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Accelerating the pace of transportation innovation

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Photo courtesy SRF Consulting Group, Inc.

Funding highway projects with value capture could speed project completion

There's broad agreement that the U.S. transportation system cannot continue to be funded with existing financing and revenue-generation methods. What's not clear, however, is how to pay for highway projects in the future. The current transportation funding system emphasizes user fees, but there is growing interest in alternative funding strategies. One promising strategy is value capture, which aims to recover the value of benefits received by property owners and developers as a result of infrastructure improvements.

Value capture continued on page 6

New Complete Streets guidebook offers practical insights for implementation

Across the United States, the Complete Streets movement is becoming more influential in transportation planning, design, and engineering. As part of this movement, a variety of jurisdictions are considering a more comprehensive range of modes and users in their systems.

To help Minnesota practitioners implement Complete Streets in their communities, researchers from the Humphrey School of Public Affairs have published a guidebook filled with insights and best practices. The guidebook—*Complete Streets from Policy to Project: The Planning and Implementation of Complete Streets at Multiple Scales*—explores what it takes to successfully move Complete Streets from concept to implementation.

Complete Streets continued on page 5



Photo courtesy Cindy Zerger

Public trust funds could pay for infrastructure, dividend checks



Funding the nation's transportation system using a per-gallon fuel tax worked well for decades. Now, however, the system is under severe strain, says Cornell University's Rick Geddes. Policies encourage motorists to drive more efficient vehicles, and people seem to be driving less. The fuel tax is not indexed to inflation—and was last raised in 1993—so its purchasing power has declined by about a third. Combined, these factors spell decreasing revenues just as investment needs are rising for our aging infrastructure.

Economists widely agree that switching to a system that charges per unit used—similar to how heat and electricity are paid for—is the best solution. The problem, Geddes says, is that a mileage-based user fee system “currently is a political non-starter.” Geddes, professor of policy analysis and management, and research assistant Dimitar Nentchev developed a new approach for road pricing that they believe will make it more appealing: an investment public-private partnership (IP3) feeding a public trust fund.

Geddes described the approach at

the CTS Winter Luncheon in Minneapolis on February 12.

Pricing new capacity such as freeway expansion is already feasible. “The challenge is overcoming resistance to pricing existing capacity in a system-wide manner,” Geddes said. The key to greater acceptance rests on how the revenue is used. Options could include giving tax rebates to motorists or net revenues to jurisdictions through which a road passes.

The problem with such options, Geddes explained, is that they ignore the existing ownership of the facility. In the case of a corporation, shareholders have the right to the revenue generated; with public infrastructure, citizens are the asset owners and have the right to the revenue stream from tolling. This “publicization” of infrastructure assets (the flip side of privatization) better recognizes the existing, inherent property rights of citizen-owners, he says.

The IP3 generates large, upfront concession payments that monetize asset value through public-private leases. All or part of the concession fee (Geddes suggests 70 percent) would be paid into

a permanent fund—a type of public trust fund—to capitalize it. “If invested wisely, the fund generates a dividend forever to all citizen-owners of the transportation facility,” he said. The remainder of the fund could be used to develop road projects and alternatives such as transit.

Permanent funds already exist in Alaska, Alberta, Texas, Wyoming, and Norway. Alaska's by far is the best known, Geddes said. Income from oil leases funds an annual dividend payment to every Alaskan (\$878 in 2012); the fund was worth \$42.1 billion as of August 2012. “It tells you that it's a serious fund with real assets.”

U.S. interstates have enormous value, and the country's well-known system of property rights and contracting enforcement make the U.S. market extremely appealing for investors. “You will get a big pot of money if you do these concession leases,” he predicted.

In response to several questions from the audience, Geddes added that moving from theory to implementation would involve addressing a number of issues, such as subsidizing less marketable rural roads, sharing revenues across jurisdictions, and determining eligibility for dividends.

A report describing the concept in more detail—*Road Pricing and Asset Publicization*—is available on the Cornell Program in Infrastructure Policy website.

