

CTS Catalyst

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Accelerating the pace of transportation innovation

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Enhanced SMART Signal system provides real-time traffic data to road users and traffic engineers

When traffic signals run efficiently, local road networks become faster and safer. With increasing congestion on our nation's roadways, transportation engineers are looking for new ways to monitor and manage local traffic signal systems. Despite this growing need for traffic signal data and analysis, most existing signal control systems don't make it convenient to monitor or archive traffic signal performance data. That's where SMART Signal (Systematic Monitoring of Arterial Road and Traffic Signals) technology developed by University of Minnesota researchers comes in.

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Commissioner Zelle shares vision for MnDOT, research

Charles Zelle began his work as commissioner of the Minnesota Department of Transportation (MnDOT) on January 15. Previously, Zelle served as president and CEO of Jefferson Lines, a Minneapolis-based transportation company providing travel services in 13 states across the Midwest. He shares his vision for MnDOT and his goals for transportation research and innovation below.

What is your vision for MnDOT?

Before I became MnDOT commissioner, it was my honor to serve as a private-sector member of the Minnesota Go steering committee that advised the agency on a 50-year vision for

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Moving beyond mobility: measuring accessibility in U.S. cities

Every year, Americans face a steady stream of discouraging news. We're spending more time stuck in traffic. Congestion in our metro areas is on the rise. Yet these reports focus almost exclusively on traffic mobility—how quickly travelers can move between any two points via automobile or transit. But according to a new University of Minnesota study, there's much more to the story.

"Focusing solely on mobility and traffic delay doesn't provide a complete picture of how the traffic system is functioning," says Professor David Levinson, the R.P. Braun/CTS Chair in Transportation Engineering. "Travelers in many of these cities have the ability to reach their desired destinations, such as shopping, jobs, and recreation, in a reasonable amount of time despite congestion and slower travel because these cities have greater density of activities. In short, these travelers enjoy better access to destinations."

A new study, *Access Across America*, goes beyond congestion rankings to focus on accessibility: a measure that examines both land use and the transportation system. The study is the first systematic comparison of trends in accessibility to jobs by car within the U.S. By comparing accessibility to jobs by automobile during the morning peak period for 51 metropolitan areas, the study shows which cities are performing well in terms of accessibility and which

have seen the greatest change.

To generate the rankings for this study, Levinson created a weighted average of accessibility, giving a higher weight to closer jobs. Jobs reachable within 10 minutes are weighted most heavily, and jobs are given decreasing weight as travel time increases up to 60 minutes. Based on this measure, the 10 metro areas that provide the greatest average accessibility to jobs are Los Angeles, San Francisco, New York, Chicago, Minneapolis, San Jose, Washington, Dallas, Boston, and Houston.

"It can be surprising to see that some of the cities often ranked as the most congested also have the highest levels of job accessibility," Levinson says. "This is due to the density of jobs those urban areas offer."

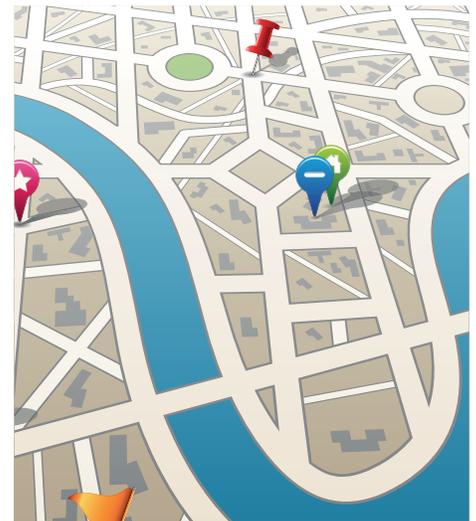
Levinson also found that job accessibility has changed over time. In the past two decades, Las Vegas, Jacksonville, Austin, Orlando, and Phoenix have seen the largest percentage gains in job accessibility while Cleveland, Detroit, Honolulu, and Los Angeles have seen the largest percentage drops.

According to Levinson, this research offers an important takeaway for metro areas interested in increasing accessibility. "There are two ways for cities to improve accessibility—by making transportation faster and more direct or by increasing the density of

MINNEAPOLIS-ST. PAUL RANKED

#5 OF 51

U.S. cities in accessibility to jobs by car in 2010.



activities, such as locating jobs closer together and closer to workers. While neither of these things can easily be shifted overnight, they can make a significant impact over the long term."

An interactive map and the full study are available at cts.umn.edu/access-study/acrossamerica. This report extends the Access to Destinations study, an interdisciplinary research and outreach effort coordinated by CTS with support from multiple sponsors.

