With more than a billion vehicles on roads around the world, traffic congestion affects millions of people each day. It eats up precious time that could be better spent on the job or at home with family, and it has psychological and physical health implications. In the world of business, it is responsible for the loss of billions of dollars in productivity.

Traffic congestion can seem inevitable, or at least too expensive and difficult to solve. TomTom, a global leader in navigation and mapping products, is challenging this conventional thinking. In its Traffic Manifesto, TomTom advocates using big data analytics and smart mobility to reduce traffic congestion for all.

Green Line and related bus network improvements increase access to jobs

A new analysis from the University of Minnesota’s Accessibility Observatory has quantified how much the Green Line light-rail transit route and related changes to the regional bus network changed residents’ ability to reach jobs by transit. The study measured access to jobs in Minneapolis and St. Paul before and after the Green Line began service on June 14, 2014.

“Changes were greatest in St. Paul, where most of the Green Line’s stations are located,” says Andrew Owen, director of the Observatory. “A year after the opening of the Green Line, workers...”
In early 2016, an estimated $6.2 billion project will conclude with the opening of a new set of locks enabling the Panama Canal to handle larger ships. This increase in capacity has triggered many expectations about its potential impacts on global trade, in particular for ports on the American East Coast.

The common belief is that the expansion will bring additional traffic and economic opportunities—but many experts disagree. In the luncheon session of the CTS Transportation Research Conference on May 20, Hofstra University professor of global studies and geography Jean-Paul Rodrigue outlined the controversy surrounding this multi-billion dollar transportation project.

“It’s true that the new canal will have operational benefits including improved capacity, reliability, and transit times, along with lower unit costs,” Rodrigue said. “However, these benefits tend to be exaggerated while the costs tend to be underestimated. In reality, lower shipping costs will likely not be passed on to the consumer, the prevalence of a hub-and-spoke transshipment model will increase, and most of the growth will continue to occur in Latin American and other emerging economies.”

In evaluating the impacts of the canal expansion, Rodrigue emphasized the importance of understanding the current economic realities of trade in North America. “Global trade is now stalling and declining, and since the financial crisis it has diverged. Growth has shifted to South America and the Caribbean, and it is difficult to see how expanding the Panama Canal is going to change this.”

While the canal expansion has triggered upgrades at U.S. ports, such as dredging for increased channel clearance, improved piers, and new cranes and yard equipment, it will also create a need for expanded inland infrastructure.

“The ‘massification’ of water ports is useless without the massification of inland ports where those huge loads can be broken,” Rodrigue said. “Larger ships will carry more containers at a time, so more space will be needed on trucks and trains to unload more cargo in a shorter time frame, which could impact local roads, rail crossings, and communities near the ports.”

Other disadvantages of the new, larger ships calling on U.S. ports are the negative impacts on manufacturing supply chains and import/export businesses. “If you shift to bigger boats, you get the same amount of cargo but within a compressed time frame and fewer calls per week, which makes importers, exporters, and supply chain managers unhappy.”

On the national level, Rodrigue says the canal expansion may have limited impacts on the inland transportation system and Midwestern economy. “In the Midwest, we may see a slightly lower transportation cost for containers, increased access to a wider variety of gateways that will reinforce overland transportation services, and better connectivity with key inland logistical platforms that link the ports with rail services.”

The bottom line, said Rodrigue, is that while U.S. ports have upgraded their facilities to handle larger ships, exactly where the positive impacts will be felt is completely outside government control. “The people who make decisions about how freight is going to be moved have nothing to do with the U.S. economy. These are maritime shipping companies, and they say how they’re going to use the canal and which port they will call on.”
Researchers and practitioners interested in transportation safety gathered in St. Paul on May 21 for the Roadway Safety Showcase: Safety Innovations for Today and Tomorrow, a one-day event held in conjunction with the CTS Transportation Research Conference.

The showcase highlighted the latest work by researchers from the Roadway Safety Institute (RSI), the Region 5 University Transportation Center led by the University of Minnesota. RSI’s goal is to prevent crashes to reduce fatalities and life-changing injuries.

This goal fits well with the USDOT’s vision for the future of transportation safety, according to USDOT Assistant Secretary for Transportation Greg Winfree, who gave opening remarks.

