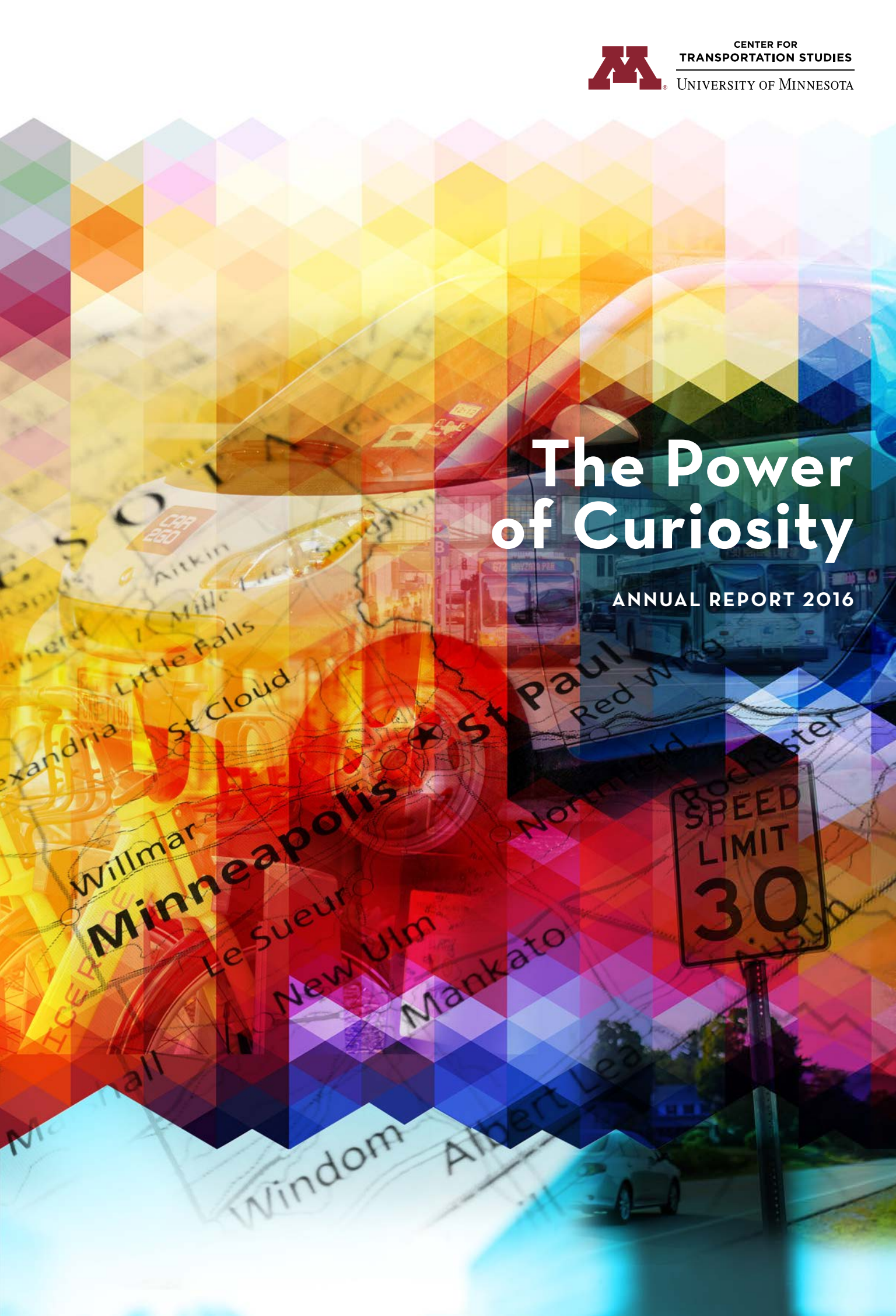




The Power of Curiosity

ANNUAL REPORT 2016



CURRICULUM DISCO NOW



C U R I O S I T Y



Curiosity. We see it in the sparkling eyes of a teen at a campus summer camp. It's there in the bright minds of university students. It's a driving force for the scholars who explore everything from nano-platelets to the sharing economy.

At the University of Minnesota, curiosity becomes discovery. Discovery becomes knowledge. Knowledge becomes innovation that transforms our lives, our state, and our world.

At CTS, we channel curiosity to make transportation better. The creative energy of world-class scholars is borne in models and algorithms, protocols and guidelines, technologies and apps. Some products are patented and commercialized—meaning revenue and jobs for Minnesota.

CTS brings together researchers, funders, and stakeholders to create shared understanding of new and emerging issues and ensure that research is relevant and useful. We relay the latest thinking and research findings through our events and communications. And we help develop the workforce that will put new knowledge into practice.

This annual report highlights examples from FY16. As always, our success depends on the support of our partners, sponsors, and committee members. My thanks to all of you.

Sincerely,

A handwritten signature in cursive script that reads "Laurie G. McGinnis".

Laurie G. McGinnis, Director



WHAT DRIVES A RESEARCHER TO SEARCH FOR ANSWERS?

Our discoveries are making
transportation better for all.

The Transportation Futures Project: planning for technology change

New technologies are changing whether and how people travel. What could these changes mean for Minnesota's transportation future? The Minnesota Department of Transportation (MnDOT) and the Minnesota Local Road Research Board (LRRB) turned to U of M experts for analysis.

The Transportation Futures Project, a multipronged study by researchers in several disciplines, detailed how the transportation system will need to accommodate innovations such as autonomous vehicles, mobility as a service, and energy and fuel alternatives.

