

CTS Catalyst

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Accelerating the pace of transportation innovation

SUSTAINABLE CITIES

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How can governments promote and prepare for automated driving?

More than 90 percent of motor vehicle crashes are caused at least in part by human error. For the transportation community, this is a key motivator to encourage automated driving. However, despite its life-saving potential, automated driving has seen its share of pushback; in fact, some states have passed laws restricting it. So what role should government play in promoting this promising technology?

Automated continued on page 5

Warning system aims to save lives in highway work zones

For highway workers, work zones can be dangerous or even deadly. Each year more than 20,000 workers are injured and more than 100 lose their lives in U.S. highway work zones; most of those injuries and almost all of those fatalities are caused by either construction vehicles or passing traffic.

"The main solution for making work zones safer has always been reducing the speed limit," says Imran Hayee, a professor of electrical engineering at the University of Minnesota Duluth. But while strict enforcement of lower speed limits is necessary to make road construction sites as safe as possible, Hayee says, "Lower speed limits alone cannot guarantee workers' safety because there are

Work zones continued on page 7



Creating the sustainable, livable cities of tomorrow



One of the keys to creating cities of the future is looking to the past.

Today's cities have at least one thing in common: they all grapple with managing the challenges of transportation, infrastructure financing, housing, and environmental sustainability. These complexities are compounded by rapidly changing modes of operation, new and disruptive technologies, and changing expectations and demands from citizens and businesses.

In the opening session of CTS's 2016 Transportation Research Conference, Gabe Klein, author of *Start-up City: Inspiring Private and Public Entrepreneurship, Getting Projects Done, and Having Fun*, discussed the innovations taking place in our cities and examined how government, business, and nonprofit leaders can work together to use this wave of change and shape a better quality of life for the future.

Klein believes one of the keys to creating the cities of the future is looking to the past. "At the turn of the century people ruled the streets—they

got everywhere by walking, biking, or taking streetcars," he said. "It was only about 75 years ago that we built the [interstate] highway system, and not everyone benefitted. We built highways through neighborhoods and shut down the streetcars, which created a situation where more-affluent people left our cities for the suburbs and a way of life that revolves around consumption."

According to Klein, history is coming full circle and we are starting the return to an era of "people first" streets and collaborative consumption. "We can only fit so many cars on our roads, and cars change the economics of how people live," Klein said. "People are finally figuring out this equation, and we are seeing the rise of ride-sharing and bike-sharing services, light rail, transit-oriented development, and 'complete street' design in our cities."

City leaders are also starting to take note of the popularity of these types of projects. "We used to focus solely

How can local cities become the 'cities of tomorrow'?

Following Gabe Klein's opening presentation at CTS's 2016 research conference, a panel of local experts shared their perspectives on how the future of transportation will affect Minnesota's cities and how local leaders are positioning their cities to become the 'cities of tomorrow' that Klein envisions.

How should cities be thinking in order to take advantage of the opportunities Klein describes?

"One of the keys is getting people to change their perspectives, which can be very challenging—many still want a home in the suburbs with a three-car garage," said Chris Coleman, mayor of the City of Saint Paul. "However, if you look at the appeal of downtowns, you see the vibrancy of places that are walkable;

on throughput and safety, but people tend to take these things for granted," Klein said. "Leading transportation departments, I've seen that relatively inexpensive bike-sharing and bike-path projects generate much more excitement than big, expensive bridge and highway projects."

Moving forward, Klein said our goals need to shift to access, mobility, multimodal transportation, environmental quality, and livability. "We've seen that transit-oriented development works, and we need to get back to that model," Klein said. "Let's organize services around active and

places where people can work, play, live, and drink and never have to use a car. In the future, we will need to overcome the old way of thinking and build cities where we put people first. In addition, we need to ensure we build transit systems not just to where people are, but to where we want them to be.”