“The first 50 years of transportation safety focused on occupants surviving crashes,” Winfree said. “The next 50 years will be about avoiding those crashes altogether.”

Showcase attendees learned how RSI researchers are developing solutions for some of today’s most pressing safety problems. Researchers shared updates on projects related to tribal nation road safety, connected vehicle technology, bicycle and pedestrian safety, wrong-way driving, automated speed enforcement, alcohol-related hot-spot analysis, a decision-support system for older drivers, and commercial vehicle driver safety.

The event featured 14 researchers from three U of M campuses as well as researchers from other RSI member institutions, including the University of Illinois at Urbana-Champaign (UIUC), University of Akron, and Auburn University.

One of the event’s featured sessions focused on railroad grade crossing safety. More than 200 people lose their lives at railroad crossings in the United States each year, and railroad incidents involving hazardous material pose significant threats to safety, public health, and the environment. Although the number of crashes has been declining in recent decades, the result of a vehicle–train collision is often catastrophic.

Three RSI researchers from UIUC described how they are working to improve safety at and around railroad grade crossings through a three-part project. Their work includes developing modeling techniques that provide a better understanding of crash occurrence, contributor factors, and crash prediction at rail crossings; predicting train arrival times to facilitate emergency response management and alert drivers at unsignalized crossings; and strategically allocating emergency responders and resources in the event of a rail incident, even across jurisdictional boundaries.

Presentations from the showcase, and a fact sheet about the rail crossing project, are available on the RSI website at roadwaysafety.umn.edu.

Catalyst Year in Review

During the past year, these were our top three most-read stories online:

#1: **THE MISSING LINK: BIKE NETWORK QUALITY BOOSTS BIKE COMMUTING**

#2: **IMPROVING WORK-ZONE SAFETY FOR VISUALLY IMPAIRED PEDESTRIANS**

#3: **TRAVEL BEHAVIOR STUDY SHOWS DRIVERS ARE SPENDING LESS TIME TRAVELING AND MORE TIME AT HOME**

If you missed them, the stories are available online in the Catalyst archive.
In the opening session of the annual CTS Transportation Research Conference on May 20, keynote speaker Ralf-Peter Schäfer, vice president of TomTom’s Traffic and Travel Information Product Unit, described how big data is the fuel needed to reduce congestion worldwide.

“In the past, we’ve had to rely on loop data and macro models to compute density, speed, and travel time, but we don’t always get the precise data we need with these two methods to make good decisions,” Schäfer said. “With the emergence of connected GPS systems, smartphones, and smart cars, we suddenly have millions of connected users on the road, which has allowed us to gather huge amounts of real-time floating vehicle data based on real trips. We’re talking about hyper connectivity that can result in massive change.”

Through road traffic analytics, this massive amount of data can be converted into powerful information such as route travel times, road segment speeds, vehicle flow and density, city performance analysis, speed profiles for navigation, and origin-destination traffic flow analysis.

These analytics can then be used in a wide variety of ways, including planning trips for commuters and logistics businesses, helping transportation planning organizations and governments understand what is occurring in specific areas and on the system as a whole, or even allowing outdoor advertisers to determine the most effective placement for their billboards.

The availability of advanced analytics can also have a positive impact on roadway safety by warning drivers about weather-related problems, road construction, and unexpected congestion.

“More than 35 percent of drivers have admitted to experiencing an accident caused by sudden or unexpected traffic holdups,” Schäfer said. “We can use data to detect traffic queues and get ‘traffic jam ahead’ warnings to drivers with a high degree of accuracy so that they are not surprised by sudden traffic stoppages.”

Advanced navigation technology also has the power to reduce congestion for all road users—whether or not they use the technology themselves.

“We’ve determined that if just 10 percent of drivers use this technology, individual journey time for these users will be reduced by up to 15 percent, and the collective journey time reduction for all road users will be up to 5 percent,” Schäfer said. “As connected users make informed detours, traffic volume on the congested route decreases.”

Harnessing the power of traffic data: a local perspective

Following Ralf-Peter Schäfer’s conference presentation, a panel of local experts shared their perspectives on how data might solve challenges and shape the future of transportation in Minnesota.