The impacts of these innovations could be dramatic. For example, the researchers predict that fully human-driven cars will be generally prohibited from public roads by 2040, and that electric vehicles may make up 68 percent of new car sales by 2050.

"This research has important implications for how we plan, develop, and operate our transportation networks and systems," says Ken Buckeye, program manager in MnDOT's Office of Financial Management.

The research team included principal investigator David Levinson, professor in the Department of Civil, Environmental, and Geo-Engineering (CEGE); CECE assistant professor Adam Boies; and associate professors Jason Cao and Yingling Fan of the Humphrey School of Public Affairs.





SOME AREAS OF INTENSE DISADVANTAGE, SUCH AS NORTH MINNEAPOLIS, BROOKLYN PARK, AND MIDWAY ST. PAUL, HAVE RELATIVELY POOR ACCESS TO ENTRY-LEVEL JOBS IN THE SUBURBS.

Transit and training crucial to connecting unemployed with jobs

The biggest concentrations of unemployed workers in the Twin Cities lack fast or frequent transit service to some of the richest concentrations of job vacancies. U of M researchers analyzed such employment mismatches in the Twin Cities seven-county metropolitan area and examined the potential of a new approach that integrates transit planning and workforce development.

“Transit plays a crucial role in connecting the unemployed with job opportunities, but it could be even more effective if efforts to get the unemployed to those job vacancies were better coordinated with efforts to give them the skills they need for those job vacancies,” says principal investigator Yingling Fan, who conducted the study with research fellow Andrew Guthrie. “Our research lays out an approach to reconcile those mismatches by coordinating transit planning, job training, and job placement services.”

According to the researchers, the mismatch between unemployed workers and job vacancies is a serious problem in the Twin Cities region and it appears to have

worsened since the turn of the millennium. The team’s policy recommendations center on finding “sweet spots” for coordinated transit planning and workforce development and creating a future transit system to serve the needs of disadvantaged workers.

The study was sponsored by Hennepin County, the Jay and Rose Phillips Family Foundation of Minnesota, and the McKnight Foundation.

“McKnight Foundation focuses on our low-income people and places that have been left out of the picture previously. Dr. Fan’s research pulls these areas together so policymakers can see how policy can connect, reinforce, support, and provide benefit to the people that we care about,” says Eric Muschler, program director with the McKnight Foundation.



Truckers with sleep apnea have higher crash risk

Truck drivers who fail to adhere to treatment for obstructive sleep apnea (OSA) are five times more likely to be involved in serious, preventable crashes, according to a study led by researchers at the University of Minnesota Morris (UMM). The project, sponsored in part by the Roadway Safety Institute, is the largest study of sleep apnea and crash risk among commercial motor vehicle drivers to date.


“This study emphasizes that untreated obstructive sleep apnea is a pervasive threat to transportation safety,” says American Academy of Sleep Medicine President Dr. Nathaniel Watson. “It is critical for transportation companies to implement comprehensive sleep apnea screening and treatment programs to ensure that truck drivers stay awake at the wheel.”

Stephen Burks, lead author of the study and professor of economics and management at UMM, puts the findings in context: “If we look at 1,000 truck drivers each working for a year, the drivers with obstructive sleep apnea who refuse mandated treatment would have 70 preventable serious truck crashes, compared to 14 crashes experienced by both a control group and by drivers with sleep apnea who adhered to treatment.”

The data for the study were acquired in part from Schneider National, the first major motor carrier to institute an internal OSA program.



5 TIMES Truckers with untreated sleep apnea are 5 TIMES more likely to be involved in serious, preventable crashes.

A photograph of a road with a speed limit sign and a car in the background. The sign is a white rectangular sign with a black border, mounted on a metal post. It reads "SPEED LIMIT 30". In the background, a silver car is driving away on a paved road. The sky is blue with some clouds, and there are trees and houses in the distance. The image is partially overlaid with a dark red semi-transparent box on the left side, which contains white text.

AS A SUPPLEMENT TO EXTERNAL SIGNS, IN-VEHICLE SIGN SYSTEMS MIGHT REDUCE TRAFFIC SPEED VARIABILITY.

In-vehicle sign systems may improve driver behavior, safety

The idea of fewer—or no—roadside signs holds appeal for highway departments (less maintenance) and drivers (less visual clutter). But if the information typically conveyed on signs—such as the speed limit—is given to drivers in another way, would it be safer? And how would drivers respond?

Researchers at the U of M's HumanFIRST Laboratory recently tested how in-vehicle signing could warn drivers of changes in the environment and influence their behavior. Led by principal investigator Nichole Morris, the project examined how drivers react to in-vehicle sign (IVS) systems designed to prepare them for transitions in driving conditions such as speed zone changes, school zones, construction zones, and curves.

The project, sponsored by the LRRB, arose from a previous MnDOT study that looked at the feasibility of using smartphones for implementing connected vehicle programs. One of the questions that came out of that study was whether road signage could be eliminated from the roadside and displayed in the vehicle instead.

The researchers found that when an IVS system was used without external signs, speeding and speed variability increased. "Safety across all crash types was significantly reduced when in-vehicle warnings were used without external signs," Morris says.

Speeds did not increase, however, when both IVS systems and external signs were used, and variability in speed declined slightly. "This suggests that as a supplement to external signs, the IVS system might reduce traffic speed variability and improve safety," she says.

Victor Lund, a traffic engineer with St. Louis County and the technical liaison for the study, says traffic engineers are very concerned about the safety impacts of people driving at different speeds. "An IVS system might help reduce speed differentials, and we get really excited when we see something constructive toward that end."

