Researchers at the U of M’s HumanFIRST Laboratory are helping to make it faster and easier for Minnesota law enforcement officers to log the data they collect at the scene of a crash.

Nichole Morris, principal researcher at the HumanFIRST Lab, and her team redesigned the electronic crash report interface used by Minnesota law enforcement officers to improve the accuracy, reliability, and meaningfulness of crash data. Although at first glance these data appear to serve simply drivers and insurance companies, the information is highly valued because it is used by state and federal agencies, as well as researchers, to analyze and evaluate crashes, trends, and
Information and communication technologies (ICT) are changing how and where we work, shop, and live our lives by making virtual activities a viable alternative to traditional physical activities. The rapid growth of these technologies has important implications for the transportation system.

“Unsurprisingly, transportation policymakers and planners are hoping ICT will replace some activities that require travel between places and help alleviate the transportation challenges that many large metropolitan areas face,” says Jason Cao, an associate professor in the Humphrey School of Public Affairs. “However, the impact of ICT on activity participation and travel is more complex than it appears at first glance.”

In a project sponsored by the Minnesota Department of Transportation (MnDOT) and the Minnesota Local Road Research Board, U of M experts synthesized the effects telecommuting and teleshopping have on travel behavior and predicted their potential impacts on our transportation system in the decades to come.

Both e-shopping and telecommuting are growing, and this growth is expected to continue. In 2010, about 16 million employees worked at home at least once a month—an increase of 62 percent from 2005. Currently, e-shopping makes up more than 6 percent of total retail sales, and experts estimate it may eventually account for up to 50 percent. Other ICT such as telemedicine and telebanking are also likely to see growth.

Cao found that previous studies on the travel impacts of ICT show mixed results. Telecommuting offers the potential to reduce travel during peak hours, lower VMT slightly, and help mitigate freeway congestion in the short term, but it can increase non-work travel and influence the travel of other household members. It may also enable commuters to move farther away from their work and become auto-dependent.

For e-shopping, the literature shows that people who buy online also buy in person more often, so e-shopping may—or may not—reduce travel to stores in the short term. Online buying increases delivery traffic and freight transportation, Cao says, and if the share of e-shopping grows enough to change the distribution of commercial land uses in a region, it would have a profound effect on shopping-related travel.

“We believe that transportation planners should be realistic about the relationship between ICT and travel,” he says. “Although the short-term effect of ICT on travel may be substitution, leading to slight reductions in VMT, in the long term travel demand is likely to grow as ICT induces new travel.”

“This work clearly shows the complex relationship of information and communications technology with travel behavior and impacts on the system,” says Ken Buckeye, program manager with MnDOT’s Office of Financial Management. “As transportation planners and managers, we must be mindful that the short-term effects of these policies and trends may mask more significant long-term effects like the potential for increasing travel.”

Cao’s research is part of a multi-pronged study that analyzed the technological shifts altering surface transportation and the implications for Minnesota. Other contributors included Professor David Levinson (principal investigator) and assistant professor Adam Boies of the Department of Civil, Environmental and Geo-Engineering, and Humphrey School associate professor Yingling Fan. Their high-level white papers are compiled in a final report: The Transportation Futures Project: Planning for Technology Change.

What impacts will e-shopping and telecommuting have on our transportation future?
Research helps field engineers manage traffic at work zones

When drivers encounter a work zone, they have a choice: go through or go around. But for traffic engineers, this choice represents a tricky problem. How do you predict the number of drivers who will divert around the work zone versus the number that will go through, in order to create an effective traffic management plan?

“The capability to accurately estimate the traffic diversion caused by work-zone delays and the capacity reduction associated with lane closures is of critical importance in developing effective traffic management plans,” says Eil Kwon, professor at the Department of Civil Engineering at the University of Minnesota Duluth (UMD), the principal investigator of this study. “However, the traffic planning models that had been used to address these problems require a very time-consuming process and an extensive origin/destination data set that is not easily available to practicing engineers.”

