

CTS Catalyst

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Accelerating the pace of transportation innovation

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Driving better health through transportation

In the world of transportation, the focus is most often on creating mobility and accessibility. But according to Minnesota Department of Health Commissioner Edward Ehlinger, transportation also plays a major role in creating health. Delivering the keynote address at the 24th Annual CTS Transportation Research Conference, Ehlinger told the crowd, "Transportation is around us every day and influences everything we do, which makes it integral to creating the conditions for great health."

As an example of the many ways health and transportation are intertwined, Ehlinger shared a list of community indicators for health and quality of life, including access to recreation, access to healthy foods, access to medical services, and access to public transit—all of which have clear ties

Health continued on page 4

A new wave of technological change in transportation

From social media to intelligent transportation systems, technology is rapidly changing the transportation landscape to create "new mobility"—a trend that was the focus of Elizabeth Deakin's luncheon presentation at the 24th Annual CTS Transportation Research Conference.

"New mobility isn't just about moving people—it is integrating new technologies and new ways of delivering sustainable transportation services that gives people access to more goods, services, and opportunities," said Deakin, a professor of city and regional planning at the University of California, Berkeley.

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Investigating air pollution risks for pedestrians and cyclists

Although active forms of travel such as bicycling and walking provide many health benefits, they may also increase travelers' exposure to air pollution—especially in urban areas, where the air pollutants that drive health concerns are typically at their highest concentrations.

To investigate the exposure of cyclists and pedestrians to these pollutants in the City of Minneapolis, researchers from the U of M's Department of Civil Engineering (CE) are developing a block-by-block analysis of air pollution levels. In a presentation at the 24th Annual CTS Transportation Research Conference on May 23, graduate student Steve Hankey explained how this information could ultimately be used to identify high-risk locations and shape decisions about new

nonmotorized infrastructure. The project is funded by the U of M's College of Science and Engineering and the Humphrey School of Public Affairs.

In summer 2012, Hankey collected particulate air pollution measurements in Minneapolis using an instrumented bicycle trailer as he rode around the city on three 20-mile routes. Each route captured different levels of traffic and air pollution, Hankey said, and included a wide variety of road types and surrounding land uses.

Preliminary findings suggest that air pollution levels are 1.5 to 2.3 times higher in on-road locations than on off-street trails and 2 to 3.5 times higher in the morning than in the afternoon. Results also indicate that air pollution concentrations are associated with street classification and traffic intensity.

Arterial streets with the most traffic had the highest air pollution levels, with lower concentrations on local roads and off-street trails. "If you can choose to bike on a local road that's a block or two off an arterial collector, that would make a big difference in your exposure," Hankey said.

The project's next step is to tie the existing mobile measures to land-use variables so the data can be extrapolated to other parts of the city, Hankey said. The resulting model will show air pollution levels for every block in Minneapolis.

The researchers plan to use this model in conjunction with bicycle and pedestrian traffic volume data being collected

by a team of researchers from the Humphrey School led by Professor Greg Lindsey. The combined model could be used to identify "hot spots" with both large volumes of pedestrian or bicycle traffic and high levels of air pollution, Hankey said.

This information could be used to develop mitigation strategies in high-risk locations and to make recommendations for the development of future infrastructure in areas with lower pollution concentrations.

"We'll also release the air pollution estimates so people can integrate them into existing tools," Hankey said. "For example, in [the bike route tool] Cyclopath, a user could choose a low air pollution route instead of the fastest route or shortest route."



OUTDOOR URBAN AIR POLLUTION

is responsible for

81%

OF ENVIRONMENTAL HEALTH RISKS

in high-income countries like the United States.

Source: World Health Organization



Hankey's instrumented trailer measured the air at "breathing" height rather than at tailpipe level.

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Warning system aims to alert drivers to potential crashes

Between 2009 and 2011, 55 percent of Minnesota's fatal intersection crashes occurred at rural two-way-stop intersections. Right-angle crashes, often a result of drivers' inability to recognize a safe gap in traffic, account for most of these. When a curve or hill creates a limited sight distance at the intersection, safety issues are compounded.