Shrub willows hold promise for snow fence, biomass, farm income

University of Minnesota researchers identified and tested a promising plant that has the potential to make the creation of living snow fences faster and more affordable. The plant—shrub willow—also could become a source of biomass and income for farmers.

Results of the MnDOT-sponsored project show that the willows had high survival and growth rates after two growing seasons, with the potential to trap all of the mean annual blowing snow at the MnDOT test site after three or four growing seasons. The team also discovered that shrub willows are easier to plant and more cost-effective to install than other plants used for living snow fences in Minnesota, says lead researcher Diomy Zamora, Extension professor/Extension educator.

Based on the findings, MnDOT moved forward with implementation and installed one shrub willow planting in the spring of 2016, says Dan Gullickson, MnDOT's living snow fence coordinator.

Researchers also analyzed the viability of harvesting the shrub willows for biomass energy. In most cases, living snow fences must be planted on private land, but many farmers don't have the time or money to invest in planting or maintaining them or are reluctant to remove cropland from production. The team found that the cost of using shrub willows for biomass is likely too expensive for the individual farmer and that there is currently little demand for shrub willow biomass in Minnesota. "However," Zamora says, "if an entire corridor was planted as a shrub willow living snow fence, it could compete with field-scale production and provide a possible energy source in the future."





ACCURATELY ESTIMATING IMPERVIOUS LAND AREA WILL RESULT IN MORE EFFECTIVE STORMWATER CONTROL MEASURES AND REDUCED INFRASTRUCTURE COSTS.

Rainfall-runoff model creates a more sustainable stormwater system

In urban and suburban areas, much of the land is covered by “impervious surface”—buildings and pavement that prevent rain from soaking into the ground. Large amounts of this rainfall runoff are directed into storm drains that carry it into nearby waterways. Unfortunately, runoff can also carry pollutants such as oil, dirt, and chemicals.

To better estimate the impervious area in urban watersheds, a U of M research team developed a new method that could eventually lead to the design of a more sustainable urban stormwater infrastructure. The project was funded by the LRRB.

“Overestimating impervious area results in costly overdesign of hydraulic structures,” says John Gulliver, professor in the Department of Civil, Environmental, and Geo- Engineering (CEGE) and the principal investigator.

Typically, the total impervious area has been used in designs, but some impervious surfaces, such as the roofs of single-family homes, are not directly connected to the storm sewer system.

“Accurately determining the effective impervious area will result in more effective planning, location, and design of stormwater control measures, better identification of stormwater runoff pollution sources, cost savings, and, perhaps, more public consent for projects due to decreasing project size,” Gulliver says.

“This research provides regulated entities another tool that can more accurately estimate runoff and pollutant loading from urban watersheds in the absence of monitoring data,” says Scott Anderson, senior civil engineer of water resources with the City of Bloomington. “Ultimately, it offers the ability to more easily plan stormwater management best management practices in an efficient and cost-effective way.”

Others on the research team included Ali Ebrahimiyan of CECE and Professor Bruce N. Wilson of the Department of Bioproducts and Biosystems Engineering.



**USERS OF THE
MICROWAVE METHOD
COMPLETED PATCHING IN
LESS THAN 15 MINUTES.**

Pothole-patching techniques using taconite lead to repairs that last

To make progress in the seemingly unending task of pothole repair, U of M researchers are designing durable patches and repairs that are quick to apply and less costly for maintenance budgets.

A team led by Lawrence Zanko, a senior research fellow at the University of Minnesota Duluth's Natural Resources Research Institute (NRRI), developed two improved options for pothole repair that are ideally suited to Minnesota's cold and wet conditions. The research was part of a broader effort by MnDOT to evaluate current practices, materials, and policies for pavement patching and repair.

The first approach is a fast-setting, taconite-based compound, which was found to be especially well-suited for rigid and relatively deep repairs in concrete pavements. The second approach uses a vehicle-based microwave heating system with taconite materials for in-place pothole and pavement repair; this technology proved very

effective for repairing potholes in asphalt pavement at all temperatures, including very cold temperatures.

"Our findings indicate that these two repair options have the potential to save maintenance departments thousands of dollars in labor costs annually, reduce traffic disruption caused by the frequent repair of repeatedly failing patches, and add efficiency and longevity to repairs," Zanko says.

A new licensing agreement was finalized with a company interested in NRRI's patented pothole/pavement repair compound. The agreement was in part influenced by work performed during the project, Zanko says. And in new work funded by the LRRB, researchers will refine the taconite-based repair compound and develop and field-test a low-cost mechanized system.



FY16 RESEARCH PROGRAM AT A GLANCE:

4 patents/licenses applied for; 1 granted

30 research reports published

41 funding sources

99 journal articles published

107 faculty and research staff

152 active projects

\$12.2 million in funding

Innovative asphalt mixture leads to new patent

Researchers in the Department of Civil, Environmental, and Geo- Engineering (CEGE) were granted a new patent for their innovative asphalt mixture formulas. Developed by a team led by CEGE assistant professor Jia-Liang Le, the mixture formulas are part of ongoing U of M research efforts aimed at reducing low-temperature cracking—a major concern for asphalt pavements in cold regions.

The mixtures incorporate a unique powder made of graphene nano-platelets (GNP)—layers of carbon particles that are arranged in a honeycomb lattice and have superior mechanical and electrical properties—in the asphalt binder. Including GNP doubles the asphalt’s strength at cold temperatures and improves its strain tolerance and creep stiffness, helping to prevent low-temperature cracking.