A new study from UMD researchers aims to help engineers solve this problem—and ultimately create better traffic management plans for their work zones.

The research team began with a set of traffic data that was collected from 12 work-zone sites in the Twin Cities’ freeway network. Next, the researchers analyzed the data to create a set of new traffic diversion models that relates the diversion rates at highway ramps to freeway delays and alternate-route travel times for different types of corridors. Finally, they developed an estimation process in which a freeway simulation model interacts with the newly created diversion estimation models until a convergence is achieved between diversion and resulting freeway delays. The research group also analyzed the capacity changes in work zones and determined a set of capacity values for the sections with lane closures.

“When we tested this model using both new and existing work-zone data, it showed very promising results,” Kwon says. “We believe this methodology can be used to effectively determine both the diversion rates and freeway delays for a given work zone without requiring origin/destination demand data.”

Based on their findings, the

Minnesota LTAP offers hands-on maintenance training at Demo Day

The Minnesota Local Technical Assistance Program (LTAP) hosted its annual spring training event, the Minnesota Roadway Maintenance Training and Demo Day, in Little Falls on May 19. At this year’s event, more than 130 attendees learned about gravel road maintenance, roadside vegetation, culverts, roadway safety for maintenance operations, and more. Minnesota LTAP is housed within CTS.
In early May, CTS and the Roadway Safety Institute hosted a visit by U.S. Senator Amy Klobuchar to highlight the dangers of distracted driving.

“As a mother of a 20-year-old driver, safety is always on my mind. But you don’t need to be a parent to appreciate the importance of keeping kids’—and really all drivers’—eyes on the road,” Klobuchar said. “We all know that 5 seconds—5 seconds—is the average time your eyes are off the road when you send a text, which means for a driver traveling 55 miles per hour, you actually are going the length of a football field blindfolded.”

Klobuchar went on to cite the sobering statistics of deaths and injuries due to driver distraction, but then got much more personal. “Despite all those numbers that are so startling and so big, no one [is] with me up here...because of the statistics. They’re here because of lost lives, because of their own family members, and because of those that they want to prevent from being injured or killed.”

Klobuchar was joined by Minnesota high school students, safety leaders, advocates, and representatives from the U of M, including Nichole Morris, principal researcher at the HumanFIRST Laboratory; Max Donath, director of the Roadway Safety Institute; and CTS director Laurie McGinnis.

Following remarks, the group toured the HumanFIRST Lab, which uses the tools and methods of psychology and human factors engineering to better understand driver performance. High school students from distraction-free driving clubs took turns behind the wheel of the lab’s immersive driving simulator, which is used for researching driver distraction and impairment.

“One of the ways that we take on [distracted driving] here in the HumanFIRST Laboratory is to impose some technology to the driving situation to improve teen driving,” Morris said. Morris discussed some of her current research involving teen drivers. For example, the lab has developed a smartphone app that offers real-time feedback for teen drivers and automatically suppresses the teen’s ability to talk and text while driving.

In April, 1,000 Minnesota drivers were cited for distracted driving.
potential countermeasures.

The project was a component of a larger effort that redesigned Minnesota’s crash records database and was sponsored by the Traffic Records Coordinating Committee at the Minnesota Department of Public Safety (DPS) and the Minnesota Department of Transportation. The new interface launched on January 1, 2016, and has since been used to log nearly 30,000 crashes with mostly positive feedback.

HumanFIRST’s work included conducting a human factors analysis and obtaining extensive input from law enforcement officers to design a system that best met their needs. Morris and her team then developed two prototype interfaces that were subsequently built by Appriss, the state’s software vendor.

“One of the biggest things that I hear over and over from officers is how impressed they are and how pleased they are that we started with the officer and built the system up,” says Kathleen Haney, traffic records coordinator at DPS. “Legal and law enforcement software [often treat] the officer as an afterthought, and for us to go out there first and say, ‘How do you want to collect this data?’ has made a huge impact on them.”

