Traffic modeling is an essential tool for transportation planners and organizations—models are used for everything from resource management to project scheduling and impact studies. Researchers at the U of M’s Minnesota Traffic Observatory (MTO) recently developed a highly complex traffic model of the entire Twin Cities metropolitan area. “In testing it,” says John Hourdos, the principal investigator, “we found that the Green Line light-rail transit line and the accompanying road and bus changes have increased road congestion on nearby roads, but not by much.”

In most cases, models are developed at a “macroscopic” level to include only the most basic

Green Line light-rail corridor: new model helps analyze congestion impacts on nearby roads

The missing link: bike network quality boosts bike commuting

Cities promote strong bicycle networks to support and encourage bicycle commuting, yet until now little has been known about how the overall quality of a city’s bicycle infrastructure network impacts bicycle ridership.

In a study analyzing bike networks in 74 U.S. cities, University of Minnesota researchers have discovered that even after controlling for city size and demographics, both connectivity and directness are important factors in predicting bicycle commuting.
A researcher at the University of Minnesota Duluth (UMD) is experimenting with video games in an attempt to change teens’ attitudes toward distracted driving.

Edward Downs, associate professor of communication at UMD, used a PlayStation 3 video game console and a popular racing game to create a simple driving simulator, complete with a steering wheel and gas and brake pedals. His goal was to demonstrate the dangers of cell phone use behind the wheel in a safe, affordable, controlled environment—and ultimately make teen drivers less likely to drive distracted in the real world.

To test the simulator, Downs recruited a group of students from UMD and split them into three groups: a texting while driving group, a talking while driving group, and a control group (with no distractions). Downs then measured how often each group of drivers crashed, crossed the fog line, and engaged in speed violations to determine the effects of distraction.

To test this theory, Downs conducted a follow-up study that allowed participants to drive in both distracted and non-distracted conditions. “Allowing participants to see both their undistracted scores and their distracted scores resulted in much stronger attitude changes,” Downs says. “Participants’ intent to drive distracted was significantly reduced.”

The study’s results have implications for community programs and parents of teen drivers, Downs says. “In a time when financial resources are limited, driver’s education programs may be interested in setting up driving simulators of their own to show people how inefficient they are at driving distracted. For less than $500, they could purchase a video game console and accessories to begin changing attitudes toward distracted driving.”

For parents, especially those who may already have a video game console in their home, this study could provide guidance on a safe way to demonstrate the negative consequences of distracted driving.

“The added benefit of using video game technology is that, used properly, attitudes can be changed through experiential learning,” Downs says. “Allowing young drivers, particularly the youngest drivers with the least amount of driving experience, to reach a conclusion through their own experiences in a safe, controlled environment could be much more powerful than an authority figure telling them what they should or should not do.”

Following the initial study, Downs took three driving simulators to the 2014 Minnesota State Fair as part of the U of M’s Driven to Discover initiative. Downs and his team collected data from more than 200 participants, with a focus on whether or not the simulator could change attitudes toward texting and driving.

Preliminary analysis indicates that the simulator was successful, with participants reporting that they would be less likely to text and drive in the future. Downs and his research team are continuing to analyze the data to further their understanding of the relationships between technology, learning, and attitude change.

**Can video games change attitudes toward distracted driving?**

71% OF TEENS ADMIT TO SENDING TEXT MESSAGES while driving, and 78% ADMIT TO READING THEM.
Making SMART Signal even smarter

Your drive home may be a few minutes quicker thanks to a team of researchers who are making it easier for Minnesota engineers to retime traffic signals.

Traffic delays typically grow 3 to 5 percent per year due to outdated signal timing. However, most traffic signals in the United States are only retimed every two to five years (or longer), largely due to the expense associated with retiming efforts. It normally costs $3,500 to retime one traffic signal because of the time involved in collecting data and optimizing timings.

But over the past several years, University of Minnesota researchers have developed and refined the SMART Signal system to make it easier and less expensive to retime signals. The system—developed with funding from the Minnesota Department of Transportation (MnDOT)—not only collects traffic and signal-phase data automatically, but it also identifies under-performing traffic signals and generates optimal signal timing plans with minimal human intervention.

MnDOT (along with many cities and counties) embeds loop detectors in roads that notify a traffic signal when a vehicle is present. Staff normally must manually track wait times to determine how signal timing is affecting traffic.

