

UMTRI

RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • APRIL-JUNE 2013 • VOLUME 44, NUMBER 2 •



Connected Vehicles: Experts Discuss Progress, Next Steps at Global Symposium

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Cover Photography: U.S. Transportation Secretary Ray LaHood gives opening remarks at the Global Symposium on Connected Vehicles and Infrastructure. Also shown (from left) are UMTRI director Peter Sweatman, O. Kevin Vincent of NHTSA, Stephen Forrest, U-M vice president for research, and Congressman John Dingell. Photo by Austin Thomason, Michigan Photography. Photo of East Washington Street by Charles Bradley, UMTRI; Connected vehicle graphic courtesy USDOT.

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UMTRI's Strategic Intent

To be the leader in transportation systems research integrating vehicles, people, and infrastructure to achieve a highway transportation system where:

- Fatalities and injuries are eliminated
- People and goods flow efficiently
- Reliance on nonrenewable energy is reduced

Connected Vehicles: Experts Discuss Progress, Next Steps at Global Symposium

More than 200 people took part in the first Global Symposium on Connected Vehicles and Infrastructure, held May 14-16, at the University of Michigan. UMTRI hosted the inaugural event in collaboration with the Michigan Department of Transportation, Texas A&M Transportation Institute, and ITS America.

“There is a lot of excitement around connected technology and a sense of urgency,” said UMTRI director Peter Sweatman in introductory remarks. “Connected technology is the cornerstone for a more sustainable, automated mobility system of the future.”

Stephen Forrest, U-M vice president for research, said connected-vehicle technology holds the promise to address environmental, social, and economic challenges, and he took the opportunity to announce formation of the Michigan Mobility Transformation Center (MTC). A key focus of the MTC will be a model

deployment that will allow researchers to test emerging concepts in connected and automated vehicles in both off-roadway and on-roadway settings. *Read the full story on page 3.*

Opening speakers also highlighted UMTRI’s connected-vehicle program, known as Safety Pilot Model Deployment, which has turned Ann Arbor into a unique, on-road test bed. Since August 2012, more than 2,800 vehicles in the Ann Arbor area have participated in the program by having communication devices installed. The devices communicate wirelessly with each other and with the infrastructure (such as roadside equipment located at intersections, curves, and highway sites) by transmitting information on vehicle position, speed, and direction. Drivers are alerted to potential crash situations, such as a nearby vehicle braking or a sudden lane change, by a visual or audible warning inside their vehicle.

The Safety Pilot project is part of

the U.S. DOT’s Connected Vehicle Program. U.S. Transportation Secretary Ray LaHood opened the symposium. He said the Safety Pilot represents a major step forward in our understanding of connected-vehicle technology, which offers real promise in making our roads safer and more efficient.

“V2V—vehicles talking to other vehicles, cars talking to cars—is the future of motor vehicle safety,” said LaHood.

Challenges Ahead

Following opening comments, the three-day symposium featured more than 30 speakers who addressed a wide range of topics encompassing technical issues, policy implications, and public acceptance of wireless communication between vehicles and between vehicles and the infrastructure.

Many speakers highlighted complex issues still to be worked out, among them some uncertainty regarding the

future of dedicated short-range communication (DSRC) spectrum as well as cyber security, or making sure that messages between vehicles or between vehicles and infrastructure are coming from a valid source. In essence, cyber security involves protecting communications, protecting privacy,



CHARLES BRADLEY, UMTRI

UMTRI research scientist Jim Sayer leads a panel discussion on vehicle-to-infrastructure strategy. From left are John Horsley of Horsley and Associates, Robert Denaro of Intelligent Transportation Systems, Hiroyuki Watanabe of Toyota, David St. Amant of Econolite Group, Inc., and Edward Seymour of Texas A&M Transportation Institute.

Continued

Continued from page 1

and thwarting malicious behavior, said Kenneth Leonard, director, Intelligent Transportation Systems (ITS) Joint Program Office.

“It’s not just something that resides in the vehicle but something that has to fit within the whole system of connected vehicles,” which could include the security entities involved as well as the GPS network, he said. “It’s a very complex problem.”

Other important issues include interoperability, or making sure that communications devices used by different manufacturers are able to communicate seamlessly, harmonization of international ITS standards, and continued funding for connected-vehicle systems, technologies, and deployment.



AUSTIN THOMASON, MICHIGAN PHOTOGRAPHY

Shown from left are chief counsel O. Kevin Vincent of NHTSA, John Maddox, director of collaborative program strategies for UMTRI/TTI, Congressman John Dingell, U.S. Transportation Secretary Ray LaHood, and UMTRI director Peter Sweatman.