“Although the cost of GNP-reinforced asphalt mixtures is slightly more expensive than some other asphalt mixtures, it allows for building a better, more durable product,” Le says. The cost of GNP could also drop in the future as production improves and the market grows. In addition, the many benefits of GNP-reinforced asphalt may help outweigh these costs. For instance, the mixture may improve construction speed and quality and potentially extend the construction season in cold climates.

CTS provided initial funding for Le, who originally collaborated with researchers from the National University of Singapore on the use of GNP in concrete. This project inspired Le to conduct a second project funded by the National Cooperative Highway Research Program with fellow CEGE researchers Mihai Marasteanu and Mugurel Turos on the use of GNP in asphalt, which ultimately led to the new patent.

Le’s team is currently creating a computerized model to provide inexpensive simulations of the new asphalt mixtures in a project funded by MnDOT.





WHAT DRIVES A STUDENT TO IMAGINE TOMORROW?

**Our camps and courses develop
the transportation workforce.**

Events spark the interest of the future transportation workforce

CTS held a number of events to reach out to youth and spark their interest in transportation-related degrees and careers.

Twenty-seven students got a hands-on introduction to transportation at the second annual CTS-hosted National Summer Transportation Institute. The interactive two-week day camp, open to students entering grades 7-9, featured classroom and lab sessions as well as field trips across the Twin Cities.

More than 40 White Earth Nation students were introduced to transportation topics in a daylong session offered by the Roadway Safety Institute. The program was part of the White Earth Indian Reservation Summer Academy of Math and Science, a two-week day camp for reservation youth in grades 4 to 8. It is offered in partnership by the White Earth Nation and the University of Minnesota Extension.

Staff taught sessions on basic traffic principles and pedestrian safety to 60 eighth-grade students from Woodbury as part of the AVID (Advancement Via Individual Determination) program, which promotes college and STEM careers for first-generation college students.

CTS also hosted seven girls from Blaine High School in a half-day visit organized by TransportationYOU, a mentoring program of the Women's Transportation Seminar that encourages girls ages 13-18 to pursue transportation careers.





FY16 EDUCATION AT A GLANCE:

33 Ph.D. and master's graduates

127 CTS student affiliates

787 K-12 students participating in CTS outreach activities

Redesigned game lets students learn to manage traffic flow

Gridlock Buster, an online game that teaches middle and high school students about traffic control, was redesigned this year. The new version features updated, more user-friendly graphics and can now be played on tablets and mobile devices.

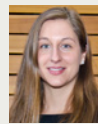
Gridlock Buster incorporates tools and ideas used by traffic control engineers in their daily work to teach students what it's like to manage traffic flow. Players work their way through progressively more-challenging levels, learning how to control traffic signals and ensuring that delays don't get out of hand.

The game was originally developed with funding from the Intelligent Transportation Systems Institute at the U of M in 2009. CTS worked with Web Courseworks, the original game developer, to create the updated version.

In addition to being freely available online, the game is also used with related traffic engineering curriculum in educational and outreach activities. "We use the game in a variety of camps and activities to let students experience what it's like to work in transportation and engineering," says Gina Baas, CTS associate director of engagement and education.

Education Awards

Matthew J. Huber Award (honoring students in engineering, science, and technology fields)



» **Maria Garcia-Serrana**, doctoral candidate, civil engineering; John Gulliver, advisor

» **Vahid Moshtagh**, master's degree, transportation engineering; Gary Davis, advisor



John S. Adams Award (honoring students in policy and planning fields)



» **Kirti Das**, doctoral candidate, public affairs; Yingling Fan, advisor

» **Alireza Ermagun**, master's candidate, urban and regional planning; Greg Lindsey, advisor



Roadway Safety Institute Outstanding Student of the Year



» **Brendan Murphy**, master's degree, civil engineering; David Levinson, advisor



Student exchange launched with Chinese universities

CTS hosted 24 students from two Chinese universities—Southeast University and Nanjing Tech University—for the inaugural offering of the Global Transit Innovations (GTI) Summer Training Program.

Focusing on transportation and urban planning, the program included academic courses, professional seminars, and site visits. It was developed by CTS, GTI, and the U of M China Center's Mingda Institute. Plans for future years include attracting students from additional countries and offering opportunities for U of M students to study in China.

GTI was established by CTS in partnership with Associate Professor Yingling Fan of the Humphrey School of Public Affairs, who serves as GTI director. In addition to its education efforts, GTI has a growing research component with faculty contributors from five countries.

Internship program helps students explore transportation careers

Bridges and waterways, pavement construction, and highway noise sampling are just a few of the topic areas explored by students in the Summer Transportation Internship Program.

The program, offered jointly by CTS and MnDOT, allows civil engineering undergrads to gain real-world experience in transportation and hone their professional skills.

Nine students from the U of M's Twin Cities and Duluth campuses participated in the 2016 program. Student highlights included working directly with MnDOT engineers on a variety of projects, taking field measurements, writing research reports, and offering guidance to local transportation agencies.



Gurham, Ph.D.
How do we see for a world...
of cities...
there is no...
13
4
12



SYMPOSIUM BY THE NUMBERS:

132 attendees from **55** organizations

14% from other states

5% from other countries



WHAT DRIVES A PRACTITIONER TO SEEK INNOVATION?

Our events and communications share new knowledge.

Symposium sheds light on the sharing economy

Cars are one of many things—from meeting space to power tools—that are privately owned but barely used. Unlocking this excess capacity is the essential idea of the sharing economy, said Professor Saif Benjaafar, chair of the Symposium on the Sharing Economy, held in May in Minneapolis.

The two-day symposium, consisting of a research workshop and a public forum, was the first major activity of the Initiative on the Sharing Economy. The symposium was organized by the initiative and sponsored by CTS and the Department of Industrial and Systems Engineering.

