

CTS Catalyst

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Accelerating the pace of transportation innovation

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Automated speed enforcement study finds public support in Minnesota

Automated speed enforcement (ASE) is proven to be an effective strategy for reducing speeding and improving road safety. Its use in the United States, however, has been limited in part because of a perception by policymakers that it is unpopular and controversial. As part of a recent study, U of M researchers asked Minnesotans what they think of ASE. They found strong support—particularly for ASE in work zones and school zones and if revenues from fines are dedicated for road safety programs.

Frank Douma, associate director of the State and Local Policy Program in the Humphrey School of Public Affairs, shared findings of the study at the Minnesota Toward Zero Deaths Conference in October (see related article on page 5).

Automated continued on page 4

New treatment practice removes dissolved phosphate from stormwater

Stormwater treatment practices have long focused on removing suspended solids and particles from stormwater runoff. As much as half of the pollutants in stormwater, however, are actually dissolved compounds, including nutrients such as phosphorus. These pollutants are not settled or filtered in many existing stormwater runoff treatment systems found across the region, state, and nation.

Stormwater continued on page 7



New specifications help reduce low-temperature cracking

Good fracture properties are essential for asphalt pavements in Minnesota and other northern states, where low-temperature cracking is a common pavement distress. As temperature decreases, stresses accumulate in the pavement and eventually a crack or multiple cracks form.

To help select asphalt mixtures and binders that are resistant to low-temperature cracking, a team of researchers led by civil engineering professor Mihai Marasteanu has been working to develop new testing methods and specification criteria.

This project, the second phase of a study that began in 2003, was conducted in partnership with

the Minnesota Department of Transportation (MnDOT), the University of Minnesota, Iowa State University, the University of Illinois at Urbana-Champaign, and the University of Wisconsin–Madison.

As part of the project, the research team developed a new test for asphalt mixtures based on fracture mechanics principles. The test, called the disk-shaped compact tension (DCT) test, can better determine a mixture's resistance to low-temperature cracking than current methods that examine creep and strength properties.

After using the DCT test to evaluate the performance of laboratory mixtures and cores from in-service

pavements, the research team created new specifications that could reduce low-temperature cracking in asphalt pavements. The team identified parameters for binder grade and content, aggregate type and size, recycled content, and other properties that can help maximize a pavement's resistance to low-temperature cracking.

"This pooled-fund study is the culmination of over ten years of research," says Tim Clyne, materials and program delivery engineer at MnDOT. "The results can be used by [Minnesota and other] state DOTs to select the optimal materials resistant to thermal cracking."

According to Clyne, MnDOT is getting ready to implement the low-temperature cracking mixture specification on some pilot projects. In 2013, MnDOT plans to use the DCT test during mix design on up to five construction projects. Another project will involve taking core samples of existing pavements with a history of good or poor performance, conducting laboratory tests, and correlating the results and mixture properties with pavement performance.

"MnDOT will benefit [from these projects] by having superior performance of asphalt mixtures on our roadways," Clyne says. "These mixtures will exhibit reduced cracking, which will require less time, materials, labor, and money to maintain."



Pavement conference to share lessons from Duluth-area flooding

Major flooding struck northeastern Minnesota in June of 2012, causing more than \$100 million worth of damage. One of the speakers at the 17th annual TERRA Pavement Conference will share lessons learned for recovering from such a large-scale disaster. U of M research into sustainable pavement rehabilitation is also on the agenda, along with new ideas and techniques for providing long-life pavements. The event will take place February 14 on the St. Paul campus.

The annual conference looks at new pavement research and technology and examines national and local trends and innovations. It is sponsored by the Transportation Engineering and Road Research Alliance (TERRA), a partnership of government, industry, and academia, in cooperation with CTS and a number of organizations. For more information, visit cts.umn.edu/Events.

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Improving culvert design and service life in Minnesota

Researchers at the University's St. Anthony Falls Laboratory (SAFL) recently completed a project aiming to improve culvert design, installation, and monitoring throughout Minnesota.

As an important component of Minnesota's drainage network, culverts affect transportation, public and private property, health, quality of life, and safety.

"They're really an intersection point between the water resources in our state and the transportation infrastructure," said Jeff Marr, director of engineering and facilities at SAFL, in a CTS research seminar on October 25.

In the seminar, Marr provided an overview of the project and its goals, which included examining pipe material options, evaluating the current practice, and optimizing design for service life and performance. The study—led by Marr and SAFL associate engineer Craig Taylor—was funded by the Minnesota Department of Transportation (MnDOT) and SAFL.

