University of Minnesota

CENTER FOR TRANSPORTATION STUDIES

APRIL 2017

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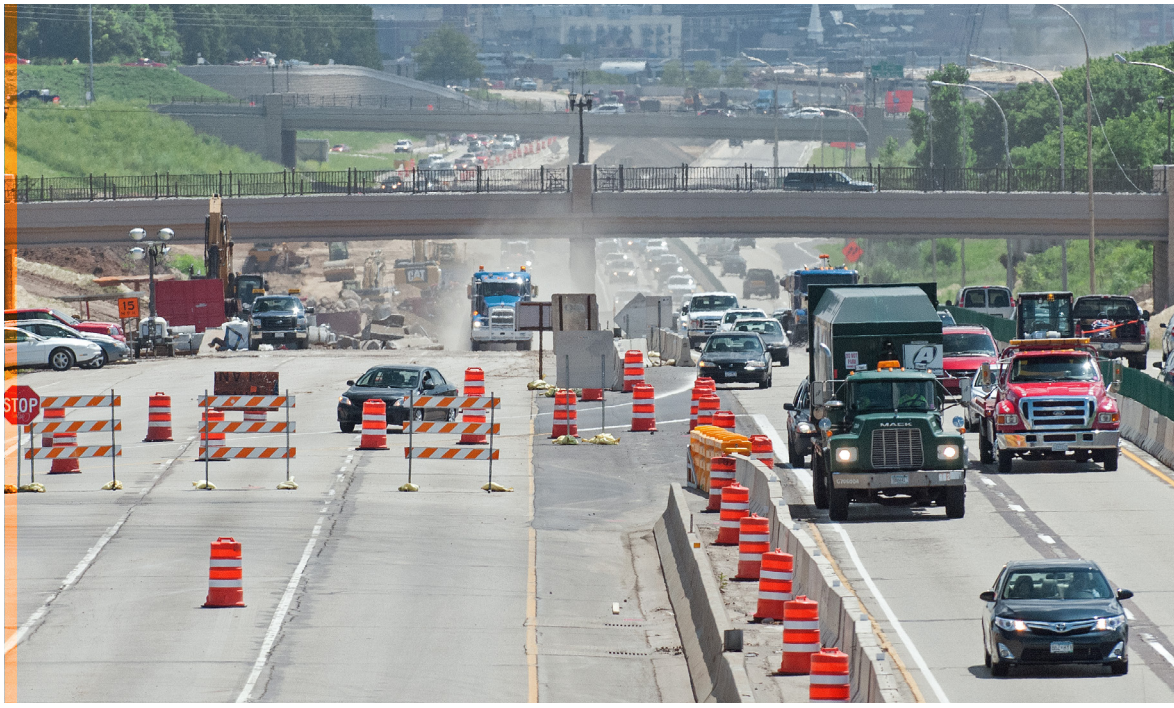
Accelerating the pace of transportation innovation



Work-zone warnings could soon be delivered to your smartphone

Imagine that you're driving to work as usual when your smartphone announces, "Caution, you are approaching an active work zone." You slow down and soon spot orange barrels and highway workers on the road shoulder. Thanks to a new app being developed by University of Minnesota researchers, this scenario is on its way to becoming reality.

"Drivers often rely on signs along the roadway to be cautious and slow down as they approach

