

# CTS Catalyst

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Accelerating the pace of transportation innovation

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## Bike, pedestrian counting efforts engage local agencies statewide

Across Minnesota, local agencies need better information about where and how many people are biking and walking to make decisions about infrastructure investments, understand safety risks, and even plan active living initiatives.

To help provide agencies with bicycle and pedestrian traffic data, U of M researchers have been working with the Minnesota Department of Transportation (MnDOT) on the Minnesota Bicycle and

*Bike counting continued on page 7*

## MnPASS extension on I-35E shaped by U of M study

Based in part on a planning study conducted by U of M researchers at the Humphrey School of Public Affairs, the Minnesota Department of Transportation (MnDOT) is extending MnPASS Express Lanes on Interstate 35E in the northeast Twin Cities. The extension will build on the project currently adding MnPASS lanes from Cayuga Street to Little Canada Road.

The study, funded by MnDOT and the Federal Highway Administration (FHWA), examined the feasibility of extending these MnPASS lanes from Little Canada Road north to County Road 96. During peak periods, MnPASS lanes provide a congestion-free option to transit vehicles, carpools, and motorcycles at no cost—and to single-occupant vehicles for a fee.

*MnPASS continued on page 6*



Photo: David Gonzalez, MnDOT

# Does telecommuting alter travel behavior and residential choice?

The potential of telecommuting to alter travel patterns—and even mitigate congestion during peak hours—has sparked interest among transportation planners. Despite this potential, however, the actual impact of telecommuting on traffic has remained an open question.

“In practice, the relationships between telecommuting and travel behavior vary,” says Jason Cao, an associate professor with the Humphrey School of Public Affairs. “For example, an individual might replace a commute trip by working at home but make another non-work trip because of the time savings from not making the commute trip.”

In a recent study, U of M researchers examined the impacts of telecommuting on travel behavior in the Twin Cities metropolitan area. One key finding: regular, non-daily telecommuting is on the rise. While those who telecommuted every day dropped, the number of people who telecommuted once a week or more increased, Cao says.

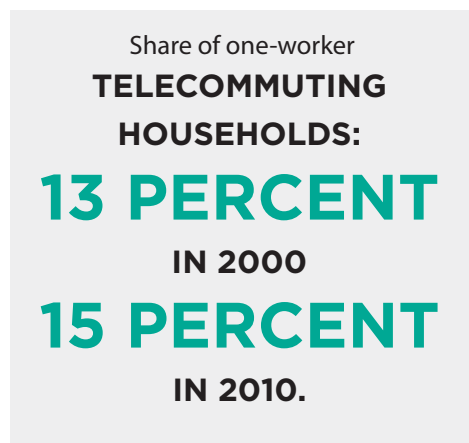
The research team’s first task was investigating how telecommuters and non-telecommuters differ from each other in terms of demographic and land-use characteristics. To explore the impact

of telecommuting on other household members, the team divided the data into one-worker households and multiple-worker households. Some sample findings:

- In one-worker households, telecommuters tended to be more affluent, more highly educated, older, and more likely to have multiple jobs than non-telecommuters.
- Multiple-worker telecommuting households tended to be more affluent, have more members, and live in more job-rich areas than non-telecommuting households.

Next, researchers set out to determine how telecommuting replaces or complements auto use. Their data analysis shows that the effects of telecommuting on travel are limited for multiple-worker households, but that it tends to increase travel of one-worker households, particularly for non-work travel. The team also found that the share of one-worker telecommuting households increased from 13 percent in 2000 to 15 percent in 2010, and other telecommuting frequency categories also increased, Cao says.

Finally, researchers examined how



telecommuting affects where people choose to live. Research results indicate that while telecommuting has no influence on commute distance for one-worker households, it tends to decrease average commute distances for multiple-worker households. “This suggests that the ability of one worker to telecommute may motivate the household to seek a location closer to the workplace of other household members and reduce the average commute distance,” Cao says.

“This research has revealed the complexity of telecommuting patterns and the real differences in travel between occasional, regular, and daily telecommuters,” says Jonathan Ehrlich, planning analyst with the Metropolitan Council. “We need to be aware in planning how Internet and mobile technology both replace some and necessitate other travel.”