The finished system gives officers three choices for electronically submitting a report: a quick capture, a wizard, and a form. Appriss also built a website interface and a standalone platform that can be loaded onto officers’ laptops, allowing them to complete electronic reports even when they have limited Internet access.

“By coupling the work from HumanFIRST with an experienced software vendor, Minnesota was able to get the best-of-breeds,“ Haney says. “We are unaware of any other state that gives so many options to the officers. And our goal of high-quality data—by easing the burden of collection—was clearly met.”

The project’s success has also garnered national attention. In February, NHTSA administrator Mark Rosekind and regional administrator Darin Jones visited the HumanFIRST Lab to learn about the redesign.

Going forward, the state will continue fine-tuning the interfaces and making enhancements based on officer feedback. Later this year, the state also plans to launch a public portal that will allow citizens to perform aggregated crash data inquiries and run data reports. In other future work, HumanFIRST researchers will evaluate the effectiveness of the new system by examining data accuracy, Morris says.

“The paramount goal of this project was to help officers,” Morris says. “They really put themselves at risk when they’re on the roadside, so the faster we can help them collect and document data and clear the scene, the better. After that, we want to make sure that what we’ve done is resulting in high-quality data.”

Researchers have integrated their results into a guideline that can provide practical assistance to field engineers in estimating the traffic diversion rates and capacity reduction for work zones. These values can then be used to develop an accurate and effective work-zone traffic management plan.

In the future, researchers hope to develop a user-friendly, computerized process for field engineers, so that diversion rates at a given work zone can be determined in an efficient way.

The study was sponsored by the Minnesota Department of Transportation (MnDOT). “An accurate estimate of delay is an important component of a transportation management plan, and it is also very challenging,” says Tiffany Dagon, traffic work zone engineer with MnDOT’s Metro Division. “We are excited to have this new tool and look forward to using it during the design of upcoming projects.”
In the luncheon presentation of the Symposium on the Sharing Economy, Professor Tom Fisher looked at the deeper reasons why the sharing economy is appealing to so many people, so fast—and what the transformation may mean for our daily lives.

“The sharing economy resonates in ways that are very deeply embedded in our subconscious,” began Fisher, director of the Metropolitan Design Center in the U of M’s College of Design. “Ninety percent of human history was spent in small tribal groups. The sharing economy is a reinvention of capitalism and a return to a village economy—a high-tech version of the one in which humans evolved. And it’s almost irresistible.”

With this shift will come a return to ways of living and working not seen in a very long time. “More people are becoming interested in access, not ownership, and in collaboration, not competition,” Fisher said. “We’re moving from a Darwinian framework of competition for scarce resources toward a world as a collaborative, cooperative set of ecosystems with abundance.”

Global villages—connected in an instant through technology—may become the way we identify and organize ourselves. Artisan crafts and mass customization will replace mass commodities. “The value system as a whole is becoming less about amassing things and more about memorable experiences, purposeful work, equity, and sustainability,” he said.

Travel and land-use patterns of the last century were a reasonable response to a mass production and consumption society, but the sharing economy moves in the opposite direction. “For the first time in 50 years, we’ve seen a steady decline in vehicle-miles traveled in the last eight years,” he said. “People are living closer together, closer to where they work, or working at home.”

The shared economy will continue to wring out the excess capacity inherited from the 20th century economy, Fisher said, filling empty vehicle seats and closing more retail malls. Skeptics label the shift impractical, utopian, and far off, but data show it’s not confined to millennials, and it’s happening now. “The speed with which it is emerging is remarkable,” he said.

As in previous economic transformations, there will be disruptions. Tensions are already high between car-sharing firms and cab drivers, and truckers will soon feel the impact of autonomous vehicles. The sharing economy will also challenge public policies and interrupt government revenue streams.