Work zone continued on page 7

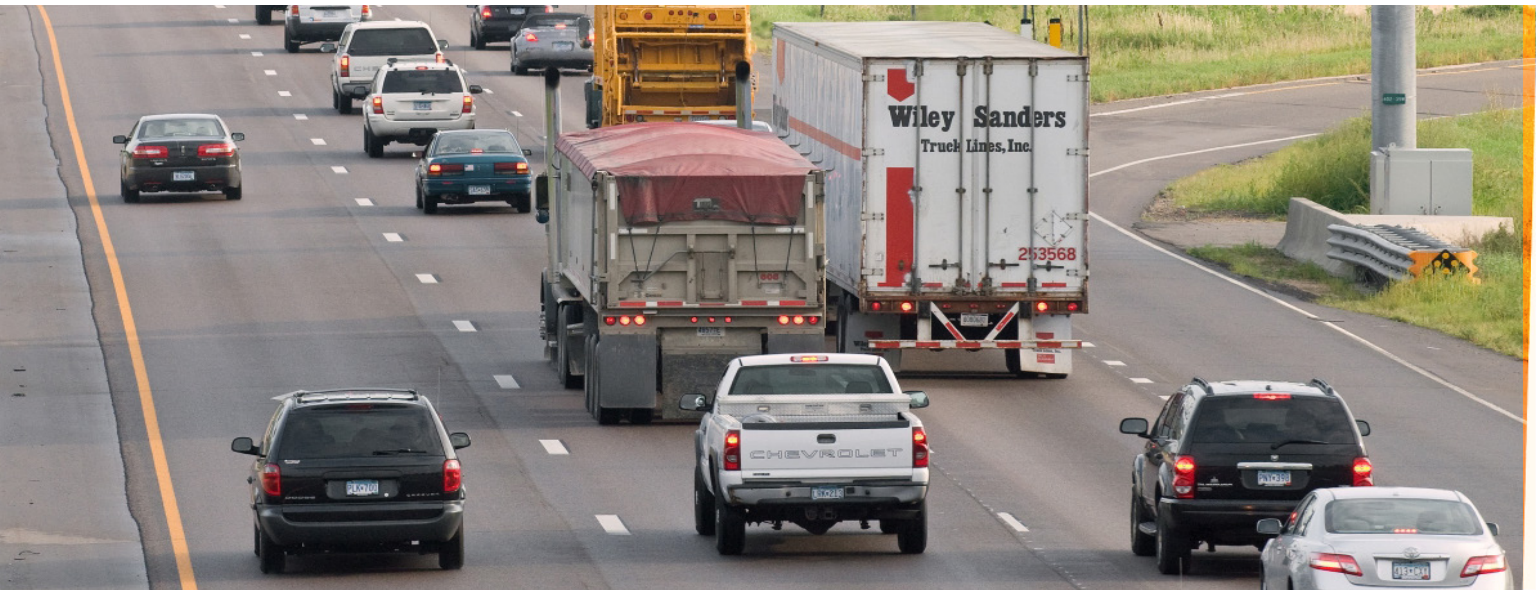
Volunteer driver programs at risk from changing demographics, ridesharing services

Volunteer drivers are a key component of human services transportation in Minnesota. They provide low-cost transportation for trips ranging from non-emergency medical appointments to general errands. Most of the organizations that use volunteer drivers are located in small towns or rural areas where dedicated transit services do not exist. But changing demographics and the rise of ridesharing services such as Uber and Lyft could put many volunteer driving programs at risk, according to a new U of M study.

"The programs evolved and worked well to meet the transportation needs of the World War II

Volunteer continued on page 6

U of M researchers join new Freight Mobility Research Institute



University of Minnesota researchers at the Minnesota Traffic Observatory (MTO) will work to improve the mobility of people and goods across the nation as part of the new Freight Mobility Research Institute, a Tier 1 University Transportation Center funded in 2016.

Led by Florida Atlantic University (FAU), the Institute will receive $1.4 million per year from the United States Department of Transportation for five years. A combined match from state and private-sector sources will bring the award to more than $10 million in total. In addition to FAU and the U of M, Institute members include the University of Florida, Portland State University, Hampton University, the University of Memphis, and Texas A&M University (College Station).

With the primary goal of strengthening U.S. economic competitiveness, the Institute will address critical issues affecting the planning, design, operation, and safety of the nation's intermodal freight transportation system. Initial work will focus on improving freight mobility through information technology, freight network modeling and operations, intermodal logistics, and freight and supply chain sustainability.

"Efficient and safe freight movement is inextricably linked to the economic vitality of a local area, state, region, and even beyond," said FAU's Evangelos I. Kaisar, Institute director. "We are motivated to embrace innovative research projects, to train current and future transportation leaders and workforce, and to engage with industry to enhance collaboration between agencies."

U of M researchers John Hourdos, MTO director, and Chen-Fu Liao, senior systems engineer, will lend their expertise in freight demand forecasting, freight operations, modeling and simulation, intelligent transportation systems, and sustainability and planning to the Institute. Hourdos will also serve as the Institute's assistant director for research. In this role, he will be responsible for the Institute's overall research activities and serve on the executive committee.