In 2010 the U.S. had
47,182 MILES
OF INTERSTATE
VALUED AT
\$2.5
TRILLION.

New automated reporting tool offers insight into Twin Cities traffic congestion



Like many major metropolitan areas, the Twin Cities has a large number of data-collection stations positioned throughout its highway system that produce a vast amount of traffic data each year. However, collecting data is the easy part—effectively using the data is another story.

Each year, the Minnesota Department of Transportation (MnDOT) uses the collected traffic data to produce a congestion report examining the behavior of the network over time. “The report, however, has always been created manually using time-intensive methods and only a small sample of the available data,” says John Hourdos, director of the U of M’s Minnesota Traffic Observatory. “For this project, our aim was to reduce the time investment required to convert the available traffic data into useful information.”

In a MnDOT-funded project, researchers designed a tool to accomplish this objective and named it the Highway Automated Report Tool (HART). It works using a three-step

process. First, a simple user interface guides the user through corridor, time, and report selection. Next, the data are cleaned and data errors are corrected, then entered into a database. Finally, the report is generated and displayed in a standardized, user-friendly format.

In addition to automating the creation of the state’s annual congestion report, HART also includes several additional performance reports that provide greater insight into the operation of Twin Cities freeways. These include a new version of the congestion report that takes into account the number of lanes on each section of freeway, a report that estimates the “lost potential” of the freeway system due to traffic bottlenecks, a report that shows how much room each highway segment has for additional use, and reports that show the maximum and total traffic throughput available for each highway segment.

“The creation of HART is the first step toward streamlining and improving the performance-based management tools available to monitor the health of the

Twin Cities highway network,” Hourdos says. “HART enables users to clean and store data quickly for easy analysis, widens the spectrum of available performance measures, and gives planners more information with which to make critical planning and congestion management decisions.”

In the future, MnDOT traffic engineers can use HART’s flexible coding language to maintain, update, and implement changes to the program. Researchers expect this will make HART a living program that can grow as monitoring needs shift and change over time.

“The HART program will allow us to produce our congestion report more efficiently, requiring less staff time to process the data for the report,” says Brian Kary, freeway operations engineer with MnDOT’s Regional Transportation Management Center. “This new tool will allow us to process traffic data in new ways that were not possible before without significant effort, thus improving MnDOT’s ability to track performance of the metro freeway system.”

Monitoring bridge scour with safe, cost-effective technology

The general public expects Minnesota's bridges to be reliable, safe, and constantly maintained. But river floods and high-flow events can cause bridge scour—the erosion of riverbed material around bridge foundations—that can result in a loss of structural integrity and even the catastrophic failure of a bridge.

In Minnesota, crews normally monitor bridge scour with portable devices, which require manual measurements of streambed levels and structures. Manual monitoring methods are often expensive and difficult, and they can be dangerous.

In a project funded by the Minnesota Department of Transportation (MnDOT), researchers at the University of Minnesota's St. Anthony Falls Laboratory (SAFL) have been testing fixed, hands-off monitoring technologies installed on two scour-critical bridges in Minnesota. Fixed scour monitoring could be a safer and more cost-effective alternative to manual monitoring methods because it allows for continuous monitoring without requiring personnel to be constantly on site.

At a CTS seminar on February 6, Jeff

Marr, associate director of engineering and facilities at SAFL, gave an overview of the ongoing research.

"It's a bridge engineering challenge," Marr said. "We're designing, constructing, and maintaining a static engineering structure—an important structure—in a complex and dynamic environment."

Marr and his team installed sonar, pressure stage sensors, and float-out devices on two high-traffic bridges in Winona and Mankato. The devices are powered by solar panels and send data to a master station at SAFL where they are analyzed and logged into a database. The technology also includes a warning system, which sends e-mail alerts to specialists at MnDOT and SAFL if a scour event occurs.