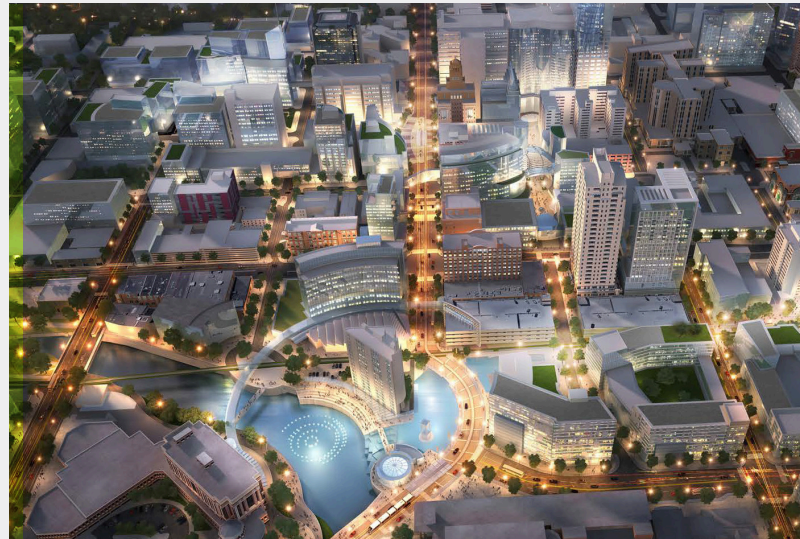
What role might the private sector play in creating the cities of the future?

“The private sector is playing a huge role in Rochester—our planning is now being driven by our Destination Medical Center,” said Ardele Brede, mayor of the City of Rochester. DMC is a 20-year economic initiative designed to position the city as a global medical destination center; more than \$5 billion in private investments are projected. “Our transportation principle for this project is to make it easy, affordable, and convenient for people from around the world to get to downtown Rochester, to create world-class streets designed for people, and to have at least 30 percent of our workforce coming to the city by transit. We also know that patients and their families who come for healthcare spend 70 percent of their time in the community, so the private sector will play a big role in creating the ample entertainment and leisure-time activities that are needed.”

How can urban transportation systems adapt to the needs of the future?

“In my research, we are examining the localizing movement toward local foods, energy, water treatment, and even

transportation systems in cities around the world,” said Anu Ramaswami, a professor in the U of M’s Humphrey School of Public Affairs. “We can see that the answer isn’t service through larger infrastructure, especially in light of the terrible air pollution problems we experience in cities like Beijing. We’ll need to move to smaller, more nimble transportation systems and ensure that the problems we have created with the development of the highway system here in the U.S. don’t become the planning paradigm in developing parts of the world.”



The vision for Rochester’s Destination Medical Center includes world-class streets designed for people.

shared transportation with links to other cities and rethink what transit is—other types of transit are emerging quickly, such as a car that can operate as a transit vehicle.”

Revamping parking in our cities is a promising starting point. “In the future, you won’t be able to drive your car into cities—roads will become active and shared transportation lanes and all those parking spaces can be repurposed for other uses such as affordable housing,” Klein said.

Finally, Klein emphasized that U.S. government agencies need to move beyond the idea that all transit and transportation systems must be run by the public sector and embrace the public-private partnership models that have been used successfully in other

parts of the world. “We need to align our incentives and investment and create true partnerships between the public and the private,” Klein said. “For example, Hong Kong’s transportation is run by the private sector, and it is one of the best transportation systems in the world. We need to study that example and others like it in Europe and Asia if we want to make sure transit is a crucial part of our future.”

Parking takes up a huge part of U.S. cities—

as many as

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Policy perspectives on connected and autonomous vehicles

Following the conference luncheon presentation, Bryant Walker Smith joined a panel of experts in a question-and-answer session that explored technical issues and broader policy perspectives of connected and autonomous vehicles.

Autonomous vehicles are probably legal in Minnesota. What would it take to remove the “probably”?