Hourdos and Liao will join other experts from the Institute's partner universities in efforts to promote smart cities, improve multimodal connections, improve system integration and security, conduct data modeling, and develop analytical tools to optimize freight movements that improve efficiency.

Several of the Institute's proposed research activities draw on the expertise of MTO researchers and on projects previously conducted at the U of M. These activities include investigating freight signal priority for intermodal facilities in urban areas, identifying potential causes of truck bottlenecks, and developing a multimodal/intermodal freight transportation performance metric.

Celebrating 30 YEARS

U of M researchers have been participating in the University Transportation Center program since 1991, when the Intelligent Transportation Systems (ITS) Institute was established at the U.

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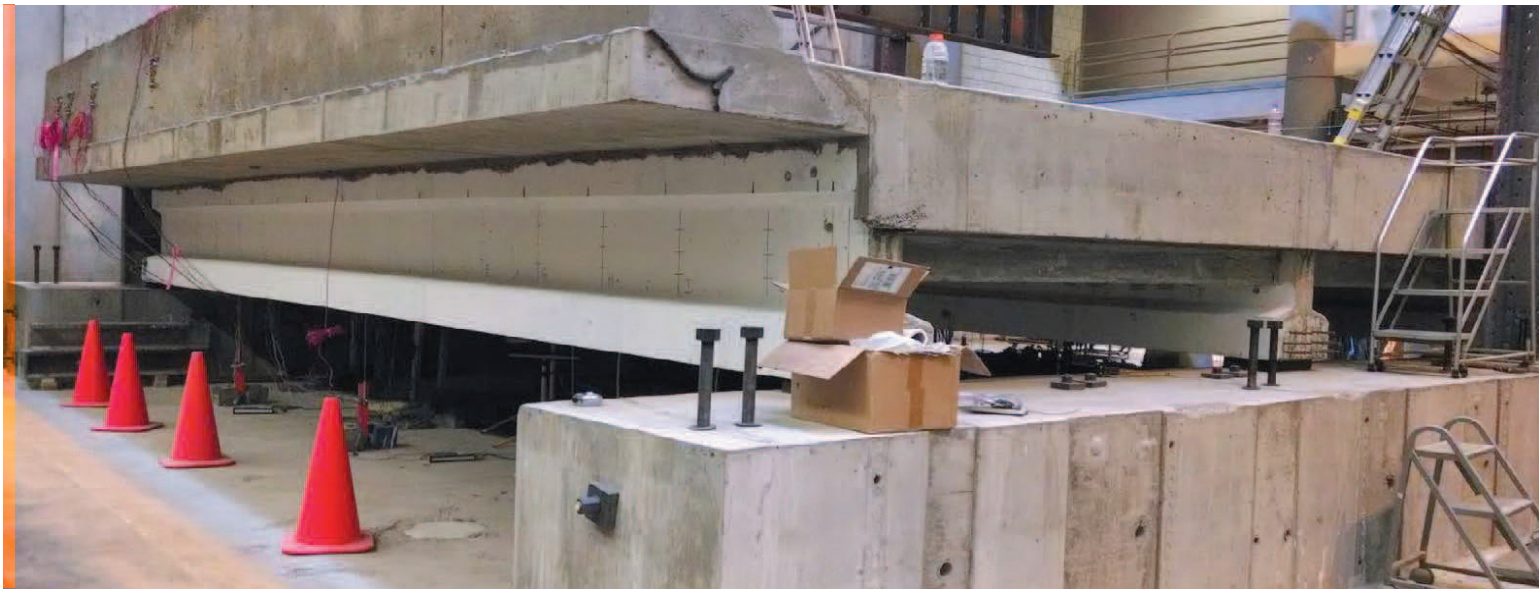
Research helps gauge safety of heavy vehicles on older concrete bridges



A full-scale single-span bridge with four prestressed concrete girders was constructed in the lab and tested to investigate shear distribution.

Bridges built using prestressed concrete girders are among the most common in Minnesota and throughout the U.S. because of their good performance, lower initial material costs, and relatively low ongoing maintenance costs. However, the federal requirements for these bridges have changed considerably over the years. As a result, bridges built to older specifications may score poorly when subjected to new bridge rating standards even though they are actually in good condition.