This research is part of a five-part report sponsored by the Metropolitan Council and the Minnesota Department of Transportation based on data produced by the council’s Travel Behavior Inventory household travel survey.

Additional components of the report examine how changing accessibility of destinations has affected travel behavior, changes in walking and biking, the effect of transit quality of service on people’s activity choices and time allocation, and transportation system changes.

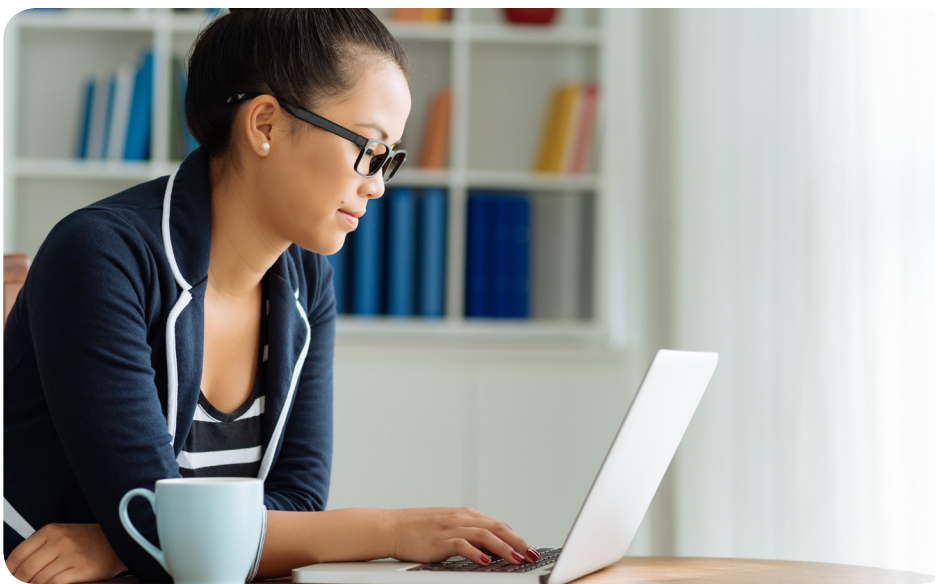


Photo: Shutterstock

# Livable, sustainable cities are focus of global research network



The University of Minnesota has received a \$12 million award from the National Science Foundation to bring together a unique network of scientists, industry leaders, and policy partners committed to building better cities of the future.

The project is directed by Anu Ramaswami, professor at the Humphrey School of Public Affairs at the University of Minnesota, with co-directors Patricia Culligan at Columbia University and Armistead Russell at Georgia Institute of Technology.

The network will connect nine research universities, major metropolitan cities in the U.S. and India, infrastructure firms, and policy groups. It is the first network of its size to focus on ways to reimagine infrastructure—road networks, energy grids, green spaces, and food and water systems—to create cities that are highly functional, promote the health of residents and the environment, and are desirable places to live and work.

“We have to think in new ways about a city’s physical infrastructure to develop sustainable solutions,” says Ramaswami, the Charles M. Denny, Jr. Chair in Science, Technology, and Public Policy at the

Humphrey School. “Understanding that these systems are interconnected serves as a foundation for this work.”

The project will focus on a new movement gaining momentum in cities around the world toward “distributed,” or more local, infrastructure. Until now, development trends have resulted in very large infrastructure systems such as large roadway networks and power grids. Emerging trends suggest cities may be better off building more local systems—bike-share systems, local solar generation, and more. The new network will try to identify the best mix of local and large to achieve urban sustainability, health, and livability goals by examining infrastructure in diverse cities in the U.S. and India. The team will also explore the public attitudes and policies that can help achieve such urban transitions.

The work of the network is organized into three themes. The first theme will develop science-based methods to track the environmental sustainability, health, and livability of cities. It will draw on U of M researchers from different colleges and disciplines. For example, by combining real-time tracking of well-being (using a smartphone approach) linked with

social and infrastructural parameters, Associate Professor Yingling Fan assesses the interactions among people, infrastructures, and the environment as they shape health, well-being, and livability. Associate Professor Julian Marshall and Assistant Professor Matteo Convertino study the influence of urban design on air pollution and health, bringing perspectives from the College of Science and Engineering and the School of Public Health, respectively.