“We are witnessing a paradigm shift away from the exclusive ownership and use of resources to one of shared use and, potentially, shared ownership,” Benjaafar said.

One of the forum panelists was Bill Dossett, executive director of Nice Ride. “The question isn’t how we regulate a changing economy with existing tools and governmental structures,” he said. “It’s ‘How do we seize this opportunity and optimize our tools for a seismic shift in the way we get around?’”

The initiative was established by CTS in partnership with Benjaafar and other faculty members across the University.

FY16 ENGAGEMENT AT A GLANCE:

229 media stories referencing U of M transportation research and outreach

4,143 participants at CTS-sponsored and CTS-hosted engagement events

21,885 subscribers of CTS-produced publications and social media

31,671 downloads and requests for technical or training resources

285,746 visits to CTS websites



Interactive workshops bring pedestrian safety solutions to practitioners

The Roadway Safety Institute held three workshops designed to inform transportation practitioners about innovative treatment options for improving pedestrian safety. The workshops—held in Wisconsin, Indiana, and Ohio—convened nearly 90 attendees from nonprofit organizations, private firms, and state and local agencies.

Each workshop featured a presentation by Institute researcher Ron Van Houten of Western Michigan University (WMU), who provided a thorough overview of cutting-edge pedestrian safety treatments and their effectiveness. Van Houten is a professor in the Department of Psychology at WMU and a behavior analysis expert in the areas of traffic safety, pedestrian safety, and traffic calming.

Van Houten discussed both pedestrian-focused and driver-focused countermeasures, with an emphasis on innovative techniques supported by recent research. He also emphasized human factors, noting that changing the safety culture in a community is as important as installing countermeasures. Following Van Houten's presentation, workshop attendees participated in group discussions about their communities' challenges and brainstormed possible solutions.

Accessibility Observatory creates national accessibility dataset

The U's Accessibility Observatory began work on its National Accessibility Evaluation, a multiyear, pooled-fund project to create and maintain a national accessibility dataset.

Updated annually, the dataset describes accessibility to jobs at the census block level for both driving and transit. Study partners can use the dataset for activities such as system evaluation, performance management, and planning.

MnDOT is the lead agency and coordinator for the study, funded under the National Cooperative Highway Research Program (NCHRP) Transportation Pooled Fund Program. Participating agencies include nine other state DOTs, the Federal Highway Administration, and the Washington, D.C., District DOT.

Led by director Andrew Owen, the Observatory provides each partner agency with direct access to detailed, customized datasets. It also produces annual reports summarizing accessibility in the 50 largest metropolitan areas.

Policymaker forum offers insight, education on UAVs

The Airport Technical Assistance Program joined with CTS to hold a special forum on unmanned aerial vehicles (UAVs) for Minnesota state legislators and their staff on the U of M campus. The forum's goal was to provide attendees with a greater understanding of the challenges and opportunities—as well as the policy and regulatory implications—of operating UAVs in Minnesota.

The event opened with a panel discussion that explored the perspectives of different UAV user groups, including retailers, law enforcement personnel, and hobbyists. Other sessions looked at UAV safety and integration, economic impacts, and privacy and ethics.



CTS leads effort to develop roadmap for TZD national strategy

Under a grant from the NCHRP, CTS is developing a guidance document, or roadmap, to advance agency

implementation of the Toward Zero Deaths national strategy. The multiyear project will provide assessments, handbooks, workshops, and other guidance to support states in their progress toward zero road fatalities. The project builds off CTS's successful work with the Minnesota TZD program.

Events bring perspectives to Minnesota

Fall Luncheon: Man vs. Machine or Man + Machine?

What is the reality of automation in our transportation future? Duke University associate professor Mary (Missy) Cummings discussed the current state of autonomous transportation and explored how we can balance the interactions between humans and robots in the future.

2015 Freight and Logistics Symposium

Today's global economy is fast-moving and more competitive than ever—and more metropolitan-centered than ever. Leaders and experts from all walks of transportation discussed this new logistics reality and other challenges and opportunities.





WHAT DRIVES A LEADER TO REACH NEW HORIZONS?

Our programs support and honor Minnesota visionaries.

Leaders honored at CTS Awards Luncheon

CTS presented the following awards at its Annual Meeting and Awards Luncheon on April 20.



William K. Smith Distinguished Service Award (leadership, mentorship, and education of future leaders in private-sector freight transportation):

- » **Brad Emch**, vice president of sales and marketing, SAV Transportation Group



Richard P. Braun Distinguished Service Award (outstanding leadership in research and innovation):

- » **John Gulliver**, professor and former head, Department of Civil, Environmental, and Geo- Engineering

Distinguished Public Leadership Award (public leaders who have influenced innovative transportation policy directions):

- » **Judge James E. Dehn**, Tenth Judicial District, Isanti County



Ray L. Lappegaard Distinguished Service Award (outstanding leadership, mentorship, and support for the profession):

- » **Don Theisen**, public works director, Washington County



Research Partnership Award

This project developed and demonstrated an automated truck stop management system that can determine the number of occupied parking spaces at MnDOT safety rest areas. The technology has the potential to improve safety, lead to better trip and operations management by drivers and carriers, and help agencies and private truck stop owners manage their facilities more effectively.