"One area in which this discrepancy between ratings and reality can cause problems is determining safe legal load limits for bridges, which are used to decide whether larger trucks may cross the bridge with an overload permit," says Catherine French, CSE Distinguished Professor in the Department of Civil, Environmental, and Geo- Engineering and the study's principal investigator. "Our goal was to evaluate whether the current guidelines regarding shear forces (which transfer the loads to the supports) may be overly conservative for these older concrete bridges that are in good condition."

Sponsored by the Minnesota Department of Transportation, the study was conducted by a team of researchers including CSE Distinguished Professor Carol Shield (co-investigator) and UMD assistant professor Benjamin Dymond.

Researchers used a multipronged approach consisting of numerical modeling and tests in both the laboratory and the field. The numerical modeling was used to apply the results of the laboratory and field tests to a study examining the effects of key parameters on the distribution of shear in a bridge system. Parameters included span length, girder spacing and depth, deck thickness, and load position.

Results showed that the shear forces for some bridges are not as high as those predicted by distribution factors in the current specifications—at least partially explaining why some MnDOT bridges with low shear ratings show no signs of distress, French says. The researchers provided recommendations for more refined methods of evaluating prestressed concrete girder bridges that rate low for shear and developed a screening tool to identify which bridges that rate low for shear should be further analyzed.

"The results of this project will help us re-evaluate aging bridges in our inventory, to distinguish those that really do have shear problems from those that don't, and make decisions about whether they need to be replaced or rehabilitated for extra capacity," says Yihong Gao, bridge designer with MnDOT's Office of Bridges and Structures.

MnDOT owns

1,556

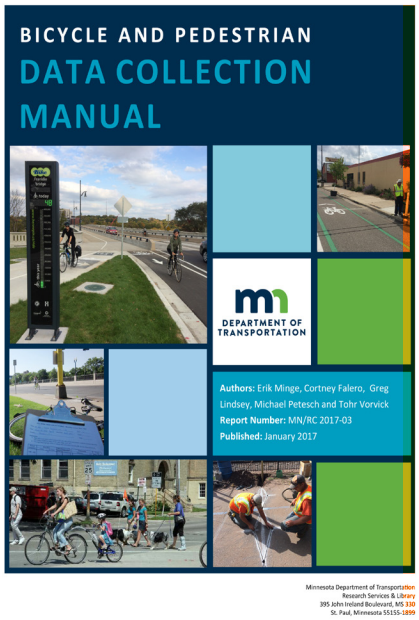
structures

WITH PRESTRESSED CONCRETE GIRDERS.

U of M research related to prestressed concrete girders has informed MnDOT bridge standards and practices over several decades.

Celebrating 30 YEARS

New manual helps agencies count bike, pedestrian traffic



As part of an ongoing effort to institutionalize bicycle and pedestrian counting in Minnesota, the Minnesota Department of Transportation (MnDOT) has published a new manual designed to help city, county, state, and other transportation practitioners in their counting efforts.

The *Bicycle and Pedestrian Data Collection Manual*, developed by University of Minnesota researchers and SRF Consulting Group, provides guidance and methods for collecting bicycle and pedestrian traffic data in Minnesota. The manual is an introductory guide to nonmotorized traffic monitoring designed to help local jurisdictions, nonprofit organizations, and consultants design their own programs.

Topics covered in the manual include general traffic-monitoring principles, bicycle and pedestrian data collection sensors, how to perform counts using several types of technologies, data management and analysis, and next steps for nonmotorized traffic monitoring in Minnesota. Several case studies illustrate how bicycle and pedestrian traffic data can be used to support transportation planning and engineering.

The manual was completed as part of the third in a series of MnDOT-funded projects related to the Minnesota Bicycle and Pedestrian Counting Initiative, a collaborative effort launched by MnDOT in 2011 to encourage nonmotorized traffic monitoring across the state. U of M researchers, led by professor Greg Lindsey at the Humphrey School of Public Affairs, have been key partners in the initiative since its inception.