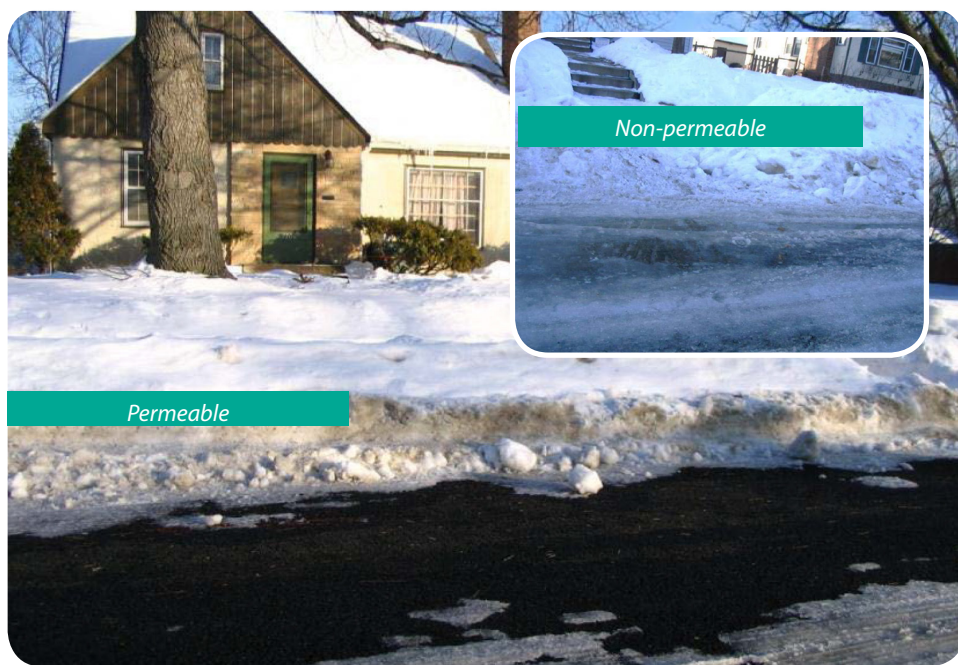
The second theme will identify the innovations needed in infrastructure design and social institutions. Researchers will draw upon new technologies being incubated in university laboratories as well as infrastructure innovations being piloted in real-world test-beds in partner cities. For example, Humphrey School professor Greg Lindsey and associate professors Jason Cao and Jerry Zhao will identify key features that enable light-rail, car-share, and bike-share programs to succeed.

The third theme will operationalize the new knowledge to model various policy and technology scenarios in diverse world cities.

“Our project presents an exciting new networked model for research and education, where students, faculty, and professional partners from the different universities will take courses together and work together to study infrastructure solutions in different cities,” says Fan, a co-investigator on the project.

For more information about the project, visit [sustainablehealthycities.org](https://sustainablehealthycities.org).

## Permeable pavements could improve safety, benefit environment



*Snow and ice melt faster on permeable pavements, reducing the need for road salt.*

In the quest for pavement options that improve road safety and are friendly to the environment, permeable pavements may be an answer, according to findings of a new study.

Researchers led by Professor John Gulliver of the Department of Civil, Environmental, and Geo-Engineering (CEGE) completed a comprehensive review of permeable pavement research and construction in northern climates. The project, funded by the Minnesota Department of Transportation (MnDOT) and the Minnesota Local Road Research Board, revealed that permeable pavement systems offer a number of environmental and safety benefits.

Permeable pavements are designed to absorb water and allow it to drain directly into the underlying layers of a pavement structure. They generally consist of a surface layer of a permeable material (asphalt, concrete, or pavers), and then one or more layers of aggregate with void spaces that can store stormwater runoff until it infiltrates into existing soil or is carried downstream by drain tile, Gulliver explains.

Infiltration is considered a “green” treatment of road runoff, and the permeable pavement will filter any water that runs off through the drain tile.

Other benefits include a big reduction in water spray during storms, greater skid resistance, a smoother ride, and noise reduction, Gulliver says.