“Minnesota laws can lend themselves to an interpretation that there could be a problem because of definitional issues: that the driver must be a person, for example,” said Frank Douma, director of the State and Local Policy Program at the U’s Humphrey School of Public Affairs.

“The issue is what happens when something goes wrong. If something goes wrong in a partially or fully automated vehicle, you will look for what went wrong to cause the crash, not whether there was a person in the driver’s seat. If a technology failure is the cause, the liability will be with the manufacturer, not the driver. So you could redefine the driver or operator to be something other than a person. NHTSA is willing to consider the vehicle itself as the driver in certain situations.”

Which connected vehicle technology applications might be deployed in Minnesota in the next five years?

“It really depends on the progress in technology and legislation and regulation,” said Imran Hayee, professor of electrical engineering at the University of Minnesota Duluth. “I think that the second part is more important because the technology is there and could be used if there is a political will. It has been almost confirmed that connected vehicle technology could save many lives, and if this is implemented...safety applications will probably come first—electronic braking systems, do-not-pass warnings, collision warning systems, and so on.”

What implications will automated vehicles have on our existing revenue sources?

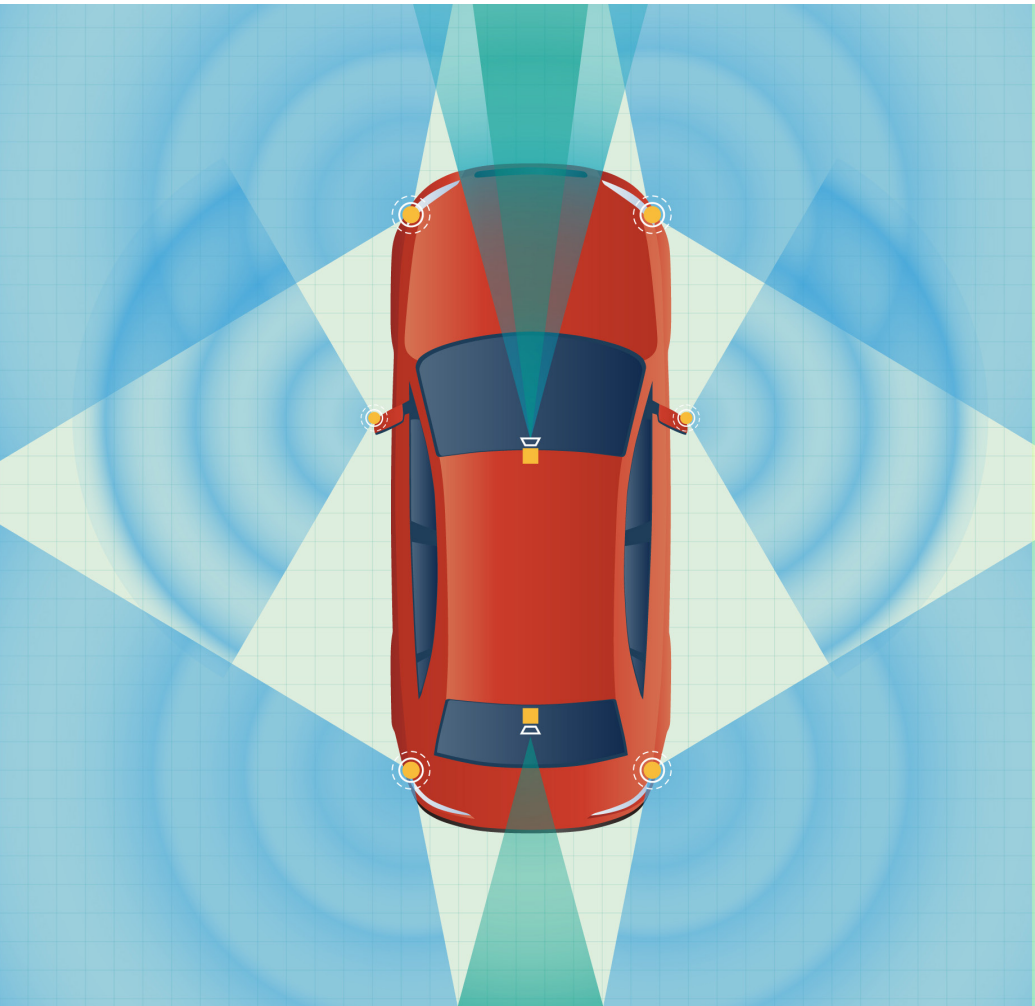
“Our major source of transportation revenue is the gas tax, which is essentially a distance-based tax,” said Ken Buckeye, project manager of the Transportation Finance Advisory Committee at the Minnesota Department of Transportation. “To the degree that automated vehicles are electric or use alternative fuels, we might