In research sponsored by the Minnesota Local Road Research Board, a team from the University of Minnesota Duluth (UMD) Department of Electrical and Computer Engineering, working with St. Louis County, developed a low-cost dynamic warning system



to improve the safety of these intersections. The ALERT System uses LED flashing signs that are activated when a vehicle is detected approaching the intersection.

In the first phase of the project, the system was installed at a sight-restricted, two-way-stop intersection in Duluth. Drivers on the major road saw signs with the message "Cross Traffic When Flashing," while drivers on the minor road saw "Vehicle Approaching When Flashing." The aim was to help drivers on the minor road determine a sufficient gap to safely complete their turn and to warn drivers on the major road that a vehicle was stopped or entering the intersection from the minor road.

Study results showed that when the alert signs were flashing, vehicle speeds on the major road decreased, drivers on the minor road waited longer before crossing, and vehicle "roll-throughs" of the stop sign were eliminated.

However, a significant unintended consequence was also observed, says research assistant Husam Ismail. "We discovered that the drivers depend completely on the warning sign, so they're ignoring the stop sign," Ismail says. Consequently, when the alert sign

was not flashing, drivers on the minor road may have assumed there was no cross traffic, and the number of roll-throughs increased.

This raises the risk of a crash if the device stops working and could indicate an overdependence on the warning system, Ismail says. Local residents voiced similar concerns, worried that some drivers would no longer obey stop signs or look for oncoming vehicles when the warning signs weren't flashing.

The current phase of the project, ALERT-2, aims to reduce the percentage of roll-throughs on the minor road as well as improve the design for easier maintenance. Besides Ismail, the team for this phase includes UMD professor Taek Kwon and traffic engineer Victor Lund with St. Louis County Public Works.

As part of the new phase, researchers replaced the static stop sign with an LED blinking stop sign and removed the "When Flashing" label under the warning sign. Cameras and detectors captured both before- and after-installation data on roll-throughs at the intersection, which the team expects to analyze by fall 2013.

"We need the vehicle on the minor road to respect the stop sign, whether there's a conflict [present] or not," Ismail says. If the percentage of roll-throughs can be reduced, he adds, the system could significantly improve the safety of rural intersections with severe sight restrictions.

According to Lund, the system shows promise to improve intersection safety by helping drivers make good decisions for turning movements. "The next step is to deploy dozens of these systems so that further research can be completed on developing a crash-reduction factor," Lund says.



In the latest phase of the project, researchers removed the "When Flashing" label from the warning sign and added LED flashing lights to the existing stop sign.

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ONLINE**

for links to research reports and other resources.

to transportation.

Transportation-related environmental factors such as air quality are also related to public health: vehicles create about half of all air pollution, and poor air quality leads to public health problems like asthma and lung cancer.

On the other hand, transportation also has historically been a major contributor to public health improvements, according to Ehlinger. “In the 20th century, Americans added 30 years to their life expectancy; 25 of those added years have been linked to public health accomplishments, including transportation-related improvements such as vehicle safety advances and increased seat belt use.”

However, in recent years, gains in longevity have leveled off. “Chronic disease has become the leading cause of death, but instead of focusing on prevention we are investing about 95 percent of our resources into medical care,” he said.

To continue improving health in the 21st century while also getting health care costs under control, Ehlinger advocates the concept of health in all policies. “Health in all policies takes a collaborative approach to health by integrating health considerations into policymaking and programming across all sectors, and transportation is a key part of that.”

Promisingly, recent transportation trends offer tremendous opportunities for public health improvements. Transportation



Implications of integrating public health with transportation

After Minnesota Department of Health Commissioner Edward Ehlinger delivered the conference’s keynote address (see page 1), a panel of experts discussed what impacts and opportunities his message of “health in all policies” will have on the transportation community.

Where are the opportunities to connect public health and transportation?