SMART Signal from page 1

"In past research, we developed the SMART Signal technology to collect and analyze real-time traffic signal and signal system performance data and deployed that technology in several test projects," says lead researcher Henry Liu. "In this most recent project, we've enhanced SMART Signal with plug-and-play technology that makes it extremely simple and much more cost-effective to deploy."

The enhanced SMART Signal system features a single data collection unit that connects quickly to standard traffic signal

controller cabinets. "The ultimate goal is to reduce the effort of customized installation as much as possible," says Liu.

Funded by MnDOT, the latest SMART Signal research has also put real-time traffic data from one of the test projects—Minnesota's Trunk Highway 13 in Burnsville and Eagan—live on the web, where both road users and traffic engineers can access it quickly and easily. Drivers can now use the new web interface (dotapp7.dot.state.mn.us/smartsignal) to view real-time travel information, historical queue length, and real-

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Behavioral mapping: the path to a safer driving experience

New vehicles today are sophisticated driving machines—and they're also becoming rich sources of information. Sensors collect data about everything from how fast you're going to when the wipers kick in. At the same time, GPS navigation systems and the high-bandwidth infrastructure built for mobile devices are making it increasingly possible to track where vehicles are and gather vast amounts of data.

What does this mean for safety? "We're on the cusp of being able to unlock vehicle information to capture the actual behavior of drivers," according to Jane MacFarlane, head of research with Nokia's location and commerce business. The result—a "behavioral map"—could reveal how drivers dynamically experience and adapt to road networks, she said, and give engineers and designers insight for creating a safer driving experience.

MacFarlane, who holds master's and doctoral degrees from the U of M, discussed how this vision could become reality at the CTS Winter Luncheon on February 28 in Minneapolis.

The goal of Nokia's research, MacFarlane said, is to turn vehicles into probes that "derive while you drive"—creating an "automotive cloud" of information to enhance safety and feed new product development. A test project in the Netherlands, for example, recorded data about drivers' speed and braking patterns as they approached a



sharp curve—behaviors that sometimes differed from expectations. The data will allow road engineers to make improvements for the future and help equipment manufacturers design real-time safety alerts and warnings in a format drivers can easily use.

Warnings could even reflect rapidly changing weather conditions. Sensor data—such as wipers switching to high speed—could be sent to the cloud, processed, and relayed down to approaching drivers. "If we can see what people are doing, we can learn from what they are doing and introduce alerts and warning into the systems," MacFarlane explained.

How soon could it happen? "It's coming," MacFarlane said. GM announced in February that it will put 4G broadband in its vehicles, and AT&T has stated that it expects vehicle systems to become a billion dollar business for the company.

The behavioral map in action could offer insight—and commercial opportunities—in other areas as well, MacFarlane added. Some weather

The percentage of **VEHICLES CONNECTED TO THE INTERNET** is likely to reach **80%** in North America and Europe by 2017, predicts ABI Research.

experts think vehicle sensors could provide better weather forecasting capability than Doppler radar. Stopped vehicles could indicate a hot new restaurant to share through social media or location-based advertising.

Arriving at the behavioral map won't be easy, MacFarlane warned. Challenges include reaching high enough usage for drawing sound conclusions, determining ownership of the data, and ensuring data privacy. The huge amount of data alone—from all kinds of vehicles and devices, from different manufacturers with different standards—is another big challenge. The data, she concluded, has "unlimited opportunity—if we can harness it."

time queue length at intersections equipped with the system. In addition, users can calculate actual travel time along the roadway between any two intersections, at any time of day.

Researchers expect that this innovative traffic signal technology will provide even greater benefits in the future. Researchers plan to use data from SMART Signal to develop an intersection safety monitoring system that will determine if a signal is properly timed to maximize safety, particularly under different weather conditions. Better signal timing could mean less red-light running, resulting in fewer crashes. The system could also be used to measure the frequency of red-light running and calculate the probability of related crashes.



The enhanced SMART Signal system connects quickly to traffic signal controller cabinets with just a power source and an Ethernet connection.

Calculating the benefits of transit coordination: four Minnesota case studies

For people unable to use a personal vehicle—seniors, persons with disabilities, persons with low incomes, and others—the lack of adequate transportation services is a barrier for fulfilling many basic needs, especially in rural areas. Transit services are too often fragmented, duplicative, and difficult for users to navigate. One way to improve these services and reduce operating costs is through coordination across agencies and providers.

How well do coordination strategies work? A study sponsored by the Minnesota Council on Transportation Access (MCOTA) analyzed the economic costs and benefits of four case studies in Minnesota, specifically looking for demonstrated, measurable cost savings.