The final report includes findings from nine case studies of permeable pavements in Minnesota and other northern climates. In a project in St. Michael, for example, MnDOT researchers studied and compared the durability, maintenance requirements, hydrologic benefits, and environmental considerations of two porous asphalt sections and one densely graded asphalt section.

“The permeable pavements performed well in ride quality, permeability, strain response, safety, and quietness,” Gulliver says. “As an added environmental benefit, they also performed better in the water quality of runoff and infiltration. This could offer a solution to environmental problems involving stormwater runoff into lakes and streams, which often occurs with conventional non-permeable pavement structures.”

Additionally, the study showed that snow and ice melted faster on the permeable pavements because of the void space, which allows heat from the ground to rise and keep the pavement

warmer overall. The permeable pavement was also quiet and provided better skid resistance—an important safety measure for drivers—than a dense-graded impermeable surface.

Mark Maloney, Shoreview’s city engineer, says the use of permeable pavements allowed the city to eliminate the need to build and maintain conventional stormwater infrastructure such as inlets, pipes, and ponds in the city’s Woodbridge neighborhood.

“One benefit was that the city was able to accomplish its goal of reconsidering public infrastructure to modern, sustainable standards without negatively impacting the character of residential neighborhoods,” he says.

Overall, Gulliver says, the study’s findings indicate that permeable pavement, with its many safety and environmental benefits, is a viable alternative in Minnesota. In addition, it may be the only alternative that will reduce the amount of harmful chloride from road salt reaching surrounding bodies of water.

Other researchers in the study included Peter T. Weiss of the Department of Civil Engineering at Valparaiso University, Masoud Kayhanian of the Department of Civil and Environmental Engineering at the University of California-Davis, and CEGE professor Lev Khazanovich.

**READ  
CATALYST  
ONLINE**

for links to research reports and other resources.

# Internship program helps students build skills, make connections

While some interns spend their days making copies and coffee runs, Caitlin Johnson spent her summer internship working on a research project exploring ways to improve safety in work zones.

Johnson, a fifth-year civil engineering student at the U of M Twin Cities (UMTC), is one of eight students from UMTC and the U of M Duluth who participated in this year's Summer Transportation Internship Program.

Interns worked at the Minnesota Department of Transportation (MnDOT) for 10 weeks and gained valuable transportation-related experience in areas ranging from designing roadways to measuring pavement movement. The program, offered jointly by CTS and MnDOT, is now in its fourth year.

This year's participants included the following students, working in these MnDOT offices:

- Caitlin Johnson, Office of Traffic, Safety and Technology
- Mamadou Mbengue, Office of Environmental Stewardship
- Ellie Lee, Office of Design
- Luke Horsager, Bridge & Hydraulics Office
- Sheue Torng Lee, Materials & Pavement Office
- Trenton Pray, Materials & Concrete Office
- Colleen Tamara Maluda, Environmental & Vegetation Office
- Lucas Karri, Bridge Office

Johnson, who worked in the Office of Traffic, Safety, and Technology, says her internship at MnDOT gave her the opportunity to study a topic that hasn't been explored in-depth in the past and present those findings to industry professionals, including staff from the Federal Highway Administration.

"I've been finding things that people weren't really expecting," Johnson says. "And it might change the way that we go about making work zones safer."

While Johnson worked primarily in the office, civil engineering student Luke Horsager spent much of his internship with the Bridge & Hydraulics Office outside, equipping MnDOT boats with



2015 summer interns with MnDOT commissioner Charles Zelle and CTS director Laurie McGinnis

new GPS and Bluetooth software used for river mapping and monitoring bridge scour. He says he enjoyed gaining hands-on experience with the technology.

"Learning how to operate and troubleshoot the new software has been really valuable," Horsager says. "Gaining an understanding of this technology is going to be universally applicable later on."

MnDOT engineer Nikki Bartlet supervised Horsager on the equipment setup project, but she says many of his duties were conducted independently.

"I think the biggest benefit [of the internship] for Luke is having to work and solve problems independently," Bartlet says. "He's done very well at that."

Heidi Gray, a MnDOT Metro District designer, supervised intern Ellie Lee in

the Office of Design. She worked with Lee on two design projects, including adding an auxiliary lane on I-94.

