

# CTS Catalyst

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Accelerating the pace of transportation innovation

## SELF-DRIVING VEHICLES

page 2

## CORRIDORS OF OPPORTUNITY

page 3

## FLASHING LED STOP SIGNS

page 4

## SHOCK WAVE WARNING SYSTEM

page 5

## AWARDS LUNCHEON

page 7



## Why do men and women travel differently? Study sheds light on gender differences

Despite their more similar roles at work and home than ever before, U.S. men and women continue to have different travel behavior. Historically, employed men have spent more time traveling to work and less time on household and family support trips than women. While this difference is well-documented, explanations for the difference vary widely: some theories say it's due to biologically driven differences in gender, while others attribute it to socially constructed gender roles or to gendered structural contexts such as labor market segregation and economic inequality.

*Gender differences continued on page 4*

## Research Partnership Award: Tools for counting bicyclists and pedestrians help guide investment

People love to walk and bike—for relaxation, for exercise, to get places like school, work, and stores. Biking and walking have increased significantly in the Twin Cities metro area during the past decade, and these activities are catching fire statewide.

U of M researchers have partnered with the Minnesota Department of Transportation, the Minnesota Department of Health, and several other state and local agencies to develop general guidance and consistent methods for counting all these bicyclists and pedestrians in Minnesota. Their work was honored with the 2014 CTS Research Partnership Award, which was presented at the

*Research partnership continued on page 6*



# Self-driving vehicles could spark big changes in roadways, travel, law

Self-driving vehicles will be on the road sooner than you think—and their presence could spark widespread and transformative changes. Two U of M researchers gave a glimpse of these changes in a session at Minnesota's Transportation Conference in March.

Companies from GM to Google are developing self-driving vehicle technology, said Adeel Lari, research fellow at the Humphrey School of Public Affairs. Much of the current discussion focuses on the systems' promise to eliminate driver error and avoid crashes, injuries, and fatalities. But there are many more implications, he said.

For example, hyperlinked self-driving vehicles would be able to follow each other closely on narrower lanes—enabling changes to long-standing roadway designs and increasing capacity. “Could it be,” Lari asked, “that we have too much infrastructure?”

Other impacts, however, could increase travel. The elderly, people with disabilities, and children would gain mobility, Lari explained, and commuters who could sleep or work en route might choose to live further away from their jobs.

State and local coffers could see some impacts. More people might forgo car ownership and join a shared fleet service, reducing vehicle tax and license revenues, Lari said. Revenues from speeding and parking tickets would also drop. (On the flip side, enforcement costs would fall as well.)

Industries also wouldn't be untouched. Smaller, alternative types of cars could become popular. The freight industry, needing to pay fewer drivers, could make more frequent shipments with lighter trucks (and do less damage to pavements). “And a taxi driver could be a thing of the past,” he said.

About a century ago, Lari noted, people doubted that Americans would switch from horses to cars; today, people question whether drivers will



*Google is one of many companies developing self-driving vehicles.*

cede control to autonomous vehicles. “But change happens,” he said, “and it’s going to come very, very fast.”

Frank Douma, associate director of the Humphrey School’s State and Local Policy Program, then looked deeper into the legal and privacy implications of self-driving vehicles. “Suppose something goes wrong,” he said. “How do you handle liability? Who is at fault—the driver or the vehicle?”

Current law is unclear, he said, but as vehicles assume more control, lawsuits are likely to shift from the driver to the manufacturer. Plaintiffs could also target vehicle owners for failing to maintain a vehicle adequately.

Given this shifting ground, Minnesota law may need attention. It explicitly defines the driver as having physical control and states that “any person driving a vehicle shall be liable.” As technology moves forward, Douma said, “the law needs to move with it.”

One way to help clarify liability is to use data from a vehicle’s black box, but this raises another issue: privacy.

States offer varying levels of privacy protection, Douma said, and the courts have been wrestling with the issue. Protections could include setting limits on the data collected and how they can be used.