In addition to the manual, U of M researchers have published a final report outlining their work with MnDOT on this project. Key accomplishments include:

- A new statewide bicycle and pedestrian traffic-monitoring network with 25 permanent monitoring locations
- A district-based portable counting equipment loan program to support MnDOT districts and local jurisdictions interested in nonmotorized traffic monitoring
- Minnesota's first *Bicycle and Pedestrian Annual Traffic Monitoring Report*
- A MnDOT website for reporting annual and short-duration counts that allows local planners and engineers to download data for analysis
- Provisions added to MnDOT equipment vendor agreements that enable local governments to purchase bicycle and monitoring equipment
- Annual training programs for bicycle and pedestrian monitoring
- Provisions in the *Statewide Bicycle System Plan* and *Minnesota Walks* that call for bicycle and pedestrian traffic monitoring and creation of performance measures based on counts

"This is an excellent resource that steps through all aspects of managing a count program, and I think it will be very helpful to other states and organizations that want to implement their own programs," says Lisa Austin, MnDOT bicycle and pedestrian planning coordinator. "Since Minnesota is a leader in counting bicycle and pedestrian traffic, it also fulfills what I think is an obligation to share our story with others."

The data collection manual and the project final report are available on the CTS website.

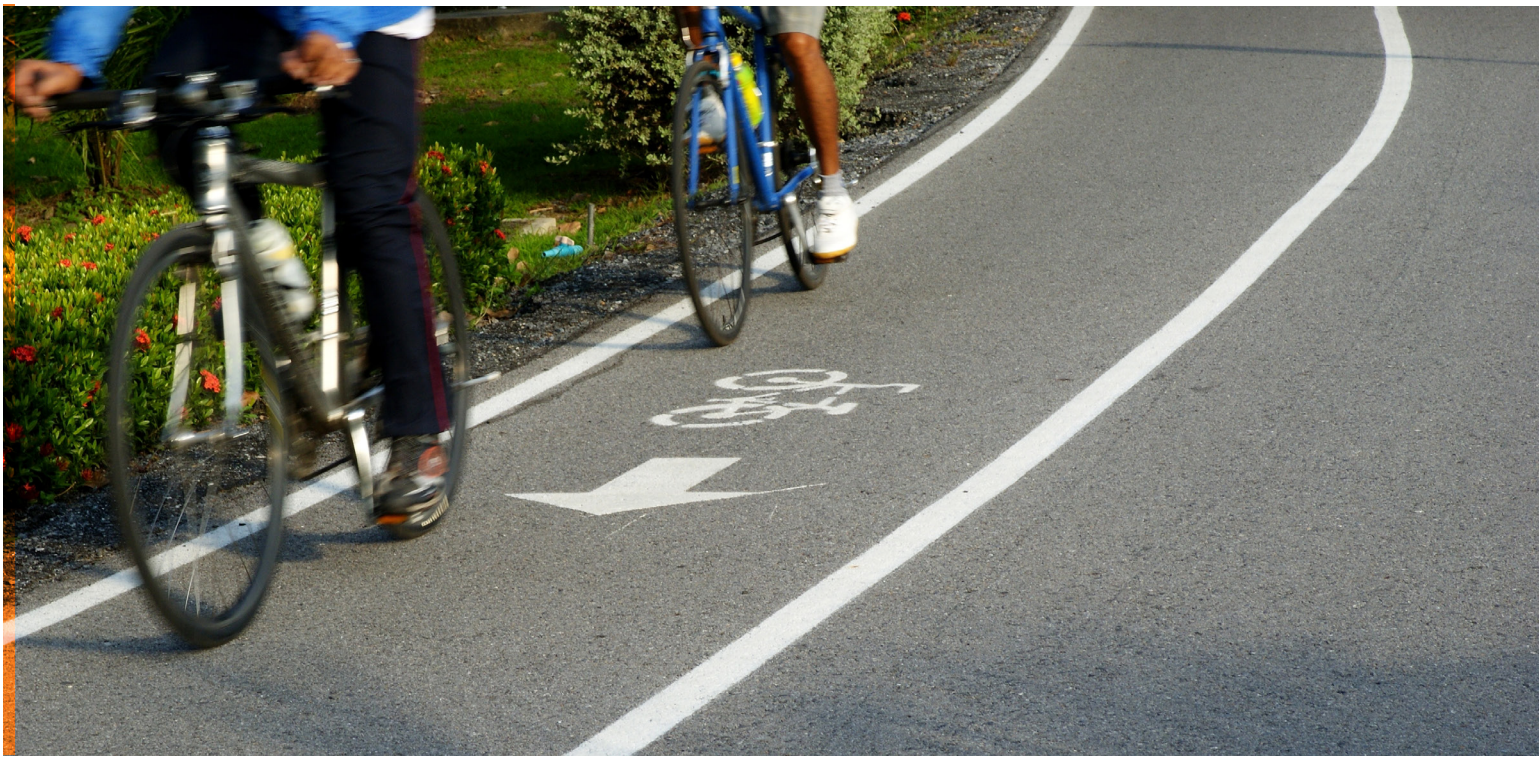
CTS Spring Luncheon: Moving to Access—Is the Current Transport Model Broken?