“There is an emerging set of practices around the integration of transportation and health. What’s exciting is the range of those practices,” said University of Minnesota Humphrey School of Public Affairs associate professor Carissa Schively Slotterback. “There are many regional transportation plans that focus on advancing active transportation and health throughout the region. We’re also seeing the integration of active transportation options in numerous projects across the country including

corridors, ports, freight projects, and trails. The Health Impact Assessment is really emerging as a key tool—it is an explicit way to explore that intersection between health and transportation, think about a broad range of health impacts, and bring in the social determinants of health.”

What should transportation professionals be doing differently to promote good health?

“I would like to see a more conscious balancing of the transportation modes,” said Michael Huber, a cardiovascular health consultant for Blue Cross and Blue Shield of Minnesota. “It’s not about forcing people to walk or bike. It is about giving them a choice so that they can make a decision. We have spent countless dollars redesigning our transportation system to accommodate the single-occupancy automobile and it is going to take some time to work ourselves out of that, but we have to start.”

safety initiatives aimed at eliminating crash-related deaths and serious injuries, such as the Minnesota Toward Zero Deaths program, have led to a marked decline in traffic fatalities during the past decade.

In addition, the number of vehicle miles being driven in the United States is dropping, and young people are leading that trend. "If we drive fewer miles, we will reduce the likelihood of obesity. The question is whether this trend will reverse or continue, and that is largely up to the transportation community," said Ehlinger.

"Transportation is in the midst of transformational change ... from a model that moves cars to a model that moves people through a safe, accessible, and affordable system," said Ehlinger. "This is our opportunity to reshape the transportation system and create the infrastructure we need while also improving our health and quality of life."

"Health in all policies takes a collaborative approach to health by integrating health considerations into policymaking and programming across all sectors, and transportation is a key part of that."

—Edward Ehlinger

EACH ADDITIONAL HOUR
spent in a car per day is associated with a

6%
INCREASE
in the likelihood of obesity.

Catalyst Year in Review

During the first year of *Catalyst*, launched in July 2012, these were the most-read stories online:

#1: EVALUATING PEDESTRIAN AND BICYCLIST RISK IN MINNESOTA ROUNDABOUTS

#2: NICE RIDE SPURS SPENDING NEAR STATIONS

#3: SMARTPHONE RESEARCH AIMS TO HELP VISUALLY IMPAIRED PEDESTRIANS

The stories are available online in the *Catalyst* archive.



How can public health and transportation professionals work together to reduce fatalities on our roads, now and in the future?

"I think it is helpful for all of us to look at highway fatalities in a more global way," said Minnesota Department of Transportation deputy commissioner and chief engineer Bernie Arseneau. "Ten years ago we would look at our roads, determine where fatality hot spots were, and try to fix them, but in 2003 we changed our model [with the Toward Zero Deaths program] and began to look at safety more collaboratively. We realized if we were going to have success reducing fatalities, we needed to bring in partners." According to Arseneau, continuing to work with public health organizations to address behavioral issues, including intoxicated driving and unrestrained drivers and occupants, is one key way to continue decreasing highway deaths in Minnesota.



Microwaves and taconite improve pothole repair

In a sense, we're still living in the olden days of pothole repair, when most are fixed by the "throw and go" process. Its name says it all—just throw in the hot mix of fill material and move on to the next hole. And you'll probably have to do the same thing with the same potholes next year—if not next week.

But with a little help from microwaves and magnetite, the olden days may soon give way to a golden age of long-lasting pothole repairs. Research led by Lawrence Zanko, a senior research fellow at the University of Minnesota Duluth's Natural Resources Research Institute (NRRRI), indicates that mixing ground magnetite—an iron mineral found in taconite ore—into the asphalt patch material and then "nuking" it with microwaves will seal the patch far more securely than conventional methods.

Zanko got the idea for using microwaves and magnetite about 10 years ago from his colleague David Hopstock, who had worked in the U.S. Bureau of Mines in the Twin Cities. The research project gradually grew, and the two eventually contacted Microwave Utilities Inc. (MUI), a Monticello-based company that had a prototype mobile technology that uses microwaves to thaw frozen ground.