- » **University of Minnesota:** Nikos Papanikolopoulos, Vassilios Morellas, Ted Morris, Max Donath, Gina Baas
- » **MnDOT:** John Tompkins, Thomas Dumont, William Gardner, Bruce Holdhusen, Tim Spencer, Ray Starr, Robert Williams
- » **American Transportation Research Institute:** Dan Murray
- » **Federal Highway Administration:** James McCarthy

Gary Davis appointed Braun/CTS Chair



Professor Gary Davis of the Department of Civil, Environmental, and Geo- Engineering (CEGE) was appointed Richard P. Braun/CTS Chair in Transportation Engineering, effective July 1, 2016. The purpose of the endowed faculty chair is to foster innovation in the academic program in transportation engineering at CEGE. CTS collaborated with the Department of Civil Engineering (now CEGE) to establish the chair in 2006. Braun was the founding director of CTS and a former commissioner of MnDOT.

FY16 ENGAGEMENT AT A GLANCE:

70 committees, councils, task forces, and other stakeholder groups convened



Executive Committee



Chair: Jay Cowles
Co-Chair, Itasca
Project Transportation
Committee



Laura Bloomberg
Associate Dean,
Humphrey School of
Public Affairs



Ardelle Brede
Mayor of Rochester,
Minnesota



Thomas Clark
Senior Vice President of
Logistics, The Schwan
Food Company



Chris Cramer
Associate Dean for
Academic Affairs,
College of Science &
Engineering, University
of Minnesota



D. Scott Dibble
Senator, Minnesota
Senate



Margaret Donahoe
Executive Director,
Minnesota
Transportation Alliance



Bill Dossett
Executive Director, Nice
Ride Minnesota



Adam Duinick
Chair, Transportation
Committee,
Metropolitan Council



Joseph Favour
Associate Professor of
Practice, Department
of Landscape
Architecture, University
of Minnesota



Peter Frosch
Director of Strategic
Partnerships, GREATER
MSP



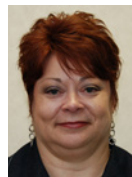
Andy Furco
Associate Vice President
for Public Engagement,
University of Minnesota



Brian Herman
Vice President for
Research, University of
Minnesota



Ann Johnson
President, Professional
Engineering Services,
Ltd.



Arlene Kocher
Minnesota Division
Administrator, Federal
Highway Administration



Matt Kramer
President, Saint Paul Area
Chamber of Commerce



Brian J. Lamb
General Manager, Metro
Transit



Kevin McCarthy
Director of Consulting
Services, C.H. Robinson



Jim McDonough
Commissioner, Ramsey
County



**Nicole Griensewic
Mickelson**
Executive Director,
Region Nine Development
Commission



Kjersti Monson
Partner, Director of Civic
Studio, Duval Companies



Dave Montebello
President and CEO, SRF
Consulting Group Inc.



Sue Mulvihill
Deputy Commissioner
and Chief Engineer,
Minnesota Department
of Transportation



Michael Noble
Executive Director, Fresh
Energy



John Petersburg
Representative,
Minnesota House of
Representatives



Mark Phillips
Director of Business
Development, Kraus-
Anderson® Construction
Company



Brian Ryks
Executive Director,
Metropolitan Airports
Commission



George Schember
Vice President, Cargill
Transportation & Logistics



Megan Selby
Global Business
Director, 3M



Charles Zelle
Commissioner,
Minnesota Department
of Transportation

CTS Faculty and Research Scholars

Aerospace Engineering and Mechanics

Demoz Gebre-Egziabher, Associate Professor

Applied Economics

Jerry Fruin, Professor Emeritus
Gerard McCullough, Associate Professor

Bioproducts and Biosystems Engineering

Bruce Wilson, Professor

Carlson School of Management

Karen Donohue, Associate Professor,
Operations and Management Sciences
Alfred Marcus, Professor

Civil, Environmental, and Geo- Engineering

Adam Boies, Assistant Professor
Gary Davis, Professor
Catherine French, Professor
John Gulliver, Professor
Bojan Guzina, Professor
John Hourdos, Director, Minnesota Traffic Observatory
Alireza Khani, Assistant Professor
Lev Khazanovich, Professor
Joseph Labuz, Professor and Department Head
Jia-Liang Le, Associate Professor
David Levinson, Professor
Chen-Fu Liao, Senior Systems Engineer, Minnesota Traffic Observatory
Lauren Linderman, Assistant Professor
Mihai Marasteanu, Associate Professor
Panos Michalopoulos, Professor Emeritus
Andrew Owen, Director, Accessibility Observatory
Arturo Schultz, Professor
Carol Shield, Professor
Derek Tompkins, Research Associate

College of Design

Tom Fisher, Director, Metropolitan Design Center
Kathleen Harder, Director, Center for Design in Health
Mary Vogel, Research Fellow and Director, Center for Changing Landscapes

Computer Science and Engineering

Tian He, Professor
Vassilios Morellas, Director, Safety, Security, and Rescue Research Center
Ted Morris, Research Engineer
Nikolaos Papanikolopoulos, Professor
Shashi Shekhar, Professor

Forest Resources

Ingrid Schneider, Professor

Geography, Environment and Society

Ying Song, Assistant Professor

Horticultural Science

Eric Watkins, Associate Professor

Humphrey School of Public Affairs

Xinyu (Jason) Cao, Associate Professor
Frank Douma, Director, State and Local Policy Program
Yingling Fan, Associate Professor
Andrew Guthrie, Research Fellow
Robert Johns, Senior Fellow
Adeel Lari, Research Fellow, State and Local Policy Program
Greg Lindsey, Professor
Lee Munnich, Senior Fellow, State and Local Policy Program
Guillermo Narvaez, Research Associate, Public and Nonprofit Leadership Center
Kathryn Quick, Associate Professor
Carissa Slotterback, Associate Professor