“There are legal issues to deal with, but the law will not be the obstacle that keeps self-driving vehicles off the road,” he concluded.

The conference, held March 4–6 in Bloomington, attracted more than 1,400 people. CTS managed the planning and delivery of the conference and was also a sponsor. A complete list of sponsors can be found on the conference website at [mntransportationconference.org](http://mntransportationconference.org).

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ONLINE**

for links to research reports and other resources.

# Transit initiative expected to have positive long-term impacts

In 2011, an ambitious three-year transit initiative—Corridors of Opportunity (CoO)—was launched in the Twin Cities region. Backed by major grants of more than \$7 million and an additional \$13 million in loans, CoO aimed to build support for a world-class transit system in the Minneapolis–St. Paul region and to promote development along the emerging transitway system to advance economic prosperity and benefit people of all incomes and backgrounds.

With the initiative now completed, a new report prepared by Wilder Research aims to identify the impacts of this significant investment in regional transit. The report first summarizes the outcomes realized through the initiative's projects. Examples include:

- Funding of transit-oriented development (TOD) projects to demonstrate the potential of TOD. The projects will result in more than 1,000 units of housing (75 percent affordable) and substantial commercial space in mixed-use developments.
- Technical assistance to 353 diverse and locally owned small businesses during the stresses of light-rail construction, with the result that only 1 percent closed during the period of heavy construction.
- Piloting of a model for serving long-term unemployed residents of the Central Corridor. More than 600 residents were connected to workforce services in the one-year pilot.
- Increased engagement of historically underrepresented community residents in transit planning through grants to 19 organizations that helped more than 15,000 residents gain skills or confidence to express their views to policymakers.

The report then describes some of the changes to the transit planning process that occurred during the initiative, including increased cross-jurisdiction and cross-sector planning for community engagement around transit planning and greater emphasis on creating outcomes that benefit low-

## Corridors of Opportunity partners note progress at workshop

Representatives from government agencies, community organizations, and advocacy groups gathered at the University of Minnesota on January 29 to celebrate the progress made through the Corridors of Opportunity effort and to share lessons learned. Now called the Partnership for Regional Opportunity, the collaboration will continue for at least another year and focus on transit-oriented development, regional competitiveness, transportation funding, and equity and community engagement.

CTS coordinated the workshop and created the proceedings. For details, see [CorridorsofOpportunity.org](http://CorridorsofOpportunity.org).

income and other historically underrepresented communities. It also assesses the potential for these outcomes to occur over the longer term.

Importantly, the research team found that several of these system changes are likely to endure beyond the end of the project and create a “new normal” in which collaboration is the preferred approach to transit and transit-oriented development. “Through surveys and interviews, we found that the vast majority of the initiative’s stakeholders feel it has significantly influenced their organization’s practices, culture, policies, and the way they partner with other organizations,” says Ellen Shelton of Wilder Research, author of the report.

Another system change that has taken root is the shared vision of equity as a key goal of transit planning and development—on par with economic competitiveness. “The shift in perception surrounding the importance of equity is huge,” Shelton says. “Over the course of this project, we built consensus that it is both possible and desirable to take action to address equity issues through transit.”

“This region has one of the best economies in the country, with many strengths,” says Susan Haigh, chair of the Metropolitan Council and co-chair of the policy board for Corridors of Opportunity. “However, prosperity that is widely shared does not just happen—it must be intentionally acted on. This evaluation report provides important insight as we continue our work to reduce racial disparities and engage communities of color in planning transportation investments.”

Wilder Research prepared the report with assistance from the Metropolitan Council Community Development Division, CTS, and HousingLink. The report will be available on the Corridors of Opportunity website: [CorridorsofOpportunity.org](http://CorridorsofOpportunity.org).



Photo courtesy Metropolitan Council

The initiative increased engagement of historically underrepresented community residents.