Gray says the internship program is valuable not only for the students, but also for the supervisors and MnDOT as a whole. While the interns gained important hands-on work experience and made valuable professional connections, MnDOT supervisors were introduced to talented young professionals, she says.

"It's really good to get young people in here and teach them what MnDOT is all about," she says. "I personally have enjoyed the opportunity to teach and pass along what I know. It's a good refresher."

## Man vs. machine...or Man + machine?

### CTS FALL LUNCHEON

November 9. McNamara Alumni Center. Minneapolis campus

Associate Professor Mary (Missy) Cummings will discuss where we are in terms of the state of automation and autonomy in our everyday lives, what the future likely holds, how to conceptualize the balance between humans and robots, and give a brief overview of some of the research currently under way in Dr. Cummings' lab at Duke University—the Humans and Autonomy Laboratory. Her research interests include human-unmanned vehicle interaction and the public policy implications of unmanned vehicles. Learn more and register at [cts.umn.edu/events/luncheons](https://cts.umn.edu/events/luncheons).



Photo: David Gonzalez, MnDOT

The extension will build on the I-35E MnPASS project currently adding express lanes between St. Paul and Little Canada.

Led by Director Lee Munnich and Associate Director Frank Douma of the Humphrey School's State and Local Policy Program, the U of M research team worked with Parsons Brinckerhoff to develop and evaluate several concepts for the MnPASS extension. The goal was to provide an option that reduced congestion for all users, including drivers in the general-purpose traffic lanes and transit users. The team also included Mary Vogel from the U's Center for Changing Landscapes.

The primary challenge was how to handle MnPASS traffic through the recently reconstructed I-694/I-35E interchange. Initially, options included continuing the MnPASS lanes through the interchange, suspending them through the interchange, or converting the shoulder through the interchange into a MnPASS lane during peak periods. However, traffic modeling showed that all of these options pushed the northbound traffic bottleneck further upstream, so the team created a fourth "hybrid" option.

"The hybrid option creates a continuous southbound MnPASS lane and a discontinuous northbound MnPASS lane through the interchange.

It also extends the northbound MnPASS lane one exit further north than originally planned, to County Road J," Douma says. "We found that this option significantly improved the level of service for the afternoon peak and produced the highest cost/benefit analysis results."

Researchers also engaged community stakeholders and corridor users to gather feedback about the proposed alternatives and worked to illustrate options that could facilitate greater transit, carpool, and vanpool use in communities along this section of I-35E.

Using this information, a team of representatives from MnDOT, the FHWA, the Metropolitan Council, and the U of M—with guidance from technical advisory and steering committees—developed a set of recommendations for the MnPASS extension. The recommendations included implementing the "hybrid" concept; continuing to educate community motorists about the MnPASS program; and expanding transit options by creating more park-and-ride sites, encouraging mixed land uses, and building better walking and biking connections.

Based on these recommendations, MnDOT is moving forward with the hybrid option for the project, says Brad Larsen, director of the MnPASS Policy and Planning Program. MnPASS lanes will be added to southbound I-35E between County Road 96 and Little Canada Road; through the I-35E/I-694 commons area, the existing inside lane will be designated as a MnPASS lane during peak periods. There will be no MnPASS lane northbound through the commons area, but a lane will be added north of the interchange from County Road E to County Road J.

"This study is a good example of how effective planning and analysis can cultivate action on a valuable transportation improvement," Larsen says. "Without the study, it's unlikely the 35E MnPASS extension project would have been advanced or its numerous benefits realized any time in the near future. We also anticipate that the land-use and transit enhancement component of the study will result in benefits that will serve the corridor for years to come."

Construction on the extension project is expected to begin in March 2016, with the lanes slated to open in late 2016.

Pedestrian Counting Initiative since 2010. The initiative is a collaborative, statewide effort to support bike and pedestrian traffic monitoring by local, regional, and state organizations.

Recently, the project team completed an implementation study—the second of three MnDOT-funded projects related to the initiative—specifically designed to engage local agencies. The goal was to demonstrate the feasibility of using both permanent and portable sensors to collect bicycle and pedestrian traffic data in several Minnesota cities, suburbs, and small towns.