For several generations, urban transportation policymakers and practitioners around the world favored a "mobility" approach, aimed at moving people and vehicles as fast as possible by reducing congestion. The limits of such an approach, however, have become more apparent over time, as residents struggle to reach workplaces, schools, hospitals, shopping, and numerous other destinations in an equitable and sustainable manner.

Researchers have been able to define this challenge more precisely and elevate the importance of "accessibility" over the past few decades, but the adoption of new policies, tools, and investments by practitioners remains slow and uneven across most regions. At the CTS Spring Luncheon, Adie Tomer, a fellow at the Brookings Institution's Metropolitan Policy Program, will provide an overview of the Moving to Access Initiative. His presentation will highlight challenges from the current mobility model, impediments to adopting an accessibility-focused approach, and where metro areas can go from here.

The event is scheduled for May 11 in Minneapolis. Register to attend at **cts.umn.edu/events/luncheons**.

Report estimates magnitude of bicycling in Minnesota



How often do Minnesotans ride bicycles? How far do they ride? A report from University of Minnesota researchers provides some estimates.

The research, funded by the Minnesota Department of Transportation (MnDOT), is part of a larger study that provides a comprehensive understanding of the economic impact and health effects of bicycling in Minnesota. This part of the project systematically estimated the use of trails, roads, and other bicycling infrastructure.

Led by Professor Greg Lindsey of the Humphrey School of Public Affairs, researchers reviewed multiple sources of information, including results of the MnDOT pilot field counts of bicycles undertaken in 2012 as part of the Minnesota Bicycle and Pedestrian Counting Initiative (see related article on page 4).

They then estimated the number of bicycle trips and bicycle-miles traveled annually using two different methods. One method extrapolated results from the 2010 American Community Survey (ACS) and the Metropolitan Council's regional Travel Behavior Inventory (TBI; 2010–2012); the other extrapolated results from the 2013 MnDOT Omnibus Survey.

Using the first method, the researchers estimate that the number of bicycle trips in Minnesota is between 87 and 96 million annually. Using the second method, the total estimated number of trips for the year is 75 million.

"Both of these estimates are conservative because bicycle trips on weekends for recreation are likely to be underestimated," Lindsey says. The ACS measures only commuting trips; the TBI measures all trips but is not administered on weekends. "The fact that two different methods using different sources of data produce estimates of the same order of magnitude indicates the estimates are reasonable," he explains.

In terms of bicycle-miles traveled, Minnesotans traveled between 139 and 197 million miles annually by bicycle. "This number, too, is an underestimate, because it did not include all trips, and the mileage estimates used to calculate miles per trip were median rather than mean (i.e., average) values," Lindsey says.

The analysis also found that the Twin Cities metropolitan area (TCMA) accounts for 69 percent to 72 percent of the total number of trips and miles traveled in the state. At the same time, some counties in Greater Minnesota (e.g., Olmsted County, St. Louis County) have comparable numbers of annual bicycle trips as some of the counties in the TCMA.

"The findings are evidence that Minnesotans in every county in the state take tens of thousands of trips by bicycle each year," Lindsey says.

The procedures used to develop these estimates are relatively straightforward and could be replicated periodically by MnDOT or other agencies as new results from the ACS or the MnDOT Omnibus survey become available, he adds, helping policymakers identify demand and support for bicycle facilities throughout the state.

READ CATALYST ONLINE

for links to research reports and other resources.

Volunteer from page 1

generation," says Frank Douma, director of the State and Local Policy Program at the Humphrey School of Public Affairs. "More numerous members of the baby boom generation, who were looking for ways to productively spend their time in retirement, often provided these services. But as time passes and the baby boomers themselves need transportation services, there are fewer members of Generation X to meet this increasing need."