Elizabeth Wilson, Professor
Zhirong (Jerry) Zhao, Associate Professor

Industrial & Systems Engineering

Saif Benjaafar, Professor
Diwakar Gupta, Professor

Mechanical Engineering

Brian Davis, Research Fellow
Max Donath, Professor and Director, Roadway Safety Institute
David Kittelson, Professor
Nichole Morris, Principal Researcher, HumanFIRST Laboratory
Will Northrop, Assistant Professor
Rajesh Rajamani, Professor

Plant Biology

David Biesboer, Professor

St. Anthony Falls Laboratory

Jeff Marr, Associate Director for Engineering and Facilities

Tourism Center

Xinyi (Lisa) Qian, Assistant Extension Professor

Urban and Regional Affairs

Edward Goetz, Professor and Director, Center for Urban and Regional Affairs
Thomas M. Scott, Professor and Director Emeritus

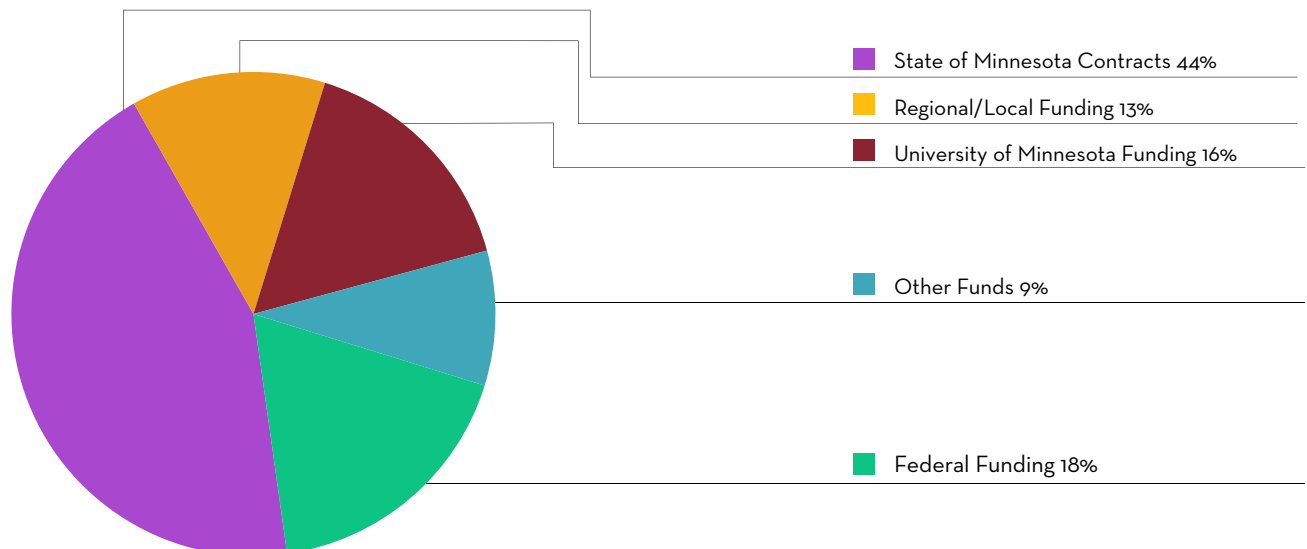
Civil Engineering (Duluth)

Eil Kwon, Professor and Director, Northland Advanced Transportation Systems Research Laboratories

Electrical and Computer Engineering (Duluth)

Taek Kwon, Professor

FY16 Revenues: \$15,047,299



CTS Staff

Laurie McGinnis, Director

Associate Directors

Gina Baas, Associate Director,
Engagement and Education
Dawn Spanhake, Associate
Director, Development and
Finance

Communications and Information

Christine Anderson, Senior
Editor
Amy Friebe, Senior Editor
Angela Kronebusch, Multimedia
Designer

Arlene Mathison, Director, Digital
Information and Library
Services

Michael McCarthy, Editor
Pam Snopl, Managing Editor
Marilee Tuite, Assistant Librarian

Financial Strategy and Operations

Penny Harris, Manager, Financial
Strategy and Contract
Coordination
Brian Hasty, Operations
Coordinator
Mary Snyder, Executive Assistant

Erik Haugan, Contract
Coordinator

Program Development and Delivery

Elizabeth Andrews, Program
Coordinator
Kylie Bivins, Program
Coordinator
Mindy Carlson, Manager,
Technical Assistance and
Customized Training
Jim Grothaus, Senior Director,
Technical Assistance and
Customized Training

Kaydee Kirk, Program
Coordinator

Stephanie Malinoff, Director of
Outreach Services
Colleen O'Connor Toberman,
Program Coordinator
Brenda Thomas, Director of
Coordinated Research



From left to right: Michael McCarthy, Erik Haugan, Amy Friebe, Kaydee Kirk, Pam Snopl, Brenda Thomas, Gina Baas, Colleen O'Connor Toberman, Stephanie Malinoff, Kylie Bivins, Elizabeth Andrews, Arlene Mathison, Mary Snyder, Angela Kronebusch, Brian Hasty, Laurie McGinnis, Dawn Spanhake, Jim Grothaus, Penny Harris.

Not pictured: Christine Anderson, Mindy Carlson, Marilee Tuite.

Center of Discovery

The greatest minds look beyond

what is to what might be.
 1851 scholars at the
 University of Minnesota

have established our world of
 developing, curing, inventing products.
 solving problems, and creating art
 as documented here in their own hand.