Flood material and debris present the biggest challenge to deploying fixed monitoring systems, since debris can quickly destroy equipment. In fact, MnDOT deployed some fixed monitoring systems in the early 2000s, Marr said, but the equipment was damaged by debris and is no longer operational.

Researchers will maintain and track the Winona and Mankato devices for three years. Afterward, they will review the data and create a final detailed report for MnDOT. If the systems are successful, additional fixed monitoring systems could be installed on other bridges in the state.

Next steps for the project include further validation of the prototype system's data to check for errors, Marr said. More work is also being done to make the technology as hands-off as possible.

"Really this is a project to demonstrate what's involved in deploying these kind of technologies," Marr said.

**READ
CATALYST
ONLINE**

for links to research reports and other resources.

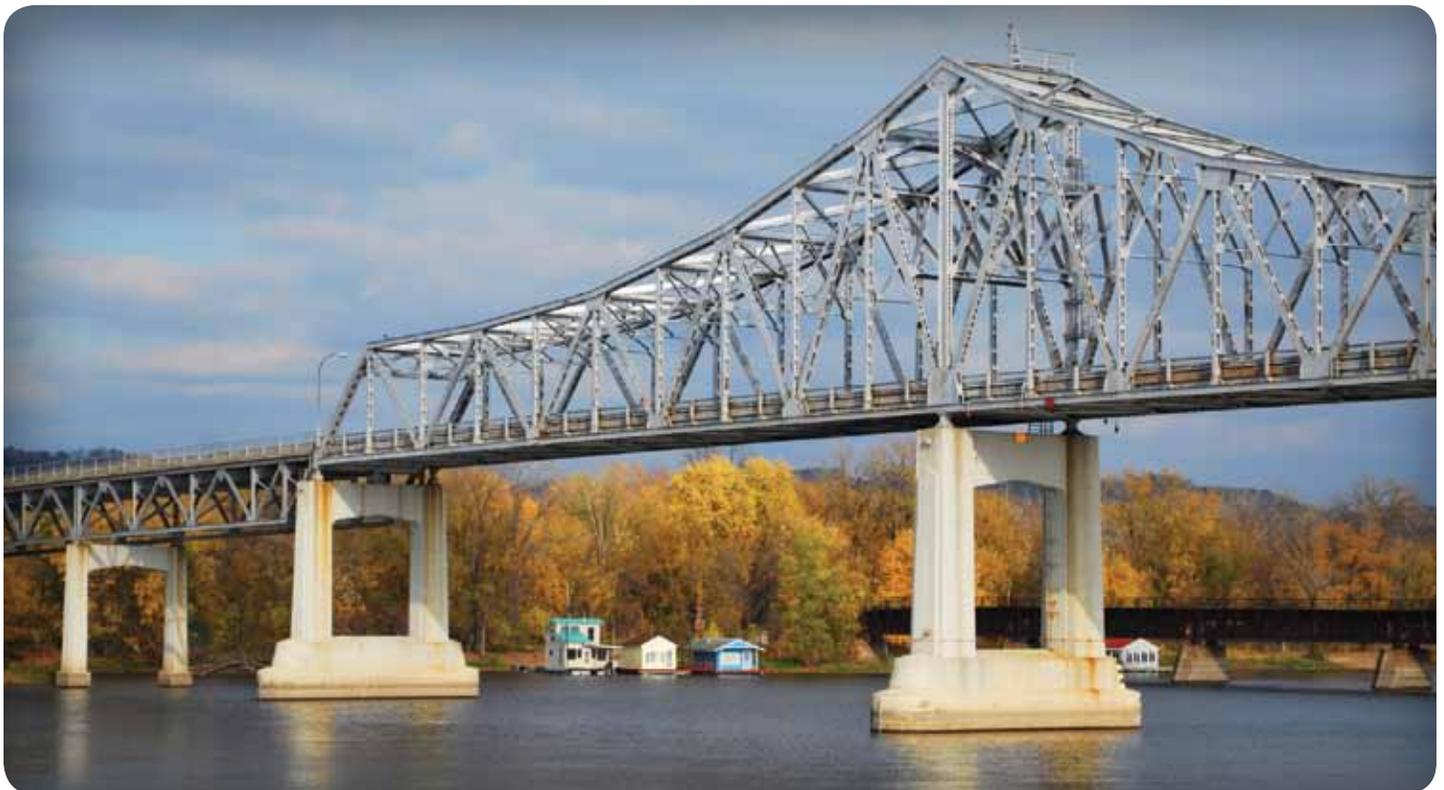


Photo courtesy Matt Lueker, SAFL

The Highway 43 bridge in Winona, Minnesota, is one of two bridges SAFL researchers equipped with fixed scour-monitoring technology.

Complete Streets from page 1

The guidebook is based on research funded by the Minnesota Department of Transportation and the Minnesota Local Road Research Board. As part of the study, Associate Professor Carissa Schively Slotterback and research fellow Cindy Zerger investigated Complete Streets projects in 11 locations across the nation (see article in August 2013 *Catalyst*).

Study locations included communities in Minnesota, Virginia, Colorado, North Carolina, Ohio, Iowa, North Dakota, Wisconsin, and Connecticut. For each location, the researchers reviewed key documents, completed site visits, created photo documentation, and conducted in-depth interviews with key stakeholders.

Drawing on this information, the guidebook explores policy, process, design, maintenance, and funding approaches. It includes sections that feature background information, details on the study's methodology, and six best practice areas that range from project delivery to promotion and education. The guidebook also presents key examples in each best practice category.

"By presenting key examples, we offer both deep detail

about each practice and critical aspects of the organizational and jurisdictional context," Zerger says.

This approach ensures that practitioners not only learn about the best practices, but also gain insight into the approaches that might be best for their particular context.

"We hope this guidebook will allow practitioners in Minnesota and other areas to learn from other cities, counties, and regions that are moving from Complete Streets concept to implementation," Zerger says.