At the same time, ridesharing programs emerged in the marketplace. Rideshare drivers expect to earn income, and their organizations face higher insurance requirements than volunteer programs do to cover the higher risk from offering more trips by a wider variety of drivers.

Given these two trends, volunteer driver programs face significant hurdles, Douma says. To counteract these challenges, the Minnesota Council on Transportation Access (MCOTA) commissioned a study of volunteer driver programs in Minnesota. The objectives were to learn which organizations use volunteer drivers, how they organize and fund their volunteer driver programs, and what challenges and barriers they face.

"MCOTA also requested recommendations regarding which of the identified barriers would be most productively addressed, and what methods would help providers address these barriers," says Noel Shughart, planning coordinator at the Minnesota Department of Transportation's Office of Transit and lead staff person for MCOTA.

Douma's team surveyed providers and reviewed current laws and regulations, including insurance. The research revealed the following findings:

- The flexibility and lower cost of using volunteer drivers creates a valuable and useful service that could not be replicated, except at higher rates, if at all, which could create significant hardships for providers to meet their core mission.
- Demographic and regulatory changes are combining to threaten the continued viability of these services.
- While the demographic issues are not easily addressed, it appears the regulatory issues, especially related to insurance, could be improved to promote rather than discourage volunteers from driving.

Specifically, Douma recommends changes to Minnesota laws and regulations to better distinguish volunteer drivers from ridesharing subcontractors and employees. "For example, state statute could specify a particular IRS mileage reimbursement rate as the ceiling for volunteer drivers, and anyone receiving a per-mile rate above this would be regulated as rideshare." Statute could also exempt certain trip types, such as medical trips, from higher insurance requirements, or specify that some trip types be offered only to volunteer drivers at lower reimbursement rates before being offered to ridesharing providers.

Another recommendation is to further enhance the attractiveness of being a volunteer driver by allowing them to claim "no-load" miles—those made before picking up clients and after dropping them off. "This provides volunteer drivers with some compensation for their entire trip," Douma says.

The report is online at **coordinatemntransit.org**.

68%
of survey respondents
indicated that they
do not have enough
VOLUNTEER DRIVERS
to meet demand.

The ability for citizens to earn income through ridesharing services such as Lyft may reduce their interest in becoming a volunteer driver.

Work zone from page 1

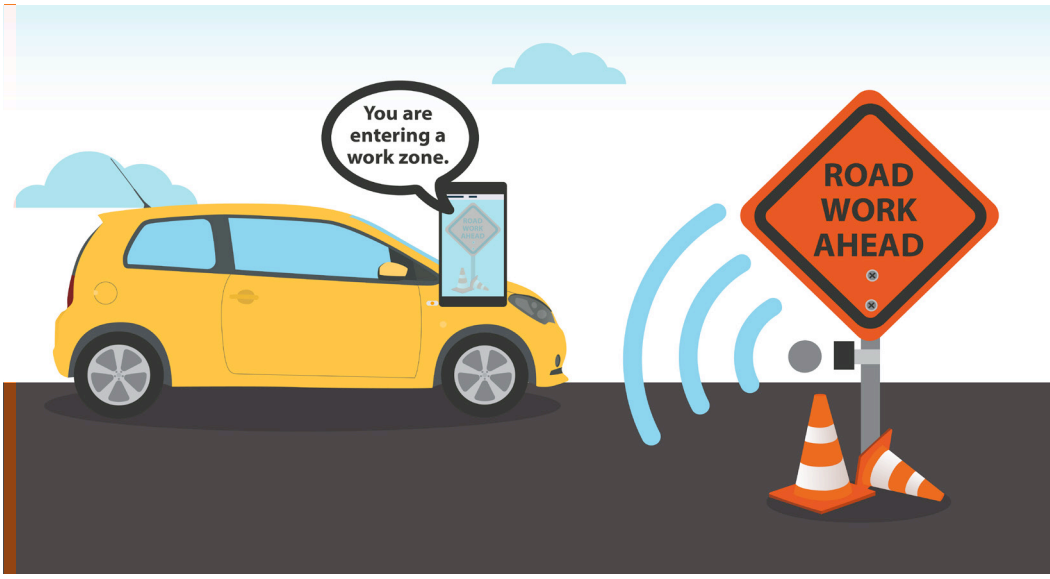
a work zone. However, most work-zone crashes are caused by drivers not paying attention," says Chen-Fu Liao, senior systems engineer at the U's Minnesota Traffic Observatory. "That's why we are working to design and test an in-vehicle work-zone alert system that announces additional messages through the driver's smartphone or the vehicle's infotainment system."