# Flashing LED stop signs can reduce dangerous right-angle crashes

When it comes to crashes, right-angle collisions are among the most dangerous for vehicle occupants. Because these crashes often occur at stop-controlled intersections when drivers fail to stop, traffic engineers are increasingly installing flashing LED stop signs—normal octagonal stop signs with flashing lights mounted on the corners—in an attempt to improve safety at these intersections.



However, little research has been done to determine if these flashing LED stop signs have a positive impact on safety.

A study by researchers from the U's civil engineering department and Minnesota Traffic Observatory aims to give traffic engineers a clearer picture of the safety benefits of flashing LED stop signs. As part of the study, the research team conducted a two-pronged investigation of the signs' safety effects: a statistical study to estimate crash reduction and a field study looking at drivers' behavior changes after the installation of a flashing LED stop sign.

For the statistical study, the team compared the frequency of crashes after the installation of flashing LED stop signs at 15 intersections with a prediction of what the crash frequency would have been without the signs. Findings estimate that the installations reduced right-angle crashes by about 42 percent.

For the field study, researchers collected video data before and after the installation of a flashing LED stop sign in Chisago County, Minnesota. They then analyzed the video to determine driver stopping behavior and vehicle deceleration rates.

"This portion of the study produced a very interesting finding," says Professor Gary Davis, principal investigator on the project. "After the installation of the flashing stop signs, there was no change in the proportion of clear stops to clear non-stops when drivers didn't encounter opposing traffic. However, when opposing traffic was present, the proportion of clear stops increased after installation of the sign."

Finally, the team used the study findings to create a decision-support tool that can help traffic engineers decide where to place flashing LED stop signs. The tool can be used to determine whether right-angle crashes are a problem at a selected intersection and to predict the crash reduction expected from installing the flashing sign.

"The results from this decision-support tool can give traffic engineers a better idea of the benefits of a flashing LED stop sign at a given location," Davis says. "This will allow them to make better use of limited resources and maximize the safety benefits of these signs."

Study sponsors were the Minnesota Department of Transportation, the Minnesota Local Road Research Board, and the U's Intelligent Transportation Systems Institute.

## Gender differences from page 1

While much research has examined these theories, few studies have tested their validity based on evidence—which prompted U of M researchers to examine the theories more deeply. "We believe a greater understanding of the underlying reasons for these enduring travel differences is necessary to effectively address the gender equity issue in transportation policy," says Yingling Fan, assistant professor in the U's Humphrey School of Public Affairs.

Researchers set out to test the competing theories by analyzing publicly available data from the American Time Use Survey (ATUS) in various ways across groups of workers with different types of family structures. (ATUS is an ongoing time diary study funded by the U.S. Bureau of Labor Statistics.)

First, they tested the theory that travel behavior differences were based on biologically driven gender differences. "If this theory was true, travel differences between men and women could be applied across all population groups regardless of

family structure, but this was not the case," Fan explains. "We found that single female workers and single male workers exhibit no significant difference in travel behavior."

Next, the team studied the impact of gendered structural contexts, such as women's greater presence in pink-collar occupations and significantly lower earnings. The team found moderate support for this theory. "These factors are associated with shorter work travel time among some—but not all—family structures," Fan says.

Researchers did find strong support, however, for the theory that socially constructed gender roles explain travel behavior differences. "We discovered that while marriage alone doesn't differentiate travel behavior between men and women, parenthood does have a significant impact," Fan says. "Interestingly, we found that even being the sole breadwinner does not insulate mothers from socially constructed gender roles—female breadwinners in married single-worker households with children have shorter work

# Warning system could protect drivers from traffic 'shock waves'

Two years ago, the Minnesota Department of Transportation (MnDOT) installed electronic message boards on parts of Interstates 35W and 94 to help warn drivers of crashes and to recommend speed levels during periods of high congestion.

Now, researchers at the Minnesota Traffic Observatory (MTO) are using these message boards as part of an automated warning system that will identify suddenly stopping or slowing traffic. When the system detects these problematic traffic patterns, it will issue automatic advisories to drivers. The goal is to help prevent the crashes that occur when drivers can't react quickly enough to these changes.