The guidebook is available on the CTS website.



Photo courtesy Carissa Schively Slotterback

Study explores how Minnesota counties deliver medical transportation assistance



Under Minnesota's Medical Assistance (MA) program, Minnesota counties are responsible for providing transportation assistance to MA recipients so they can obtain the health care services they need. This assistance is called non-emergency medical transportation (NEMT), and its purpose is to lower overall medical costs by reducing the barriers for MA recipients to access routine care.

A recent study funded by the Minnesota Council on Transportation Access (MCOTA) investigated how Minnesota counties are using transportation coordinators to provide and administer these NEMT services in an effort to boost information sharing and improve NEMT coordination.

"The study's goal was to show how different counties are administering the program so they can share

best practices," says Noel Shughart, planning coordinator at the Minnesota Department of Transportation's Office of Transit and lead staff person for MCOTA. "Without more information sharing, the counties don't have the ability to develop together and improve as a group."

As part of the study, research fellow Frank Douma and research assistant Thomas Garry from the Humphrey School of Public Affairs surveyed several Minnesota counties about their use of transportation coordinators to deliver NEMT services. In these counties, coordinators serve as intermediaries among MA recipients entitled to assistance, the county, and the transportation providers that deliver services.

Results show that using a coordinator helped counties increase the efficiency of their NEMT delivery by centralizing transportation expertise and the ride arrangement process. However, the wide range of coordination structures in use among the surveyed counties comes with both benefits and challenges.

The diversity of programs allows

counties to choose a structure that fits their resources and needs, and it enables individuals to receive service that's tailored to their county and their needs. However, individuals that relocate to a different county may have to learn a completely different system to receive medical transportation services.

In spite of the challenges, overall findings indicated that the county-based system in Minnesota is more efficient, customer friendly, and cost-effective than other methods of delivery. It allows local officials to leverage their knowledge about the population they serve as well as the transportation and health care providers in their area—a value that would be lost with a regional or statewide coordination model.