As part of the project, sponsored by the Minnesota Department of Transportation (MnDOT), Liao and his team investigated the use of inexpensive Bluetooth low-energy (BLE) tags to provide in-vehicle warning messages. The BLE tags were programmed to trigger spoken messages in smartphones within range of the tags, which were placed on construction barrels or lampposts ahead of a work zone.

The researchers also developed two applications for the project. First, they designed a smartphone app to trigger the audio-visual messages in vehicle-mounted smartphones entering the range of the BLE work-zone tags. A second app allows work-zone contractors to update messages associated with the BLE tags remotely, in real time, to provide information on current conditions such as workers on site, changes in traffic, or hazards in the environment.

Field tests proved the system works. "We found that while traveling at 70 miles per hour, our app is able to successfully detect a long-range BLE tag placed more than 400 feet away on a traffic barrel on the roadway shoulder," Liao says. "We also confirmed the system works under a variety of conditions, including heavy traffic and inclement weather."

"This was a proof of concept that showed that smartphones can receive Bluetooth signals at highway speeds and deliver messages to drivers," says Ken Johnson, work-zone, pavement marking, and traffic devices engineer at MnDOT. "Future research will look into how we should implement and maintain a driver alert system."



This future work includes using the results of a human factors study currently under way at the U's HumanFIRST Laboratory to create recommendations for the in-vehicle message phrasing and structure. Then, researchers plan to conduct a pilot implementation with multiple participants to further evaluate the system's effectiveness.

According to MnDOT, another phase of the project may investigate how to effectively maintain the BLE tag database. This phase could also investigate implementation options, such as how MnDOT can encourage drivers to download and use the app.

In 2013, there were **more than**

67,000 CRASHES

in U.S. work zones, resulting in

579 DEATHS

and nearly **48,000 INJURIES.**

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VOLUNTEER DRIVER
programs at risk from changing
DEMOGRAPHICS,
ridesharing.
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FREIGHT MOBILITY
Research Institute.
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NEW MANUAL
helps agencies
COUNT BIKE,
pedestrian traffic.
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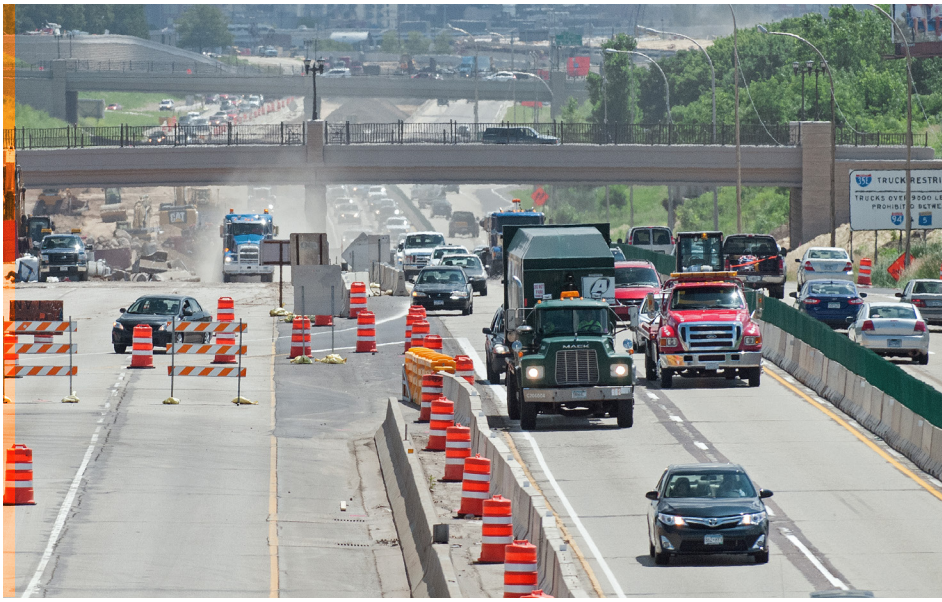

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