“Our analysis shows significant cost savings for three of the four programs we studied,” says Zhirong “Jerry” Zhao, associate professor in the Humphrey School of Public Affairs and the lead researcher. For example, the Hubbard County Heartland Express, which offers on-demand public transit service within the city of Park Rapids, began contracting in February 2011 with Paul Bunyan Transit in neighboring Beltrami County for dispatch services rather than hiring additional staff. Annual cost savings were \$22,300. And SmartLink Transit, the public transit provider in Scott and Carver counties, began coordinating medical assistance travel in 2010 for annual cost savings of \$139,740.

“This research gives policymakers real examples of the cost savings transit coordination can achieve, in addition to other benefits,” says Gerri Sutton, the Metropolitan Council’s assistant director for Contracted Transit Services and representative to MCOTA. (MCOTA promotes public transit and human services coordination throughout the state.)

In all of the programs, Zhao notes, the study found additional benefits such as greater productivity, expanded service coverage, growth in transit ridership, or improved service quality. “When agencies adopt methods to coordinate,” he says, “this creates potential for reinvesting dollars or resources into other parts of a transportation service, thus improving the overall transportation system available to the public.”

The study is available at CoordinateMNTransit.org.

New online tutorial teaches work-zone safety skills

Getting ready for the road construction season means more than dusting off the orange cones and barrels—it’s also a good

time for workers to brush up their skills and knowledge about work-zone safety.

A free online tool is now available

to provide this important training. The Work-Zone Safety Tutorial is designed for all sorts of workers: full-time or seasonal staff, contractors, utility or cable crews, and so on. It was developed by the Minnesota Technical Assistance Program (LTAP), a part of CTS.

“Spring is a very intense season for road repairs and road work, and it’s good to get geared up now,” says Monica Beeman, traffic engineer for the City of St. Paul and a member of the advisory panel that guided the tutorial’s creation. “The online tutorial is a good starter tool for those who are new to working in a work zone, such as summer hires, and for other staff as a reminder of the basic critical actions and awareness they need to work safely,” she says.

The tutorial teaches the basic concepts of the work-zone area and the



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Research conference: topics chosen for opening session, luncheon

The program for the 24th Annual CTS Transportation Research Conference is packed with presentations on a range of timely topics—from public health to pavement maintenance, car sharing to communications, transitways to toll lanes. A sneak peak at the plenary sessions is below. The conference takes place May 22 and 23 at Saint Paul RiverCentre.

Opening session: transportation and public health

Along with economic status, education, and housing, transportation is a social determinant of health—a societal factor that has an impact on health outcomes. Minnesota Commissioner of Health Edward Ehlinger will discuss the many health impacts of transportation on both the individual and community level at the conference opening plenary session.

Beyond the immediate health impacts of transportation-related trauma, the process of moving people from one location to another can have a huge impact on the physical, social, and cultural environment. The quality of air, soil, and water influences health and is influenced by transportation, as is the overall quality of life within a community. In addition, obesity, chronic health conditions, asthma, and mental health are affected by transportation and the behaviors it influences. Public health professionals recognize the importance of the transportation system in creating health and quality of life within communities and view



Bike sharing is one of the new mobility options that Professor Elizabeth Deakin will discuss at the conference luncheon.

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May 22–23

Saint Paul RiverCentre

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cts.umn.edu/events/conference/2013

individuals and organizations working in this field as part of the overall public health team.

Following Ehlinger's presentation, a panel of experts will share their perspectives on the link between transportation and public health and its implications for transportation professionals.

Luncheon: new mobility options

New mobility options—such as car sharing and bike sharing, new forms of carpooling, smart transit and paratransit, and smart cars and highways—are being developed to address many growing transportation challenges. At the conference luncheon on May 22, Elizabeth Deakin, professor of city and regional planning at the University of California Berkeley, will highlight how these new options

improve mobility and access for users.

New mobility options integrate new technologies and new ways of delivering and consuming transportation services. These options make use of new information technologies and advances in sensors, control systems, materials, and designs as well as new approaches to developing, financing, managing, and marketing transportation services. In addition, these options can reduce costs, help shape sustainable development patterns, and significantly improve public health, quality of life, and the environment.

Deakin is director of the University of California Transportation Research Center. Her research focuses on transportation and land-use policy and the environmental impacts of transportation.



**READ
CATALYST
ONLINE**

for links to research reports and other resources.

Transportation workforce summit: a framework for action

Our nation's transportation system depends on a skilled and qualified workforce, yet the transportation industry is experiencing a growing number of challenges related to workforce recruitment, training, and retention.

Leaders from across the country developed a cohesive strategic framework for addressing these challenges at the National Transportation Workforce Summit held last April in Washington, D.C. The Council of University Transportation Centers (CUTC) initiated the summit in cooperation with the U. S. Department

of Transportation. CTS was one of a number of cosponsors.