Findings indicate that concrete is currently the most common type of material—about 76 percent of all culverts in Minnesota are concrete. Culverts made of steel pipe are the next most popular, with plastic pipes being by far the least common.

Culvert problems vary significantly by material, the researchers found. For concrete culverts, joint separation is "a major issue," Marr said. About 18 percent of all concrete culverts in Minnesota have joint separation problems, and about 14 percent of those lead to road damage.

For steel culverts, the researchers found that pH and soil resistivity measurements can help successfully estimate service life. MnDOT's District 3 currently tracks and records this information in a database, and Marr suggests expanding this practice statewide to help improve design decisions for steel culverts.

Marr also said that flaws in culvert installation, such as improper compaction or damage to pipe material coatings, can shorten a culvert's service life, particularly for certain plastic and steel pipes. "Installation monitoring is key to improved performance," Marr said.

Therefore, Marr and Taylor suggest adding a third party or contractor to conduct compaction testing when culverts are installed or examining other supplemental pipe inspection methods. Study recommendations also include gasketed joints for all concrete pipes, and more standard design goals for culvert service life. The researchers proposed a 100-

There are more than
95,000
CULVERTS
in Minnesota's state highway system.



year service life standard for centerline and mainline trunk highway culverts and 50 to 75 years for entrance culverts.

According to Andrea Hendrickson, state hydraulic engineer at MnDOT, the project's recommendations are being considered for inclusion in the MnDOT Drainage Manual.

"These changes should ultimately result in better pipe performance," Hendrickson says.



University of Minnesota reception at TRB

The University of Minnesota is hosting a reception for friends and alumni during the Transportation Research Board 92nd Annual Meeting in Washington, D.C. The reception will be held in the Wardman Lobby of the Marriott Hotel on Sunday, January 13, 2013, from 5:30 to 7:00 p.m.

Details are available at cts.umn.edu/Events.

ASE uses radar and cameras to identify a speeding vehicle and capture images of the license plates, and, in some systems, the driver. Citations are then mailed to the vehicle's registered owner or, alternatively, the identified driver. ASE has been deployed in 14 states and in many countries, especially in Europe, Douma said.

In a survey of more than 600 Minnesotans this past spring, the U of M team found that a majority (56 percent) either are very supportive (20 percent) or somewhat supportive (36 percent) of the concept of ASE, which is in line with national surveys. Support is even higher for using ASE in specific, limited locations, such as construction zones where workers are endangered (83 percent net support), on roads near schools (82 percent net support), on roads where many have died (77 percent net support), and on roads where many people violate speed limits (69 percent net support). However, support for using ASE on all Minnesota roads falls just below the majority threshold, at 48 percent net support.

In addition, about seven in ten Minnesotans indicated they would be more likely to support ASE if the money raised from speeding tickets were used for local road safety improvements or if tickets were issued only to those driving at

extreme speeds, Douma said.

The researchers also examined the legal and related political obstacles for deploying ASE in Minnesota, including a state supreme court ruling that invalidated a Minneapolis red-light photo enforcement ordinance. The court's ruling was narrow, Douma explained, and did not bar automated enforcement generally or the concept of owner liability.

Moving forward, Douma said deploying ASE in Minnesota would require authorizing legislation, particularly to clarify liability issues and the role of local authorities. The researchers recommend that if legislation were drafted to authorize pilot testing of ASE, it should focus on school zones and MnDOT work zones.

State Senator Kathy Sheran said the research findings and recommendations provide the groundwork for shaping potential legislation. "We're beginning to work on the design of legislation in order to do what we need to do [to authorize a pilot]," she said. "We're exploring, and we're learning from other states." (A related article about systems in Illinois and Iowa is below.)

The study was funded by the Intelligent Transportation Systems Institute (a part of CTS), and a final research report is on the CTS website.



In 2010, more than
10,000
PEOPLE LOST THEIR LIVES
in speed-related crashes in the United States.

In Minnesota, between 2008 and 2010, illegal or unsafe speed was a contributing factor in

266
FATAL CRASHES,
resulting in
296
DEATHS
and crash-related costs of more than
\$360
MILLION.



Illinois has a statewide photo speed enforcement program for work zones.

Automated enforcement: highlights from Illinois and Iowa

At the Minnesota Toward Zero Deaths Conference, speakers from Illinois and Iowa described highlights of their automated speed enforcement programs.