Working with MUI designers and engineers, the researchers pursued a project with Anoka and St. Louis counties to test the microwave and magnetite technology for pothole repair. Results were impressive.

"We did some repairs in an Anoka main street in April 2011, and they were holding up a year later," says Zanko. Current side-by-side studies with conventional repairs indicate improved durability and longevity, but it's too early to calculate the full lifetime of the repair.

The process includes removing excess water and debris from a pothole and adding a mix of ground-up recycled asphalt pavement and shingles and powdered magnetite. A generator then produces microwaves that travel through an aluminum tube to a stainless steel box placed over the pothole and surrounding pavement. Within minutes, microwave heating raises the repair area temperature. With mixing and compacting, the fill binds well to the existing pavement.

"What I like about it is that it's particularly effective in winter, when so many other repair options don't work too well," Zanko says. "A week later those other repairs may be failing or gone."

Zanko and his colleagues are also working on a new taconite-containing repair mix formula that sets in 10 to 15 minutes—without any microwaves. The new project is sponsored by the Minnesota Department of Transportation. Zanko is optimistic that at least one of the repair methods involving taconite will become standard for all seasons.

"We consider this to be semi-permanent to permanent," he says. "Currently, if a repair lasts the season, it's considered a success. But we think that when these [microwave and magnetite] repairs are done, they're done."

Adapted from a UMNews article by Deane Morrison.



The microwave equipment is used to heat the pothole repair and surrounding pavement.

NEW RESEARCH REPORTS

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

**RIDERSHIP AND
PEDESTRIAN
IMPACTS OF TRANSITWAYS**

(CTS Research Brief 2013-01)

**THERMAL BRIDGE
MONITORING**

(MnDOT 2013-12)

**MITIGATING
CONSTRUCTION
USING TRANSIT**

(MnDOT 2013-13)

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

New mobility from page 1

A number of transportation trends fall under the definition of new mobility, Deakin said, including car sharing, bike sharing, carpooling, smart transit, smart cars, and smart highways. Importantly, while these new mobility approaches have typically been used in urban areas, many of the ideas—such as car sharing, ride sharing, and bike sharing—can work in rural settings as well.

The reasons for the growing interest in new mobility are diverse. From a government perspective, it can enhance mobility, save money, reduce congestion, decrease environmental impacts, and improve public health. For users, it creates more transportation options, greater flexibility and affordability, and health benefits while promoting environmental and social responsibility.

One of the driving forces behind the shift toward new mobility appears to be Millennials—the generation of 20-somethings that grew up building online communities through social media sites such as Facebook and Twitter. Today, they are using social

and mobile technology to build communities in the real world—and transportation is no exception. Dynamic ride sharing is just one example: commuters use their smartphones or tablets to request or offer a ride on the fly; the device’s GPS navigation capability is used to arrange the ride’s pick-up and drop-off points. “We’ve also seen an increasing interest in services where users create a network of friends and offer dynamic ride sharing only to that known group,” Deakin said.

Another growing carpooling trend is “casual carpooling,” in which drivers pick up passengers from established locations to share a ride without an ongoing arrangement. “It’s sort of like hitchhiking but more organized,” Deakin said. “The benefit is that adding riders qualifies the car for HOV lanes and saves everyone significant time off their commute.”

New mobility may also change our transportation system’s future. Transit will likely get a boost from new technologies that improve travel times with exclusive lanes, signal

preemption, off-board fare payment, and more. On the highway, the use of sensors to monitor traffic and control flows will help the whole system run more smoothly; vehicle-highway communication and vehicle sensors will improve safety.

According to Deakin, the move toward new mobility may be a way to bring together diverse views of transportation’s future. “One vision of the future is cities that are transit-oriented, while others envision a new world of vehicles that basically drive themselves. New mobility may be the way we integrate those two visions by matching them to the local context to create a transportation system that goes beyond a one-size-fits-all approach.”



24th Annual CTS Research Conference presentation slides and videos are available online.



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TO INTELLIGENT
TRANSPORTATION SYSTEMS,**
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NEW MOBILITY.
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