A summary of the summit results is now available. It identifies four critical issues:

- Demographic changes, particularly retiring baby boomers.
 - Career awareness and recruitment.
 - New technologies and the need for operators and managers who can use them.
 - Rising demand on transportation agencies, requiring a workforce with a wider range of experience.
- The summary presents a series of strategies and action steps to address

50%

of the current transportation workforce is or will become **ELIGIBLE FOR RETIREMENT** over the next 10 years.

these issues, including collaborative and interlinked initiatives of private and public entities across disciplines.

A PDF of the 28-page summary is available from cutc.tamu.edu/workforce.html.

Students learn about personal branding at Career Expo

More than 80 students seeking transportation-related career opportunities gathered at the University of Minnesota in Minneapolis on March 5 for the 2013 Transportation Career Expo.

The event included a keynote presentation on personal branding by Darren Kaltved, assistant director of career services at the U of M, who explained that a positive personal brand can help open the door to future career opportunities.

"What can you do to make sure your brand is one of success?" Kaltved asked attendees. "You have to think about this—employers want to know. Why you? What makes you unique?" His suggestions to students included making a list of their strengths and being aware of their limitations.

Expo attendees also participated in interactive roundtable discussions with transportation professionals

and networked with the expo's 29 exhibiting employers and professional associations.



Students networked with exhibiting employers and professional associations at the expo.

NEW RESEARCH REPORTS

Recently published reports on transportation-related research at the University of Minnesota explore:

**TRANSPORTATION
IMPACT
OF TRANSITWAYS**
(CTS 13-13)

**PROTOTYPE LANE-
DEPARTURE
WARNING SYSTEM**
(CTS 13-14)

**TRACKING BICYCLE LANE
POSITIONING WITH GPS**
(CTS 13-16)

Research reports are available at cts.umn.edu/Publications/ResearchReports.

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transportation. Now as commissioner, I see my role as supporting those at MnDOT who are doing great work in striving toward the long-range goals of building and maintaining a transportation system that maximizes the health of people, the environment, and our economy.

I also think it is critical that the agency is accountable to the public in all that it does, and that it is transparent. We are a large organization with many moving parts. We need to ensure that people understand what we do and why we do it, and not hide behind a veil of complication.

I intend to work hard at telling the MnDOT story. This agency accomplishes many great things. I intend to put a voice to those great things and make sure the story gets out.



Charles Zelle

What are your main interests for transportation research and innovation?

In many areas, MnDOT is considered a leader in transportation innovation. The work it did last summer on the Maryland Avenue Bridge and the Hastings Bridge, with new methods of construction, shows that. We will continue to explore new ways of doing our work so that we are always improving and gaining efficiency.

I see research as vital. We need to explore new ways of building and maintaining infrastructure. Technology advances rapidly and, if used correctly, can provide big savings in time and dollars. I am also a proponent of doing market research to find out what our customers need and want from the transportation system that will help shape sensible transportation policy and best practices.

How do you see the U of M supporting your vision?

CTS and the U of M do significant research and thought work on transportation issues. That work is critical to maintaining a high level of transportation innovation, and it provides a great synergy with the research work done at MnDOT. The U of M is also one of the leading institutions training our engineers of the future. As the infrastructure continues to age, we will need well-trained and capable engineers to continue to build and maintain the system.

What role do you see for transportation in providing a high quality of life for Minnesotans?

The better the transportation network functions, the better our experience is when using it. And that experience is reflected in how we see our quality of life. Evolving trends in how our customers utilize our transportation systems indicate how important these factors are in attracting and retaining talented people.

Businesses locate in places that will help them succeed. They look for a pool of workers and customers, as well as infrastructure, to support their efforts. Minnesota is known as a pretty business-friendly place. Governments support business, there is a strong workforce available, and it is a great place to live and raise a family. Transportation is a key component in ensuring that the environment is good for business and its employees.

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fundamentals of work-zone safety. It also addresses many of the hazards inherent in road and street work—and how to minimize these dangers to keep motorists, pedestrians, and employees safe.

The training includes a slide presentation, video, and a question/answer section to check comprehension of the material. It is based on a version developed by the Cornell Local Roads Program and includes new video shot in Minnesota. Try it yourself at mnltp.umn.edu.

Minnesota LTAP also offers traditional classroom workshops on work-zone safety as well as training on many other topics.

Minnesota LTAP's sponsors are the Minnesota Local Road Research Board, the Federal Highway Administration, and the Minnesota Department of Transportation.



There were
576
FATALITIES
in U.S. work zones in 2010.



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SHARES VISION

for research and innovation.
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congestion rankings to

MEASURE ACCESSIBILITY TO JOBS BY CAR IN U.S. CITIES.

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could give engineers insight
**FOR CREATING A SAFER
DRIVING EXPERIENCE.**

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