"These benefits shouldn't be discounted in favor of uniformity," Shughart says. "The county diversity can be a challenge, but it's also a strength for us. We need to recognize the system's shortcomings and address them without losing the benefits to customers or the cost-effective service delivery model."

Value capture from page 1

In recent years, University of Minnesota researchers have helped lead the way in value capture research with a series of reports identifying value capture strategies. In a newly published study, the research team applied their previous work to a real-world scenario, with impressive results. The new research, sponsored by the Minnesota Department of Transportation (MnDOT), focused on the planned development of Trunk Highway 610 (TH 610) in Maple Grove, Minnesota—a stretch of planned state highway delayed for years by state transportation funding shortages. Researchers set out to discover how the value of the enhanced accessibility provided by the planned improvements could be predicted and captured to help fund the project’s completion.

“Typically trunk highway funding is provided solely by MnDOT, and any enhanced value that comes from transportation improvements are windfalls enjoyed by property owners and developers or—to a lesser extent—local property tax gains,” says lead researcher and Humphrey School of Public Affairs associate professor Jerry Zhao. “However, by estimating the value of transportation improvements and implementing strategies to capture that revenue, we

The completion of TH 610 in Maple Grove would lead to a more than

\$17 MILLION INCREASE IN PROPERTY VALUE

for the study area.

can supplement project financing and expedite project completion.”

“This research on a developing strategy to finance transportation infrastructure breaks new ground,” says Matt Shands, transportation economic development program director at MnDOT’s Office of Transportation System Management. “There has never been an attempt to quantify the potential revenue impact from value capture in Minnesota before. Understanding that impact will be essential as Minnesota and its local governments consider value capture financing strategies in the future.”

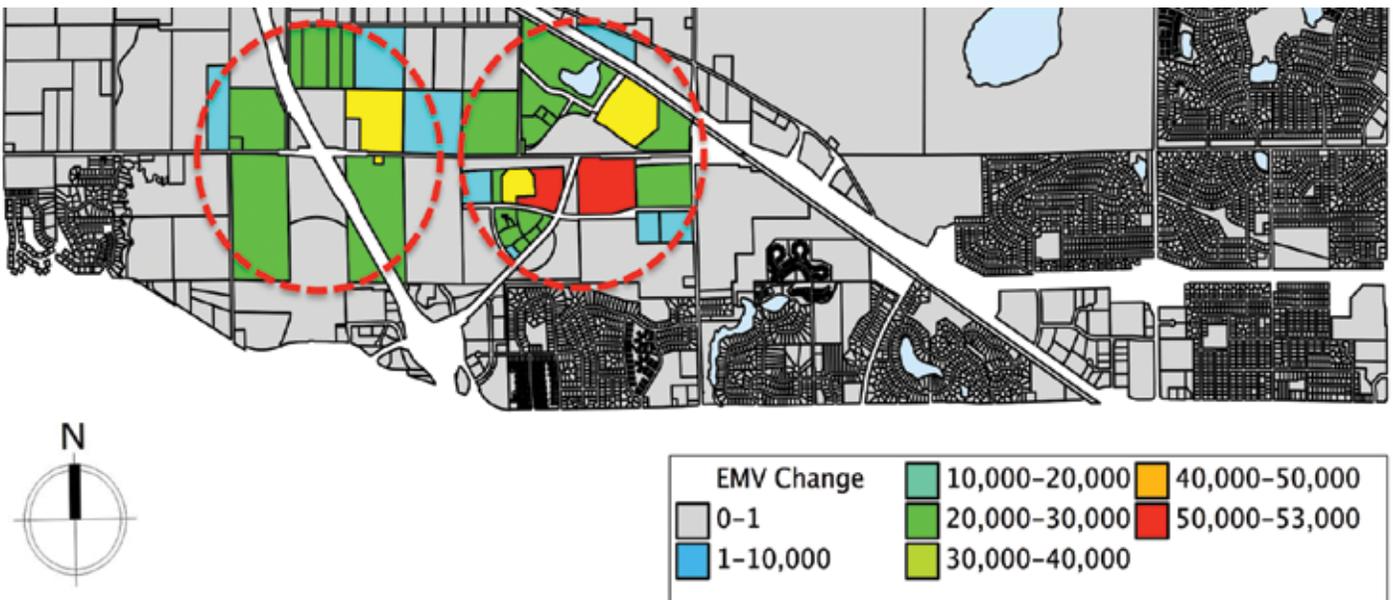
To accomplish their goal, researchers first defined a study area of about 10 square miles surrounding the unfinished highway segment. Then, they modeled