collect less tax. If we want to replicate [the gas tax effectively], we have to think about how that works with electric and automated vehicles. For example, automated vehicles will come with a lot of embedded technology that could enable us to collect distance-based charges in an efficient manner.”

How are connected and autonomous vehicles impacting planning efforts?

“All of the assumptions we have about this technology could change; we acknowledge that and can adapt,” Smith said. “We also tend to focus on the near term and immediate problems we can solve: let’s change the traffic code and think about infrastructure. Those are areas where private developers will have an incentive to do the heavy lifting. Developers don’t have the incentive in more difficult planning tasks, such as future land-use patterns and environmental impacts. That’s where the government does need to do more heavy lifting. It will require humanists and social scientists thinking about what we want our society to look like.”





In the luncheon presentation of CTS's 2016 research conference, Bryant Walker Smith outlined steps that governments can take to encourage the development, deployment, and use of automated driving systems. Smith is an assistant professor in the School of Law at the University of South Carolina and an internationally recognized expert on self-driving vehicle laws.

According to Smith, public perception barriers to new technologies like automated driving are nothing new. "In the late 1800s there was a big backlash against the bicycle, and a few decades later we saw cities passing laws outlawing cars," he said. "With any new technology, we tend to forget the old problems and only see the new problems being created."

One example of this response to automated driving was the public attention surrounding the fatal crash of

a self-driving Tesla in July 2016, which generated a flurry of news coverage. "What we didn't hear about were the 100 other people who died in car crashes that day," said Smith. "Our society focuses on the new, shiny, and scary to the exclusion of the highly imperfect status quo—a status quo that everyone agrees is a public health crisis."

To prevent this type of knee-jerk reaction, Smith encourages governments to take steps to "prepare, inform, clarify, restrict, and promote" automated driving. He gave several examples for each strategy: prepare by developing scenarios about the future of automated driving and examining the impacts of those scenarios, inform by creating a "break-the-glass" plan in case of a serious automated driving incident, clarify by specifying that the user of a commercial automated driving service is not the driver or operator of the vehicle, restrict

by mandating that any developer of an automated driving system file a 15-point safety assessment with the National Highway Traffic Safety Administration (NHTSA), and promote by internalizing the costs of driving.

"Driving today imposes all kinds of costs on others for which the driver does not pay, while automated driving has the potential to make driving safer and more economically efficient while improving land use by greatly reducing the need for parking spaces," said Smith. "If costs like gas, parking, enforcement, and insurance are borne more fully by the drivers of the vehicles, automated driving makes more sense. As a result, automated driving creates the opportunity to address issues like raising the gas tax and increasing insurance minimums by linking them to the excitement of this new technology."

Finally, Smith provided insight into the frequently asked question of who is liable for automated driving crashes. "Though liability is presented as a major issue, I would argue it is not a significant challenge," Smith said. "We can expect that with automated driving, crashes will decrease overall, so though product liability may come to represent a larger share of total crashes, the potential costs may not markedly increase. In addition, we are likely to see a service model rather than an ownership model with automated driving, so manufacturers will have flexibility to adjust their pricing as liability potential becomes clear."