Center for Transportation Studies
 University of Minnesota
 200 Transportation and Safety Building
 511 Washington Avenue S.E.
 Minneapolis, MN 55455-0375
 Phone: 612-626-1077
 Fax: 612-625-6381
 E-mail: cts@umn.edu
 Web: cts.umn.edu

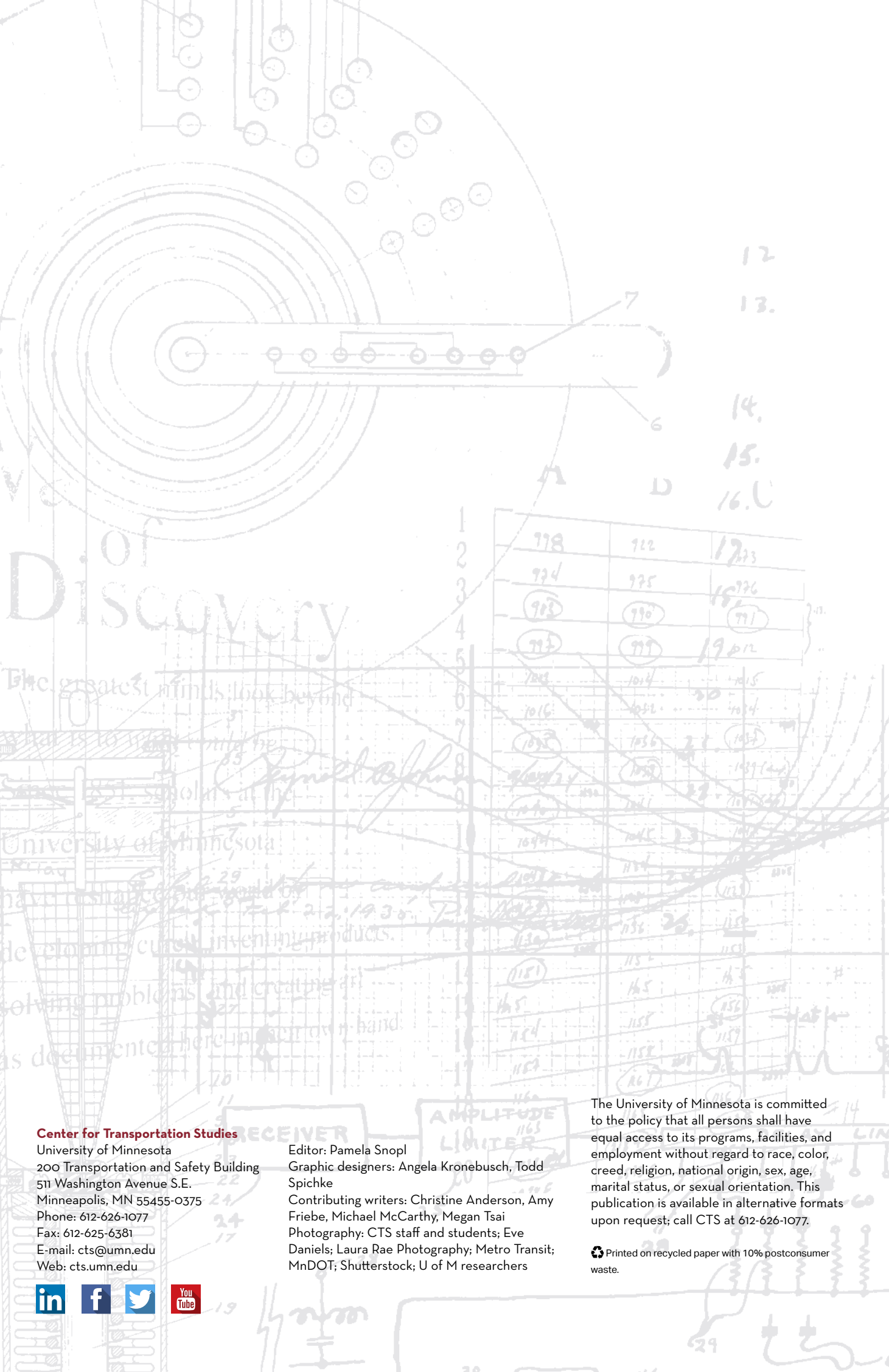
Editor: Pamela Snopl
 Graphic designers: Angela Kronebusch, Todd Spichke
 Contributing writers: Christine Anderson, Amy Friebe, Michael McCarthy, Megan Tsai
 Photography: CTS staff and students; Eve Daniels; Laura Rae Photography; Metro Transit; MnDOT; Shutterstock; U of M researchers

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, or sexual orientation. This publication is available in alternative formats upon request; call CTS at 612-626-1077.

Printed on recycled paper with 10% postconsumer waste.



1	778	922	1723
2	774	925	15726
3	773	920	771
4	772	927	19012
5	702	1014	7015
6	706	1022	7014
7	705	1036	7013
8	704	1055	1039 (and)
9	703	1061	7012 (and)
10	7044	1045	7011
11		1154	20
12		1155	21
13		1156	22
14		1157	23
15		1158	24
16		1159	25
17		1160	26
18		1161	27
19		1162	28
20		1163	29
21		1164	30
22		1165	31
23		1166	32
24		1167	33
25		1168	34
26		1169	35
27		1170	36
28		1171	37
29		1172	38
30		1173	39
31		1174	40
32		1175	41
33		1176	42
34		1177	43
35		1178	44
36		1179	45
37		1180	46
38		1181	47
39		1182	48
40		1183	49
41		1184	50
42		1185	51
43		1186	52
44		1187	53
45		1188	54
46		1189	55
47		1190	56
48		1191	57
49		1192	58
50		1193	59
51		1194	60



CTS.UMN.EDU