As they develop the system, researchers will consider traffic patterns in two locations: a portion of I-94 in downtown Minneapolis and the I-35W/Highway 62 interchange.

The section of I-94, where southbound I-35W and westbound I-94 converge in downtown Minneapolis, may have the highest crash rate in the state.



During rush hour, vehicles constantly slow down and speed up, causing a ripple effect called "shock waves."

"There's a crash every two days," says MTO director John Hourdos, whose students watched more than a year's worth of video footage to document every crash and near crash. "They're not

severe crashes—no one has died for as long as I can remember, and most happen at slow speeds—but they cause a lot of delays for the traveling public."

In 2002, the MTO deployed cameras and sensors on three downtown rooftops to observe traffic patterns on this portion of I-94. The equipment provides seamless coverage of the entire area, allowing researchers to watch vehicles from the moment they enter and exit the area. As part of a research project funded by the Intelligent Transportation Systems Institute, the researchers used data gathered from the cameras and sensors to develop an algorithm that detects shock wave patterns at this location.

Now, the team will use this algorithm to help develop the warning system, which will use the newly installed electronic message boards to warn drivers when conditions for shock waves are greatest.

The second problem area that researchers will target as they develop the warning system is I-35W southbound at the newly reconstructed Crosstown interchange. Although

*Warning system continued on page 6*

commutes and more household support travel than male breadwinners in the same family structure."

According to the researchers, these findings have important implications. First, policies to minimize auto travel (for environmental purposes, for example) may be unfair to women who wish to reach more job possibilities through longer commutes. In addition, the findings highlight the importance of incorporating parenthood as a prime variable in understanding the gender and mobility connection.

Finally, this research provides insights on how future growth or decline in specific family structures may shape travel demand. "As childless households continue to grow in relation to households with children, it's possible that fewer female workers will be confined by short work commutes and may choose to spend more time commuting to more desirable jobs, placing new demands on the transportation system," Fan says.

The research was funded in part by a Minnesota Population Center Program Development Grant.



### Research partnership from page 1

CTS Annual Meeting and Awards Luncheon (see related article on page 7). The award recognizes research teams that have drawn on the strengths of their diverse partnerships to achieve significant impacts on transportation.

The research team developed tools and methods to count and analyze bike and pedestrian traffic using a mix of manual and automated methods. “The idea here is that by establishing networks of permanent counters, in conjunction with short-duration samples, we can completely characterize the traffic network,” explains Professor Greg Lindsey of the Humphrey School of Public Affairs. “That’s our goal. We have it for vehicles. We don’t have it for bikes and pedestrians.”

Results from the counting initiative are allowing policymakers and planners to make data-driven decisions about transportation investments. “It really comes down to having more information about safety, where to make investments, the economic benefits, and the health impacts of bicycling and walking,” says Lisa Austin, MnDOT bicycle/pedestrian planning coordinator.

Work is continuing under the initiative. A MnDOT project, which will conclude in 2015, uses automated technologies for counting bicycles and pedestrians on trails, bike lanes, sidewalks, and shoulders in various urban and rural locations in Minnesota.

MnDOT also is considering how to incorporate such nonmotorized traffic data into its existing traffic database. The researchers recommended that MnDOT coordinate statewide counts and work with local agencies to establish a network of automated monitoring sites across the state.



The research team installed equipment (inset) in various locations.

Minneapolis maintains about

**80**  
**MILES**

of trails that tally

**28**  
**MILLION**

miles of use per year.

Such data already are used in cities like Minneapolis and Duluth for planning bike and pedestrian facilities. In Minneapolis, where biking has increased about 70 percent in recent years, counting is now a routine operation for the public works department.

“Having those numbers to show that the investments are justified, are being used, is really valuable for talking to council members, the mayor’s office, and other decision makers,” says Simon Blenski, bicycle planner with the City of Minneapolis.