But SMART Signal automates much of this process by recording how long a vehicle waits at an intersection and automatically reporting the data (along with signal timing) to a central server. The data—viewable in real-time on a website—can then be analyzed to determine traffic patterns and optimal signal timing. By reducing the cost of data collection and performance measurement, SMART Signal allows MnDOT to base signal retiming decisions on performance rather than a fixed schedule.

The latest research optimizes the system’s ability to reduce traffic delays by developing a framework to diagnose problems that cause delays at traffic signals and an algorithm that automatically optimizes the signal plan to address these problems.

The enhancements were successfully tested on Highway 13 in Burnsville, reducing vehicle delay there by 5 percent. The benefit could be in the double digits for corridors with worse traffic delays.

The software upgrade has since been integrated into the more than 100 intersections in Minnesota equipped with the SMART Signal system.

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

Roadway Safety Institute reaches out to engineers of the future

Young inventors and creators—and potential transportation engineers—gathered on February 28 for a day of family fun at Tech Fest, an annual event held at The Works Museum in Bloomington, Minnesota. Celebrating National Engineers Week, Tech Fest features hands-on activities and demonstrations from the museum and its engineering, technology, and science partners from all over the Twin Cities.

The U of M’s Roadway Safety Institute (RSI) hosted two activities. One was designing safety road signs. “While ‘watch out for cats or dogs’ was the most common theme the kids chose, we also had warnings about sharknados, zombies, and all sorts of other roadway dangers,” says Colleen O’Connor Toberman, CTS program coordinator.

The other RSI activity allowed children to learn about bicycle and pedestrian counting technology developed by U researchers. “The kids had a great time trying to figure out how the sensors worked—and how to pass through without getting counted,” she says.

RSI is the Region 5 University Transportation Center, led by the University of Minnesota. This year’s Tech Fest drew 1,039 attendees. The Works, a hands-on science and technology museum, offers exhibits, programs, and design challenges to engage kids in science, technology, and engineering and make learning memorable and fun.
The oil boom in North Dakota has generated a lot of wealth in a short amount of time, and resort owners in the Brainerd Lakes area would love to capture some of it by enticing new vacationers from the west. The trouble is, the area is inconvenient to reach from that direction.

This is one of the examples in a newly released research report that examines the role transportation plays in Minnesota’s economic competitiveness. “The research underscores the importance of a reliable transportation system in facilitating economic growth,” says principal investigator Lee Munnich, director of the State and Local Policy Program at the Humphrey School of Public Affairs.

Researchers examined the impact of transportation on Minnesota’s competitive industry clusters—

be used to improve traffic planning and management, geomarketing, and connected services for road travelers.

Following his presentation, a panel of experts will share their perspectives on the implications for the future of the Minnesota road network system and its users.

The presentation and panel will kick off the 26th Annual CTS Transportation Research Conference, May 20 and 21 at the Saint Paul RiverCentre. Other highlights are a luncheon presentation about the economic impacts of the Panama Canal expansion (May 20), a Roadway Safety Showcase from the Roadway Safety Institute (May 21), and a half-day Transit Transformers Workshop (May 21).

For more information and to register, please visit cts.umn.edu/events.

Navigation systems could reduce congestion for all

With more than a billion vehicles on roads around the world, traffic congestion affects millions of people each day. It eats up precious time, 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. Reducing it is a struggle for governments faced with declining funding and resources.

To many, 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 traffic data analytics and smart mobility to reduce traffic congestion for all—starting now.

At the annual CTS research conference, Ralf-Peter Schäfer, vice president of TomTom’s Traffic and Travel Information Product Unit, will describe how a growing community of connected navigation devices can move people through traffic faster. Millions of vehicles generating data and working as a collective—perhaps as little as 10 percent of them—could guide drivers to the least congested routes and thus reduce congestion for everyone. Schäfer will also outline how these systems can be used to improve traffic planning and management, geomarketing, and connected services for road travelers.

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READ CATALYST ONLINE
for links to research reports and other resources.

Study reveals how Minnesota industries rely on transportation

The oil boom in North Dakota has generated a lot of wealth in a short amount of time, and resort owners in the Brainerd Lakes area would love...
New online training offered for sign and culvert maintenance

The Minnesota Local Technical Assistance Program (LTAP) has launched two new online courses.