Illinois passed legislation in 2004 authorizing a statewide photo speed enforcement program for work zones, said Priscilla Tobias, state safety engineer with the Illinois DOT. The law also raised fees to \$375 for the first ticket (part of which goes toward a hire-back surcharge for additional officers) and \$1,000 for a second ticket. And drivers with two tickets within two years get a 90-day suspension of their license. The program is funded out of state operational funds and is not a "money generator or self-sustaining," she said.

Cameras take pictures of front and back license plates as well as drivers. An officer reviews the images and certifies citations, which are processed by a private vendor and sent by certified mail to offenders. Because the offense is a moving violation, it counts against the driver's record and requires a court appearance.

The program has improved safety for construction workers, officers, and motorists. "The reduction in speeds is amazing with it," Tobias said. "In the Chicago area, for example, we had a 75 percent reduction in crashes." Public pushback has

Toward Zero Deaths program: saving lives through collaboration

Reaching the goal of zero deaths on Minnesota's roads will require collaboration by many organizations and disciplines. On October 22 and 23, a record-setting 955 people committed to traffic safety came together at the 2012 Minnesota Toward Zero Deaths (TZD) Conference in Bloomington.

Created in 2003, Minnesota TZD is the state's cornerstone traffic safety program, employing an interdisciplinary approach to reducing traffic crashes, injuries, and deaths on Minnesota roads. The "zero deaths" idea was first adopted in Sweden in 1997 and since then has spread to Minnesota and a number of other states. A national TZD strategy is also under development.

The conference was offered by Minnesota TZD and the Minnesota Departments of Public Safety,

READ CATALYST ONLINE

for links to research reports and other resources.



Transportation, and Health, and hosted by CTS.

The conference featured several safety experts from the University of Minnesota. Steve Simon, a retired law professor, received a TZD Star Award in the category of Distinguished Public Leadership. A leader in the fight against impaired driving, Simon created the Minnesota Criminal Justice System DWI Task Force in 1982 to convene stakeholders from multiple disciplines. He served as the task force's director until he retired in 2012. Simon has also been responsible for providing training on DWI law, field sobriety

testing, and breath testing procedures to new judges. He is the only law school professor in the country to have taken such an interest in DWI and traffic safety cases.

In a concurrent session, Frank Douma, a researcher with the Humphrey School of Public Affairs, discussed issues related to the deployment of automated speed enforcement in Minnesota (see related article on page 4). In another session, Douma shared findings from a study of Minnesota's primary seat belt law. The study estimates that the law resulted in 68 fewer deaths and 320 fewer severe injuries from 2009 to 2011.

Ben Schooley, a researcher in the U's Center for Excellence in Rural Safety, gave an update on CrashHelp, a smartphone-based system that allows emergency responders to collect multimedia data about crash victims on-scene and send it directly into emergency rooms. (More about CrashHelp is in the August 2012 *Catalyst*.)

Selected presentations from the conference, as well as many other resources, are available on the redesigned TZD website: **.minnesotatzd.org**. The site was developed and is managed by CTS.

been minimal, she added.

Sgt. Mike Wallerstedt of the Cedar Rapids, Iowa, Police Department said his city has been using automated traffic enforcement since 2010 on a problem section of I-380 and at certain intersections with high crash rates.

These are municipal enforcement programs, Wallerstedt said. The Iowa legislature has not authorized them, but the state supreme court ruled that they comply with state code.

Photos are taken of the back license plate but not of the driver. As in Illinois, an officer reviews the evidence and issues the citations. Citations don't count against the offender's driving history or require a court appearance. The base fine is \$75.

The results? Since automated enforcement began, the number of crashes in the problem section of I-380 has fallen 54 percent, Wallerstedt said.



Cedar Rapids, Iowa, is using automated speed enforcement on a problem section of I-380 that runs through the city.

Urban competitiveness and transportation in the Twin Cities

A recent study sponsored by the University Metropolitan Consortium examined the urban competitiveness of the Twin Cities metropolitan region by evaluating its performance in several key areas, including transportation.

The study, conducted by former graduate student Victor Gauto from the Department of Applied Economics, also compared the Twin Cities to seven peer metropolitan areas on economic competitiveness measures ranging from education to environmental quality.

Overall results show that the performance of the Twin Cities varies greatly among the competitiveness indicator areas. Although the Twin Cities excels in such areas as health and education, its performance in economic and social equity measures was mixed. The Twin Cities has a relatively low unemployment rate, a high share of high-quality creative workers, and low inequality and poverty rates, but it ranks near the bottom of the list on real gross domestic product per job and on maintaining a middle class.