What considerations and challenges does the Twin Cities road network face?

“The reality for us is that we only have so much square footage within our right-of-way, and when we’re planning for the future we need to integrate all the different modes—cars, pedestrians, transit, and bicycles—and push them through this...
limited square footage,” said Debra Brisk, Hennepin County’s assistant county administrator of public works. “Our challenge is how to balance the demands and needs for that precious square footage to keep up with economic competitiveness and individuals’ changing mode choice—their growing preference to choose transit, walk, or bike.”

How can data help maximize the efficiency of the road system when adding lane miles is not an option for certain areas?

“By using data to gain a better understanding of where origins and destinations are and where people are ultimately going in a complex interchange, there may be some things we can do to make improvements,” said Brian Kary, MnDOT’s Metro District freeway operations engineer. “We have a lot of data that shows how many cars enter at one ramp and exit at another ramp, but we don’t really know the exact travel patterns within that interchange. Probe data can help us determine what the actual travel patterns are, and that could help with making designs more efficient to assist with some of those traffic changes without having to add more lanes.”

What data obstacles has the U of M’s Accessibility Observatory had to overcome in the development of national accessibility performance measures?

“Data is a really big part of our work measuring access to destinations throughout the entire country. We need really detailed information about the structure of our road network and the speeds people are able to travel at different times of day, as well as very specific information about our transit systems, pedestrian networks, and bicycle networks,” said Andrew Owen, director of the Accessibility Observatory. “The key for us in taking a national look at accessibility is that we need this data in a consistent way, so what makes our work possible is overcoming data fragmentation and looking at sources of data that are consistent across the whole country.”

The University of Minnesota Extension has a longstanding partnership with the White Earth Nation to operate a summer day-camp program for 40 reservation youth in grades 4 to 8. This year, the Roadway Safety Institute (RSI) sponsored one day of the two-week camp in June.

The program focuses on hands-on learning and uses Indian culture and heritage as a vehicle for studying math, science, and engineering.

RSI staff taught several lessons about safe travel in a variety of modes. Students experimented with reflectivity to understand safe pedestrian and bike travel and studied GIS mapping. The dangers of distracted driving and walking were also demonstrated by testing students’ reaction time. Connections to students’ heritage included Ojibwe vocabulary lessons and discussions of local animals’ travel patterns and traits.

Through these interactive lessons, students deepened their science and math skills while learning practical information about being safe travelers. Local engineers and a 3M representative also participated, sparking students’ desire to pursue higher education and STEM careers.

“Through these lessons, students gained an understanding of safe travel practices,” says Colleen O’Connor Toberman, CTS/RSI program coordinator. “Our goal is that they become models for safe travel in their community.”

“It was our pleasure having the RSI team at the White Earth program. The lessons were very engaging, and our students enjoyed the varied topics,” says Deb Zak, regional director of the U of M Extension’s Northwest District. “We would love to have RSI participate in our camp again in 2016.”

RSI also hosted 10 students in grades 7–11 from the Red Lake Nation on June 15 as part of another summer camp program. Students toured the Minnesota Traffic Observatory (MTO) and learned about traffic safety from Chen-Fu Liao, MTO’s educational systems manager.
Weigh-in-motion (WIM) systems are widely used by state agencies to collect traffic data on major roadways and bridges. In Minnesota, 20 WIM stations gather data about truck volume, class, speed, and weight. WIM sensors, however, are sensitive to factors such as the weather and surrounding road surface conditions, making periodic calibration essential to ensure the accuracy and reliability of the measurements.

To improve the efficiency of WIM calibration, University of Minnesota researchers developed a systematic methodology to detect WIM sensor bias. The MnDOT-funded project was led by Chen-Fu Liao, senior systems engineer in the Department of Civil, Environmental, and Geo-Engineering (CEGE), and CEGE professor Gary Davis.

MnDOT calibrates its WIM sensors twice a year, says Indrajit Chatterjee, a research assistant on the team. (Chatterjee is the recipient of this year’s Matthew Huber Award for Excellence in Transportation Research and Education from CTS.) MnDOT’s current procedures allow it to identify when a WIM system goes out of calibration, but only on a monthly basis; as a result, the reliability of WIM data is frequently questionable. “With the software developed in this project, we now can see when there are calibration issues much quicker,” says Ben Timerson, transportation data and analysis program manager at MnDOT.