Sign Maintenance and Management for Local Agencies is designed to help maintenance staff better understand sign materials, placement, installation, and retroreflectivity, as well as general maintenance and management practices. It also teaches students how to understand new federal requirements related to sign maintenance and management.

“The development of this course stemmed from the realization that no consistent sign training is available and that many key maintenance staff are retiring without transferring their knowledge to younger staff,” says Mindy Carlson, Minnesota LTAP program manager.

In the other new course, Culvert Installation and Maintenance for Local Agencies, students learn about the purpose of well-designed, well-built, and well-maintained culverts. The course also highlights the important role culverts play in the drainage system and why proper design, installation, and maintenance are essential for well-performing culverts.

Students are free to access the courses anytime and anywhere within a five-month time frame. “They’re perfect for students who are unable to travel or prefer to work at their own pace,” Carlson says.

The cost of each course is $65 (or $75 to register for Continuing Education Credit). “The training is a great way to stretch local agency training budgets,” Carlson adds. Twenty students have enrolled in each of the courses, and nearly half of those have already completed them.

The sign course, funded by the Minnesota Local Road Research Board (LRRB), was developed by SRF Consulting Group in collaboration with a technical expert panel including CH2MHILL, the U of M, the Minnesota Department of Transportation (MnDOT), and city and county agencies.

Minnesota LTAP developed the culvert course with funding from the LRRB. Barr Engineering helped develop the curriculum with a technical assistance panel including representatives from MnDOT, the Circuit Training and Assistance Program, Advanced Drainage Systems, American Concrete Pipe Association, and Minnesota Concrete Pipe Association.

Minnesota LTAP—mnltap.umn.edu—is sponsored by the LRRB, MnDOT, the Federal Highway Administration, and CTS.

Industries from page 4

from the interviews: the importance of shipment reliability, the desire for improved intermodal freight facilities, and the condition of the infrastructure.

Several firms whose products were either breakable or perishable cited the need for smooth pavements, for example.

The report also highlights the unique challenges faced by some of the state’s major industry clusters, such as the hospitality and tourism cluster in the Brainerd Lakes Area. A four-lane highway makes it easy for visitors from St. Cloud or the Twin Cities to visit resorts in the area, but travelers coming from the Dakotas face a more circuitous route. Air travel options help to an extent, bringing in visitors from farther distances who can fly in to Fargo or St. Cloud.

MnDOT research project engineer Bruce Holdhusen says MnDOT’s goal with the study was to discover how its investment decisions could help support job creation and economic prosperity. “The idea is to look at the companies and industries that are already bringing money into the state, figure out what their transportation challenges are, and then use that information to see what kind of investments we could make to support their continued growth,” he says.

MnDOT is incorporating the results of the study into its statewide freight planning. It is also using the industry-clusters approach in a statewide effort to talk with manufacturers, other shippers, and carriers about their transportation priorities and challenges, Holdhusen says. MnDOT will focus on its Metro District starting this summer. Two similar projects have been undertaken in Greater Minnesota, and a third study is starting this year.

“The research may also help to form the basis for collaboration between public and private entities in promoting economic development,” Munnich adds.
information about the road network geometry and traffic patterns. However, when it comes to analyzing the impacts of specific improvements such as the Green Line corridor, these large-scale models can be insufficient.

“Macroscopic models often lack several key elements needed for the close examination of infrastructure and systems such as the Green Line light rail, which can result in errors for the estimation of things like travel speed and congestion delay,” says Hourdos, MTO director. “To address this gap and accurately gauge the impacts of the Green Line on the Twin Cities’ road network, we developed one of the most complex traffic simulations created to date.”

The large-scale simulation constructed by the research team was designed to capture localized, high-resolution data that incorporated accurate transit and signal information while maintaining a wide, regional scope sufficient to capture long-distance travel and dynamic rerouting. “This dynamic new modeling technique really gives us the best of both worlds,” Hourdos says. “It allows us to get a very detailed, microscopic view of the light-rail transit and immediately surrounding roads while integrating a higher-level view of the larger transportation network to study how changes affect the entire system.”