In terms of transportation, the study found that the Twin Cities performs relatively poorly compared to its peer cities. Although the Twin Cities ranks third in such measures as hours of delay and the annual costs of traffic congestion, it had lower performance than most peer cities in the areas of vehicle-miles traveled (VMT) per capita, per capita carbon footprint, workers commuting by bus, and workers commuting by driving alone.

According to the study, Portland, Oregon, especially outperformed the Twin Cities in transportation and related environmental measures. For example, 78 percent of Twin Cities drivers commuted by driving alone in 2009, compared to only 71 percent of Portland drivers. The study also found that Portland had a lower VMT per capita than the Twin Cities—7,642 and 9,585 miles, respectively—even though Portland covers a larger land area.

To improve the performance of the Twin Cities in transportation-related competitiveness measures, Gauto suggests taking steps to relieve congestion on highways, discourage sprawl, and reduce VMT and commuters driving alone.

More information about the project is available in the Summer 2012 issue of the *Center for Urban and Regional Affairs (CURA) Reporter*.



Exhibitors sought for career expo

The 2013 Transportation Career Expo will be held March 5 from 4:30 to 7:15 p.m. at Coffman Memorial Union on the Minneapolis campus.

The expo allows companies and agencies to network with students and recent graduates and tell them about their organizations and job opportunities. It also offers an opportunity for professional organizations to reach out to students as potential members.

If your organization would like to exhibit at the expo, please register online by January 31.

For more information, visit cts.umn.edu/Events/CareerExpo.



NEW RESEARCH REPORTS

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

**REAL-TIME TRAFFIC
MONITORING ON URBAN
ROADWAYS**

(CTS 12-35)

**FULL-DEPTH PRECAST
CONCRETE BRIDGE DECK
SYSTEM**

(MnDOT 2012-30)

**ANALYSIS OF A HEADING
DETERMINATION SYSTEM**

(CTS 12-36)

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

Stormwater from page 1

Researchers at the U of M's St. Anthony Falls Laboratory (SAFL)—led by research scientist Andrew Erickson and professors Peter Weiss and John Gulliver—have identified techniques to remove the dissolved compound phosphate from stormwater, with excellent results. Their iron-enhanced sand filtration system, named the Minnesota Filter, has been installed in a number of locations around the Minneapolis–St. Paul metro region. The research was funded by the Minnesota Local Road Research Board.

The Minnesota Filter is a new technique in which iron filings are added to a sand filtration system. When exposed to rainfall, the iron forms iron oxides (rust), which adsorb phosphate. The system can be used in many applications including surface sand filters, wet detention basins, permeable weirs, ditch check blocks, and rain gardens, Erickson says.

The system was first installed in Maplewood in 2009 using 5 percent iron filings by weight. A number of similar systems have been installed, such as a field test in Prior Lake that used 7 percent iron filings in trenches for wet detention ponds. Results from monitoring initial installations show an average of 70 percent phosphate reduction in stormwater.

The cost of the system depends on the size and type of the installation. In one example, a quarter-acre site, material and labor costs increased by about 15 percent (for mixing the sand and iron). For other applications, more efficient approaches could get the additional cost down to perhaps 5 percent or 10 percent. “We’re improving that all the time with how we spec it,” Erickson says. “And even though it costs more, other practices are not touching that dissolved fraction.”

Cliff Aichinger, district administrator for Ramsey Washington Metro Watershed District, says the Minnesota Filter has “worked extremely well.” Aichinger was a member of the technical advisory panel for the original project that developed this technology, and his district did the first field installation. “We have adopted it as a practice virtually every chance we get,” he says. “And the cost is minimal.”

Not all sites are candidates for a Minnesota Filter. Pollutants carried by stormwater can vary greatly with different locations, storms, times of year, and pollutant sources, Erickson explains. Most urban watersheds need to treat both solids and dissolved compounds.

Since the installations are relatively new, maintenance requirements are still being determined. Lab modeling indicates the system will last more than 35 years before the iron runs out of capacity, which is longer than the design life of most filter systems. The next several years of monitoring will provide data about maintenance cycles and disposal issues, Erickson says.



The Minnesota Filter can be used in many applications, such as this site in Maplewood.

Photo: SAFL and Andrew Erickson

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Researchers developed a filtration system
that is

REMOVING PHOSPHATES

from Twin Cities
STORMWATER.

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New specifications help practitioners select
materials that

REDUCE LOW-TEMPERATURE CRACKING

in asphalt.

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Researchers aim to

OPTIMIZE

CULVERT DESIGN

for service life and performance.

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