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for links to research reports and other resources.

Students apply knowledge to real-world projects—and Minnesota communities benefit



One project explored bikeability to Southwest Transit stations.

Each year, the U's Resilient Communities Project (RCP) matches graduate and undergraduate students to sustainability-related projects in a Minnesota community. During the 2015–2016 academic year, RCP collaborated with Carver County and its partner organizations and agencies on 30 community-identified projects. As part of a CTS Research Conference session about RCP, several students shared highlights from their work.

Carver County's projects were matched with 50 courses spanning 22 departments across 8 colleges at the U of M, engaging more than 350 students. One student was Tyler Olson, a graduate of the Department of Civil, Environmental, and Geo-Engineering. As a student in the University's urban hydrology course, he took part in work on a best management practices (BMP) feasibility study for the Grace Chain of Lakes. The study, Olsen explained, involved analyzing the surrounding land, then modeling BMPs. The final deliverable was a combination of BMP recommendations that Carver County could implement to reduce the amount of phosphorus going into its lakes.

"In terms of program benefits, the industry experience was really valuable," Olsen said. "[Team members] had to create our own timeline and

figure out how to manage our project well, which is something you don't really get in a regular academic class. There were a lot of unknowns we had to deal with."

In addition, the team learned communication skills, navigated team dynamics, and made connections with practicing engineers, he said.

Another RCP participant, Sarah Sularz, used the RCP as her capstone for her master's degree in landscape architecture. The design project explored how to increase bike and pedestrian facilities near Southwest Transit (SWT) park-and-ride locations, create safe trails from residential communities to SWT stations, and increase the number of SWT commuters who do not rely on automobiles.

Sularz chose this project "because I wanted a job as soon as I graduated," she said. "And I got to work collaboratively with a committee member from my capstone in the Humphrey School, so I got a lot of interdisciplinary experience working with planners, people who are very interested in bike planning, as well as a lot of private firms in the Twin Cities that I got to collaborate with because it was a real project."

A critical part of her work, Sularz said, was to not only evaluate the benefits of increased bikeability and walkability, but

visually represent that for her clients in the form of a physical product they could distribute in the affected neighborhoods showing residents the potential changes, such as narrower vehicle lanes. She also needed to develop a safety framework and address environmental changes and impacts. Her project resulted in a 50-page design guideline and a visual framework for Carver County and the Southwest Transit Authority for the recommended proposals.

"And I'm happy to report that I was successful," she said. "I got my job, and I graduated."

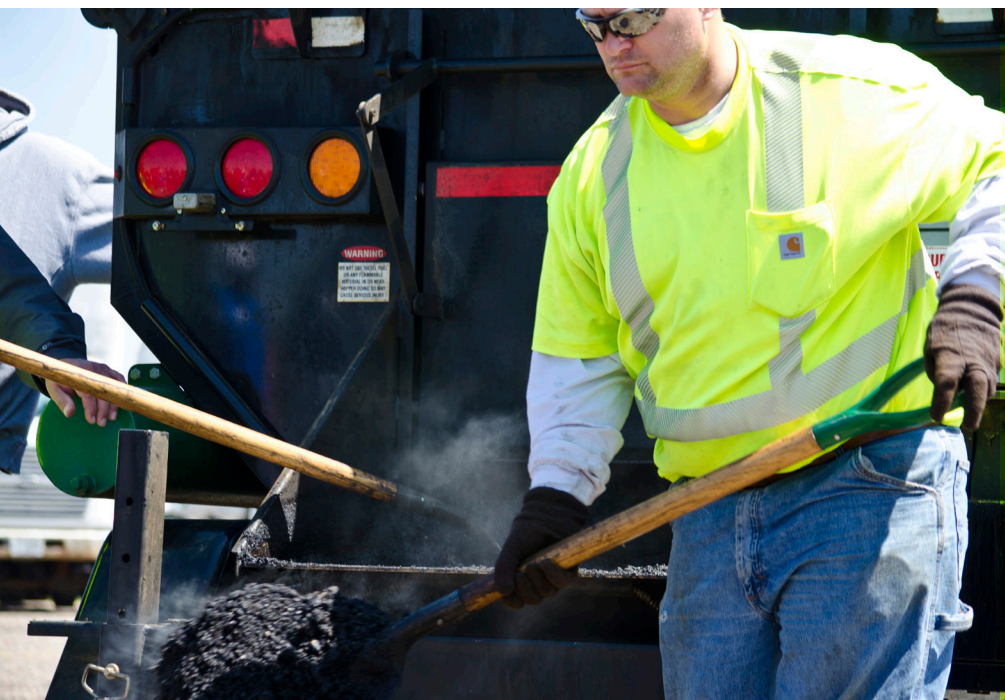
RCP is a cross-disciplinary program at the Center for Urban and Regional Affairs that supports one-year partnerships between the University and communities in the state to advance local sustainability and resilience. Each academic year, the program chooses a city or county partner through a competitive request-for-proposal process. RCP's goals are to provide the community with efficient access to the resources and expertise of the University, offer students a professional opportunity to apply their knowledge and skills to a real-world project, and provide faculty with ready-made applied-learning opportunities for the classroom. More about the program is at rcp.umn.edu.