property values based on five factors using parcel-level data. This model was designed to isolate the so-called “highway premium” by controlling for other factors that affect land value including water views, open space, railroads, transit stops, and existing highway exits. Using this model, researchers found significant evidence of a highway premium.

“We discovered that the completion of this highway would lead to a more than \$17 million increase in property value for the study area,” Zhao says. “The revenue potential of this increase using various value capture strategies ranges from about \$12 million to about \$37 million.”

Researchers expect these findings to have significant benefits for the TH 610 project and beyond. “If the value capture strategies are implemented, they could generate millions in additional funding and accelerate the completion of the project,” Zhao says. “Even if the results are not used to help with this project, we have demonstrated a way to estimate the value of transportation projects and communicate that to the public. This method can greatly assist transportation agencies and stakeholders as we work to solve our nation’s transportation funding shortage.”

Predicted estimated market value change



Researchers predict that if two new exits are added off TH 610 in Maple Grove, the estimated market value (EMV, \$/acre) of nearby land would increase significantly.

New technology will improve diagnosis of pavement problems

When diagnosing a patient, doctors often rely on advanced imaging technologies such as X-rays and MRIs. In recent years, civil engineers have also used technologies such as the falling weight deflectometer (FWD) and ground penetrating radar (GPR) to pinpoint what's going on beneath a pavement's surface and diagnose pavement problems. GPR generates a cross-sectional image of the pavement's subsurface, while FWD measures stiffness of the pavement layer.

"These tests offer significant benefits over the traditional, labor-intensive method of taking core samples," says University of Minnesota civil engineering professor Joe Labuz. "They are non-invasive and can be performed quickly with minimal traffic disruption, which improves highway safety."

Though FWD and GPR are now widely used by civil engineers in the United States, both have room for improvement. The data interpretation needed for these tests can be overly simplistic, and inherent assumptions can reduce each test's accuracy when they are used in standalone fashion, Labuz says.

To improve the effectiveness and accuracy of these tests, a team of University of Minnesota researchers—Labuz (the principal investigator), graduate student Shuling Tang, and Professor Bojan Guzina—created a new software tool for field engineers called GopherCalc. This new software package combines the analysis of both FWD and GPR data into a single tool. By integrating the two tests, calculations and results from one test can be used to inform the other. This reduces the number of assumptions needed to analyze the data, thereby increasing their accuracy. Their work was funded by the Minnesota



Like an X-ray for roads, GopherCalc helps see what's going on beneath a pavement's surface.

Department of Transportation (MnDOT).

"The project provides a good tool for MnDOT to use for pavement evaluation," says Shongtao Dai, a research operations engineer with MnDOT's Office of Materials and Road Research. "Traditionally, only peak value from FWD sensor response is used for pavement backcalculation. GopherCalc uses dynamic history data from GPR and FWD for the backcalculation and pavement thickness calculation, which should provide more reasonable results. So, GopherCalc has potential to improve pavement structure evaluation in the future."

The GopherCalc software is designed to be user-friendly for the field engineer. It uses simple menu-driven navigation and makes it easy for users to switch back and forth between the two programs, one for FWD and one for GPR, simplifying the analysis process.

"With this software, field engineers will be able to easily gain more accurate test results that can be used to make better judgments about a pavement's condition," Tang says. "This will help highway departments determine how to best invest limited pavement rehabilitation dollars to achieve the greatest impact."

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