In addition to supporting state goals, this research also is contributing to federal traffic monitoring standards.

More about the Research Partnership Award—including project team members and a short video, as well as information about two other projects that received special recognition—is at [cts.umn.edu](http://cts.umn.edu).

### Warning system from page 5

two lanes of traffic are provided for eastbound Highway 62 at the I-35W/ Highway 62 split, these vehicles must later converge into one lane because of the Portland Avenue exit. This causes traffic congestion on the Highway 62 ramp that stretches back to I-35W during rush hour.

Hourdos says developing an algorithm

to detect these queues is a different problem than what goes on with I-94, since there is a constant stoppage of cars and no rolling shockwaves.

“These two locations are good representatives of different manifestations of the same problem,” Hourdos says. “The methodologies for approaching each location will be

different, but by combining them we will form a more robust warning system that can work in most situations.”

The research team may also target other specific problem areas if MnDOT installs additional electronic message boards elsewhere in the Twin Cities.

*(Adapted from an article published on the joint MnDOT/CTS Crossroads blog.)*

# Leaders honored at CTS Awards Luncheon

CTS presented the following awards at its Annual Meeting and Awards Ceremony on April 23 in Minneapolis. Further information is at [cts.umn.edu/Awards](http://cts.umn.edu/Awards).

## **Richard P. Braun Distinguished Service Award**

*(outstanding leadership in research and innovation)*

**Yingling Fan**, McKnight Land-Grant Assistant Professor, Humphrey School of Public Affairs; principal investigator for several Transitway Impacts Research Program projects



Yingling Fan

## **Ray L. Lappegaard Distinguished Service Award**

*(outstanding leadership, mentorship, and support for the profession)*

**Howard Preston**, senior transportation engineer, CH2M Hill Inc.; project manager for the preparation of highway safety plans for all 87 counties in Minnesota



Howard Preston

## **William K. Smith Distinguished Service Award**

*(leadership, mentorship, and education of future leaders in private-sector freight transportation)*

**Chip Smith**, chief operating officer, Bay and Bay Transportation; long-time member of the Minnesota Freight Advisory Committee



Chip Smith

## **Distinguished Public Leadership Award**

*(public leaders who have influenced innovative transportation policy directions)*

**Susan Haigh**, chair, Metropolitan Council; former Ramsey County commissioner and early advocate of the Central Corridor LRT line



Susan Haigh

## **Education Awards**

**Matthew J. Huber Award** *(engineering, science, and technology fields)*

**Andrew Kotz**, doctoral candidate, mechanical engineering; advisor: William Northrup

**Jianfeng Zheng**, master's candidate, civil engineering; advisor: Henry Liu

**John S. Adams Award** *(policy and planning fields)*

**Chen Zhang**, master's candidate, science, technology, and environment policy, Humphrey School of Public Affairs; advisor: Jason Cao



Hybrid bus technology is one of the topics in the research highlights video.

## Videos debut at annual meeting

CTS aired these videos at the meeting:

- **2014 CTS Research Highlights.** Featured projects range from the launch of the Accessibility Observatory to research into hybrid bus technology, transitway corridors, and a work-zone warning system.
- **Where Are They Now? University of Minnesota Transportation Graduates.** Four recent graduates from the University of Minnesota discuss how their transportation-related classes and activities helped them find their current positions and advance their careers.
- **Minnesota: Where Every Step Counts.** An overview of the 2014 Research Partnership Award recipient (see article on page 1).

The videos are available for viewing at [cts.umn.edu/About](http://cts.umn.edu/About).

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# Catalyst

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Tools for counting

## BICYCLISTS AND PEDESTRIANS HELP GUIDE INVESTMENT.

page 1

## SELF-DRIVING VEHICLES

spark transformative change.  
page 2

## FLASHING LED STOP SIGNS

reduce right-angle crashes.  
page 4



## Why do men and women have different travel behavior?

page 1