More than

350

STUDENTS

were engaged in Carver County's projects.



serious safety risks from sources other than passing vehicles.”

In a project funded by the Roadway Safety Institute, Hayee is investigating another way to help reduce the number of injuries and fatalities in work zones: by alerting the operators of heavy construction vehicles, as well as drivers in cars passing by work zones, that construction workers are present.

To accomplish this, Hayee and his research team designed and developed a system to improve worker safety by providing visual guidance to construction vehicle operators about a workers’ presence in the vicinity. The system can also improve work-zone

traffic mobility by dynamically posting suitable speed limits and other warning messages on variable message signs based on whether workers are present in a work zone.

The new warning system operates using dedicated short-range communication (DSRC) technology and consists of three main components: DSRC-based wearable safety devices, a construction vehicle with an onboard DSRC device and monitor, and DSRC-equipped variable message signs. Workers wear a miniature DSRC-equipped device embedded in their safety vests, which constantly broadcasts each worker’s GPS location to the DSRC

device installed on a nearby construction vehicle. The construction vehicle’s DSRC unit is connected to a monitor that shows the vehicle operator the workers’ real-time positions and warns them if a worker is dangerously close. Finally, DSRC-equipped variable message signs placed near the work zone automatically detect workers’ presence and dynamically change the work-zone speed limit when workers are nearby.

“When lower speed limits are permanently in place regardless of workers’ presence, traffic mobility decreases, causing congestion at work-zone sites and increasing the potential for rear-end crashes,” Hayee says. “Our system provides an automated way to post the appropriate speed limits in work zones, which improves traffic mobility without compromising worker safety.”

After developing the prototype system, researchers conducted field tests to demonstrate its functionality and evaluate its performance. Test results show the system works: it’s able to display the workers’ positions on a tablet with acceptable distance and directional accuracy for successful visual guidance. Future plans for the warning system’s development include adding audio warnings, creating a prototype wearable safety device that includes “caution” and “panic” buttons and can be embedded into a worker’s vest, and conducting real-world tests in an active work zone.

University of Minnesota reception at TRB

The University of Minnesota is hosting a reception for friends and alumni during the Transportation Research Board 96th Annual Meeting in Washington, DC. The reception will be held at the Anthem Restaurant in the Marriott Marquis on Sunday, January 8, 2017, from 5:30 to 7:00 p.m. Details are available at cts.umn.edu/events/trbreception.

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SAVE LIVES
IN HIGHWAY WORK ZONES.
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LIVABLE CITIES**
of tomorrow.
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