing technical details as well as broader policy issues with leading practitioners and U of M researchers.

“The networking opportunities here are incredible because they’re so much higher and so much stronger than the connections you could get from a robotics competition or a debate tournament,” says Aten-Wa Theba, a St. Paul Academy senior with designs on becoming a Formula One racing driver. “To sit in front of someone who works at the highest level [at] a company that performs at the highest level is absolutely my goal because I hope that I can perform at the highest level as well.”

The CAV campers were among the first to ride city streets in the newly launched Bear Tracks automated shuttle bus in White Bear Lake. Before they hopped on board, students learned about the technology behind the shuttle’s operation from project partners AECOM, Ramsey County, and Newtrax. Campers also had an opportunity to inspect the MnCAV Ecosystem level-2 automated research vehicle just a few days before its Drive MN tour around the state to collect data and meet with transportation stakeholders.

Throughout the week, the campers also:

- Learned about the broad possibilities of CAVs and related career opportunities in sessions from The PLUM Catalyst and Danfoss
- Watched CAV technology in action during a demo from Bay and Bay Transportation and a field trip to Tesla (St. Paul/Maplewood)
- Envisioned an automated world in a transportation planning exercise led by HDR Inc.
- Got a drone's-eye view of campus during a demo with Northland Community and Technical College
- Used RumiCar and TurtleBot robots to learn how CAVs are programmed in activities led by the U's Center for Distributed Robotics
- Toured Zeus Electric Chassis and learned about electric vehicle manufacturing
- Took a field trip to Experience STEAM at Mall of America

The CAV camp was the second hosted by CTS's MnCAV Ecosystem, a collaborative environment that advances CAV-related research, engagement, and workforce development. The camp was funded by the Federal Highway Administration through the Minnesota Department of Transportation (MnDOT), with additional financial contributions from SICK Inc., Sense Media Group, and Minnesota's Transportation Conference. Curriculum planning support was provided by HDR Inc., The PLUM Catalyst, MnDOT, and the Minnesota State Transportation Center of Excellence.

At high-risk rural intersections, smart warning systems may reduce dangerous right-angle crashes

September 27, 2022

Photo: MnDOT

Smart intersection-warning systems may help prevent the most severe crash types at rural intersections, according to a new study by U of M researchers.

Far too often, Minnesota's rural intersections are deadly for drivers: Crashes at rural two-way-stop intersections make up 65 percent of all the state's fatal crashes, even though most vehicle crashes happen in urban areas. To address this issue, traffic safety experts have been working on new ways to prevent deadly crashes.

At this type of intersection, a high-volume major road typically intersects with a lower-volume minor road; the major road is uncontrolled while the minor road is controlled by a stop sign. Intersection conflict-warning systems (ICWSs) are a safety measure aimed at reducing right-angle crashes at these intersections.

"Our goal was to analyze before-and-after data to see if the systems were having the intended effect," says Disi Tian, a current postdoc at the HumanFIRST Laboratory and former doctoral student in the Midwest Center for Occupational Health and Safety (MCOHS) in the School of Public Health. Others on the research team included Professors Susan Gerberich (Tian's PhD advisor), Hyun Kim (Tian's PhD co-advisor), and Darin Erickson at the School of Public Health and Nichole Morris, director of the U's HumanFIRST Laboratory.

What are Intersection Conflict Warning Systems?

- Deployed at high crash-risk locations at rural non-signalized intersections.
- Provide extra warning to drivers, typically on both the minor and major roads.
- A combination of signing, vehicle detection, and dynamic warning beacons warn drivers of entering or approaching traffic.
- In the case of malfunction or power outage, signage on the minor road is black (off) for safety.

Researchers examined 56 Minnesota intersections that had been treated with an ICWS to determine the impacts on crash reduction. They looked at the annual crash rates—per year, per intersection—before and after system activation, comparing the ICWS intersection group with control (non-ICWS) intersection groups. Data for three years before IWCS activation and up to five years after activation was included, ranging from 2010 to 2018.

Data analysis techniques were used to estimate the average, immediate, and continuing treatment effects of ICWSs. Crash outcomes were evaluated in five categories: total, all-injury, non-injury, right angle, and non-right-angle.

“Our results show that ICWS treatment was significantly associated with a decreasing trend for right-angle crash rates—in other words, it looks like ICWSs are doing what they’re supposed to do,” Tian says. “Other types of crashes, such as left-turn crashes that could happen when drivers misjudge the gap between them and oncoming traffic, also decreased with ICWS treatment.”

Although not statistically significant, the study also suggested a possible continuing effect of ICWS treatments for crash reductions, particularly among the more severe injury crashes.

The results provide important insight into potential causal associations between intersection safety countermeasures and crashes at these intersections. “Most importantly, we found ICWS may help prevent right-angle crashes—the most dangerous type,” Tian says. “One possible explanation may be due to the ICWSs’ effectiveness in reducing vehicle speeds on major approaches, as suggested by previous research. This effect could allow more reaction time for drivers on both major and minor roads to modify their approaches and avoid more direct and severe angle impacts during crossing or left turns.”

The research was supported, in part, by the Midwest Center for Occupational Health and Safety, Education and Research Center Pilot Project Research Fund (through the National

Institute for Occupational Safety and Health, Centers for Disease Control, and Department of Health and Human Services).

The findings were published in a paper—Evaluation of the efficacy of an intersection conflict warning system at two-way stop-controlled rural intersections: difference-in-differences and triple-difference analytical approaches—in *Injury Prevention,* 2022, 28: 204–210.

Writer: Megan Tsai

Public works staff discuss careers at youth summer camps

September 22, 2022

Campers at Discover STEM

Transportation agencies in Minnesota and elsewhere are facing a growing workforce shortage. Many local agencies in particular are understaffed, delaying some maintenance and construction projects. Building awareness of exciting career opportunities for students—and getting them in the education pipeline—is an important action to address this issue.

This summer, representatives of several transportation agencies and companies participated in two University of Minnesota youth summer camps: Eureka! and Discover STEM. The camps—two on campus, one virtual—were offered by the U's College of Science and Engineering.

The Minnesota Local Technical Assistance Program (LTAP), housed within CTS, coordinated the presenters' participation. Sessions focused on science, technology, engineering, and math (STEM) careers in public works.

Eureka! is a five-year summer and school-year program focused on STEM for girls entering grades 8 and 9. It builds sisterhood with girls from all over the Twin Cities, exploring their career interests and dreams while supporting them through high school graduation and preparing them for the next step in their post-secondary education.

Discover STEM is a summer program for students entering 11th or 12th grade. During the

interactive program, students network with peers while learning about research, academic programs, and potential careers through presentations, laboratory tours, and science and technology demonstrations.

Representatives this year were:

- Eureka!: Kristin Asher and Olivia Wycklendt, City of Richfield
- Discover STEM (virtual): John Rodeberg, SEH; April Crockett, MnDOT; Jennifer Selchow, Bolton & Menk
- Discover STEM (in person): Russ Mattys, City of Eagan; Jennifer Selchow, Bolton & Menk; Alan Offerman, Stantec; Brian Schreurs, Braun Intertec

CTS would like to partner with more local agencies on youth outreach efforts. If you are interested, please contact Katherine Stanley at sell0146@umn.edu or 612-626-1023.