The goal of the research was to develop a statistical quality-control technique that identifies exactly when a system goes out of calibration. “This would allow operators to estimate the bias in the WIM sensor and modify the measurements so that the data are valid year-round and usable for analysis,” Chatterjee explains. “It could also help agencies decide when to schedule onsite testing.”

After developing the algorithm, the researchers tested it using a case study in St. Louis County, Minnesota. Results suggest that the methodology is able to estimate shift in the WIM sensor accurately and indicate when the system goes out of calibration, Chatterjee says.

The team also developed a data analysis software tool—WIM Data Analyst—with an embedded online help document (available at http://street.umn.edu/WIM_Analyst).

“WIM data are used to support traffic load forecasting, pavement design and analysis, infrastructure investment decision making, and transportation planning,” says Liao. “This tool will help agencies get the high-quality data they need without increasing onsite visits, saving time and resources.”

“We are looking to implement this software in the next few months,” says Timerson. “The software will provide a needed solution to improving our data quality and improve the usefulness of WIM data for transportation agencies.”

TRUCKS CARRY MORE THAN 63 PERCENT OF GOODS MOVED IN MINNESOTA (by volume, 2012).
—Source: MnDOT

READ CATALYST ONLINE for links to research reports and other resources.
in St. Paul can, on average, reach over 2,000 more jobs within 30 minutes by transit than they could previously—a 5.3 percent increase. In locations near Green Line stations and connecting transit routes, accessibility often increased by over 50 percent, and in a few locations more than doubled."

In Minneapolis, changes were minor, and in most cases were due to service or schedule changes unrelated to the Green Line project, he says.

For the analysis, researchers measured the number of jobs that can be reached by transit within 30 minutes of travel between 7 and 9 a.m. from each census block in St. Paul and Minneapolis. They evaluated accessibility for three scenarios:

1. The 2014 scenario uses actual transit schedules as of April 2014, prior to the start of Green Line service.
2. The 2015 scenario uses actual transit schedules as of April 2015, which reflects the new Green Line LRT service as well as changes to the regional bus network.
3. A hybrid scenario uses schedules from 2014, modified to include current Green Line service and changes to parallel bus routes, but no changes to other bus routes.

"By comparing the hybrid scenario with both 2014 and 2015, it’s possible to estimate the accessibility impacts of the Green Line itself separately from the impacts of changes to connecting routes in the regional bus network," Owen explains.

The results suggest that had the Green Line been implemented without any supporting changes to the regional bus network, accessibility benefits would have been limited to areas near the new rail stations. "The relatively low residential density of the area means that a single transit line, whether bus or rail, can reach only a small minority of residents," Owen says. "But a well-designed network of routes can provide access to a much larger area and can help distribute the benefits of new investments like the Green Line throughout the community."

Pointing to the Accessibility Observatory study, Metro Transit general manager Brian Lamb said the Green Line has expanded access to opportunities—jobs, businesses, and cultural and recreational venues. "The Green Line is about more than rides, it’s about access," Lamb said.

Owen notes that the analysis did not look at other effects of the Green Line, such as reliability and passenger comfort. "It’s likely that the Green Line provides far more reliable travel times than did the bus routes it replaced, which operated in mixed traffic," he says. Additionally, the analysis does not reflect potential travel time improvements to jobs that could already be reached in less than 30 minutes.

The analysis was sponsored by CTS and the Department of Civil, Environmental, and Geo-Engineering. The final report—Green Line LRT: Job Accessibility Impacts—is online at access.umn.edu.

IN THE GREEN LINE’S FIRST YEAR:

More than 11 MILLION RIDERS TRAVELED on the 11-mile corridor.

Average monthly ridership was 970,000.

—Source: Metro Transit
The Green Line and related bus network improvements increase access to jobs.

BIG DATA and smart mobility could help REDUCE CONGESTION.

What will be the real ECONOMIC IMPACTS of the PANAMA CANAL EXPANSION?

A new event showcases TRANSPORTATION SAFETY RESEARCH.