The Green Line, which connects Minneapolis and St. Paul, opened for service on June 14, 2014. Findings from the new model indicate that I-94 absorbed most of the vehicle traffic diverting from University Avenue—which the Green Line runs along for most of its route—but freeway speeds were not significantly lowered. Neighboring roads were also affected, but the added traffic burden did not spread far from the LRT route. In addition, some parts of the Twin Cities metropolitan area, including downtown St. Paul, saw some improvement in congestion. For example, average speeds on downtown St. Paul streets increased by 10 to 15 percent during the afternoon peak period.

Along with valuable insights about the traffic impacts of the Twin Cities newest light-rail line, the ambitious scale of this project also breaks new ground in traffic modeling. Researchers found that while this type of large-scale integrated traffic model is time- and resource-intensive, it is possible. Using these new models, transportation planners will one day be able to gain more accurate information to aid decision making, particularly in large areas with complex traffic controls.

“The importance of John’s work becomes apparent when considered in the context of the corridors being studied for future transitways,” says Mark Filipi, manager of technical planning support with the Metropolitan Council. “Fiscal realities require that the efficient use of existing rights-of-way be maximized, with transit and automobiles sharing the corridor. This modeling technique will provide the region’s planners a new tool to fully assess the resulting joint use of a corridor.”

An important takeaway for transportation organizations, Hourdos notes, is that in order for this type of large-scale model to become widespread, agencies need to store, maintain, and share their modeling software and data.

The project was funded through the Transitway Impacts Research Program with financial support from the Minnesota Department of Transportation and the U’s Intelligent Transportation Systems Institute.

Green Line from page 1
“This new research fills in a big gap in our knowledge about how bike facilities impact ridership,” says Jessica Schoner, research assistant in the Department of Civil, Environmental, and Geo-Engineering (CEGE) and lead author of the study. “Previous studies have found relationships between the quantity of bicycle infrastructure in a city and ridership, but the missing link has been insight into how the quality of a network affects bike ridership.”

To determine how network quality affects ridership, Schoner and co-author RP Braun/CTS Chair David Levinson began by collecting bicycle infrastructure maps from 74 mid- to large-sized U.S. cities and analyzing the maps to evaluate the backbone network of dedicated bicycling infrastructure. Then, they tested the relationship between the network analysis and the number of bicycle commuters in the city while controlling for a number of variables, including city population, land area, median income, household structure, college enrollment, and auto ownership.

“We wanted to determine whether a cyclist could complete their desired trip using the bicycle network without significant detours or gaps that would require riding in unsafe or uncomfortable conditions,” Schoner says.

Through their analysis, researchers found that a city’s bicycle commuting rate is associated with several measures of bike network quality, such as network density, connectivity, fragmentation, and directness. Interestingly, they discovered that density had the greatest impact on the level of bicycle commuting. According to Schoner, these findings suggest that cities hoping to maximize the impacts of their bike infrastructure investments should first consider increasing the density of a bike network before expanding its breadth. Researchers also concluded that excessive small fragments of bike facilities should be avoided, and they found that college enrollment is a strong predictor for bicycle commuting.

This research comes at a critical time in the development of bicycle networks across the U.S. According to the Federal Highway Administration (FHWA), cities are increasingly promoting biking for its environmental, health, and congestion-relief benefits. Investment in bike facilities has also increased: between 1999 and 2011, total federal and state government funding on bicycling and pedestrian infrastructure exceeded $7 billion. In 2012, the FHWA completed the Nonmotorized Transportation Pilot Program, which allocated $25 million each to four pilot cities over five years to measure the impacts of new infrastructure on mode shift to biking and walking.

“As we continue to invest in our country’s bike networks, it is important for transportation and planning agencies to fully understand how their bicycle infrastructure networks affect bicycle commuting in order to target investments in a way that optimizes the impact on existing riders and potential future cyclists,” says Schoner. “These findings provide a framework for transportation planners and policymakers to evaluate their local bicycle networks and prioritize the projects that best support nonmotorized travel behavior.”
TRAFFIC MODEL helps examine CONGESTION IMPACTS OF GREEN LINE LRT corridor.

Can video games CHANGE TEENS’ ATTITUDES about distracted driving?

SMART SIGNAL upgrades are reducing congestion and TRAFFIC DELAYS.

The missing link: bike network quality boosts bike commuting.