“If we want to institutionalize counting and monitoring across the state, local agencies need to know it’s not something that’s only important for large cities like Minneapolis,” says principal investigator Greg Lindsey, professor at the Humphrey School of Public Affairs and current MnDOT scholar-in-residence. “We have to be on the ground in these places, illustrating that it’s relevant to the decisions they’re making.”

To that end, the team worked with agencies in Duluth, Eagan, Minneapolis, Bemidji, Grand Marais, Rochester, and Hennepin County during the implementation study. In these locations, the team installed commercially available sensors—including inductive loops, passive infrared, pneumatic tubes, and radio beams—to collect traffic counts. Overall findings indicate that all of the sensors produced reasonably accurate measurements—and that participating agencies found value in the collected data.

In Grand Marais, for example, the team collaborated with staff from the Sawtooth Mountain Clinic Moving Matters program and MnDOT District 1

to complete short-term counts around the city. The data were then used as part of the health impact assessment for a proposed Highway 61 corridor redesign project. The project, which aims to improve safety, access, and the economics and livability of the community, includes alternatives to improve bicycle and pedestrian infrastructure.

In Minneapolis, the research team demonstrated how traffic counts can be used to develop measures of average annual daily traffic (AADT)—a commonly used performance measure in transportation planning. The team used data from both permanent and short-term counters on the 80-mile Minneapolis trail network to estimate AADT for each trail segment. Researchers then estimated total miles traveled by cyclists on the entire trail network.

Findings and case studies from the study have already been incorporated into the draft *Bicycle and Pedestrian Data Collection Manual*, a new MnDOT guidance document being used in statewide training workshops. Also as a result of the study, MnDOT plans to include commitments to bike and pedestrian traffic monitoring in its forthcoming statewide bicycle and pedestrian plans. In addition, MnDOT is investing in a network of permanent traffic monitoring sites around the state as well as in portable equipment that will be available to local agencies.

“Integrating our efforts with local agencies is a powerful thing for us as we build an integrated, comprehensive transportation plan for Minnesota,” says MnDOT commissioner Charles Zelle. “The data can help show decision makers that people are using the vibrant bike and

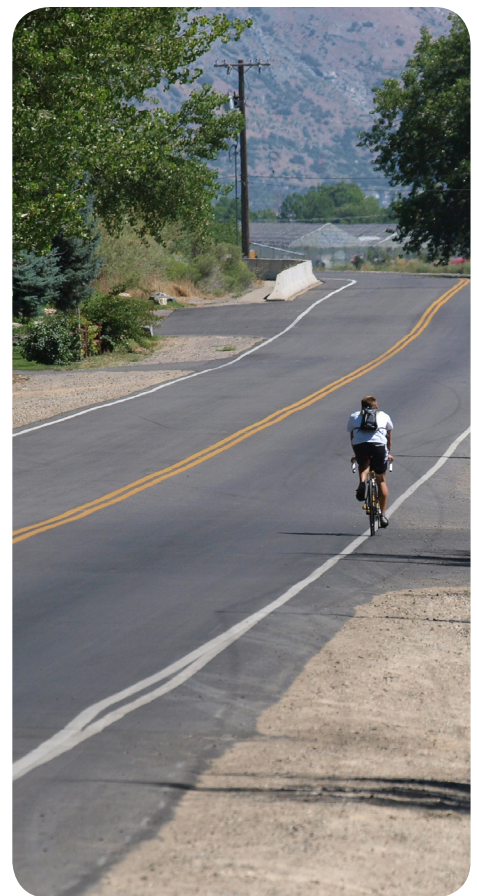


Photo: Shutterstock

pedestrian system across our state. It can also show our partners that [the system] is very much a part of our statewide economy, quality of life, and health.”

In 2013,  
**BICYCLISTS TRAVELED**  
more than  
**28 MILLION MILES**  
**ON MINNEAPOLIS TRAILS.**

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# Catalyst

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## U of M study helps shape **I-35E MNPASS EXTENSION PROJECT**

in the northeast metro.

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## Does **TELECOMMUTING** alter **TRAVEL BEHAVIOR** and **residential choice?**

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## U of M leads research network to build **LIVABLE, SUSTAINABLE** **cities.**

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## **Bike and pedestrian counting** efforts are engaging local agencies statewide.

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