“The old economy is at its end game,” Fisher said. “In quite a paradox, a decidedly capitalistic economy is returning us to a village economy. We can return to a sharing economy with a new appreciation of what we’ve learned.”

A video recording of Fisher’s presentation is available on the Initiative website: sharingeconomy.umn.edu. His full remarks will also be included in a forthcoming summary report.

Experts share research, identify future needs at symposium workshop

The Symposium on the Sharing Economy began with a one-day workshop that brought together researchers from around the globe to discuss their work, foster collaboration, and identify future research needs.

Several faculty from the U of M’s Initiative on the Sharing Economy gave presentations. For example, Professor Ravi Bapna (Carlson School of Management) described how social media measures such as shared wall posts can be used to predict trust among users. “The issue of trust is critical,” he said. “It’s a glue that enables the ideals of the sharing economy to come together.”

Other topics included market growth potential, labor welfare, package delivery, and land-use implications.

The symposium was one of the initiative’s first activities. Launched in 2015, the initiative was established by CTS in partnership with Professor Saif Benjaafar and other faculty members across the University and is administered by CTS. It aims to position the U of M at the forefront of the development of a science of the sharing economy.

Selected presentation slides and papers from the research workshop are available on the Initiative website:

sharingeconomy.umn.edu.
Saif Benjaafar

Department of Industrial and Systems Engineering at the University of Minnesota. It consisted of a research workshop (see related article on page 6) and a public forum.

Benjaafar set the stage for the forum with a broad picture of the issues. “The sharing economy is a growing trend away from the exclusive ownership and consumption of resources to one of shared use and consumption,” he said.

“It’s greatly facilitated by online platforms such as Uber and Airbnb that reduce search and transaction costs, handle payment, and weed out bad actors.”

The sharing economy is also part of a phenomenon in which firms are shifting from selling things to selling the functionality of these things—mobility instead of cars, or power instead of engines. Ford, for example, recently launched a smartphone app that helps users find parking or share vehicles. “The pilot car-sharing program allows owners of Ford-financed cars to rent them out and put the income toward their car payments,” he said.

Many other firms and people see the promise of the sharing economy. The explosion of online platforms—Uber, Lyft, Airbnb, JustPark, LiquidSpace—in the past few years points to growing opportunities for business innovation and entrepreneurship. Individuals can earn flexible income from underused assets, and consumers can gain access to expensive things they may otherwise prefer not to own. Advocates also believe the sharing economy will improve sustainability by reducing the numbers of cars and parking spaces and lowering emissions and congestion.

But there’s also a potential dark side. “There are mounting concerns the sharing economy could lead to more consumption rather than less,” Benjaafar said, citing his recent research indicating that peer-to-peer sharing can lead to lower—or higher—ownership and usage, depending on the product’s cost. “People on the cusp of buying something expensive may make the purchase if they can rely on rental income as a subsidy,” he said.

Some forecasts predict higher vehicle-miles traveled due in part to the young and old having greater accessibility. And New York City officials are questioning if the rise of Uber and other app-based car-sharing services—and the resulting cars circling streets and making stops—caused a 9 percent decrease in average speeds in the city center between 2010 and 2014.

Other concerns are that the sharing economy competes unfairly against existing businesses, such as regulated cab companies, and leads to a “gig” economy that puts downward pressure on wages and shifts corporate risk to individuals.

So what are the actual perils and promise? “Things may not go according to what advocates on either side tell us,” Benjaafar said. “Our initiative will provide objective analysis.” The growing team includes researchers from multiple U of M departments plus partners at the Singapore University of Technology and Design.

Following his remarks, the forum turned to presentations and panels with leaders from industry (including Nice Ride, HOURCAR, and Zipcar), academia, nonprofits, and government. Video recordings of the event are available on sharingeconomy.umn.edu. A summary report will also be available on the Initiative website.

UBER is in more than 450 CITIES worldwide.
Symposium sparks discussion of sharing economy’s promise—and perils.