Realization of Connected Transportation

Despite the challenges ahead, speakers were optimistic about the future of connected vehicles.

Connected-vehicle technology will likely roll out on a regional basis with pockets or areas of early adopters, said MDOT director Kirk Steudle, as vehicles and the infrastructure are instrumented with wireless technology.

Meanwhile, applications are being developed that aid transportation and mobility in a number of areas by provid-

ing, for example, real-time traveler information, weather-related data, and safety alerts for work zones. Experts anticipate that connected-vehicle technology will enable and enhance these types of applications.

In closing comments, speakers reiterated the safety benefits that connected-vehicle technology offers. The National Highway Traffic Safety Administration (NHTSA) estimates that connected-vehicle technology has the potential to prevent 80 percent of motor vehicle crashes involving unimpaired drivers. In terms of long-term funding, several speakers pointed out that the societal benefit of lives saved will one day dwarf the initial monetary investment.

Concluding the symposium, Daniel Smith, senior associate administrator for vehicle safety at NHTSA, said NHTSA will issue a regulatory decision later this year on connected-vehicle technology in relation to light vehicles. A decision in 2014 will address connected-vehicle technology in heavy vehicles.

NHTSA’s decision on connected-vehicle technology could take a variety of forms, said Smith. “It’s not a question of if but when and how,” he said.

To see all speaker presentations go to <http://global2013.umtri.umich.edu/program.html>

Save the Date:

The second, annual Global Symposium on Connected Vehicles and Infrastructure is set for April 21-23, 2014, in Ann Arbor.



Dennis Christiansen, director, Texas A&M Transportation Institute.

CHARLES BRADLEY, UMTRI

U-M Launches New Center to Transform Mobility

U-M has established the Michigan Mobility Transformation Center as a partnership with government and industry to dramatically improve the safety, sustainability, and accessibility of ways that people and goods move from place to place in our society.

“Rapid advances in such diverse areas as connected-vehicle systems, driverless vehicles, shared vehicles, and advanced propulsion systems have brought us to the cusp of a revolution that will transform mobility worldwide,” said Stephen Forrest, vice president for research.

“The goal of the MTC is to draw on U-M’s broad strengths in engineering, urban planning, energy technology, information technology, policy and social sciences to accelerate progress toward a working system that synthesizes these continuing advances.”

According to Peter Sweatman, director of UMTRI and director of the new center, emerging technological advances could bring substantial benefits to society.

“Integrating the most promising approaches to mobility into a coordinated system could reduce motor-vehicle fatalities and injuries as well as energy consumption and carbon emissions by as much as a factor of ten,” Sweatman said. “We also estimate that freight transportation costs could be cut by a factor of three, and the need for parking could go down by a factor of three.”

A key focus of the MTC will be a “model deployment,” which will allow researchers to test emerging concepts in connected and automated vehicles and vehicle systems in both off-road and on-road settings.

The model deployment will build in part on a \$25 million study for the U.S. Department of Transportation now underway at UMTRI. Researchers there have outfitted nearly 3,000 private cars, trucks and buses in Ann Arbor with wireless devices to communicate information that

can alert drivers in potential crash situations to each other as well as to similar devices located at intersections, curves, and freeway sites in the area.

Data gathered from this pilot project will be used to inform future policy decisions by the Transportation Department.

“This project has made the Ann Arbor community a unique, real-time, on-road test bed for exploring the potential of connected vehicles and vehicle systems,” Sweatman said. “A number of industry participants are making use of this resource to explore the potential for their businesses as well.”

Beyond the safety pilot, MTC draws on a strong base of existing research and relationships with industry at U-M.

“U-M has a long history of automotive research and collaborations with industry,” said David Munson, dean of the College of Engineering. “MTC will help us take our commitment to a new level and allow us to work together to pave the way for the future.”

Research conducted under the auspices of the MTC will focus on not only emerging technologies, Forrest said.

“Some of the biggest challenges we face are not technical,” he said. “There are many social, political, regulatory, and economic issues that must be addressed in order to realize the promise of technological advances. With our acknowledged strengths in these areas, and our culture of interdisciplinary cooperation, U-M is uniquely suited to address the full complexity of the challenges ahead.”

Business Leaders for Michigan, the state’s business roundtable, composed of the most senior executives from the state’s largest companies, has identified becoming a “global center for mobility” as one of the six strategies with the most potential to grow the economy.

State government also has identified the importance of continuing innovation in this arena to the vitality of the automotive industry and the health of the economy.

*By David Lampe
Office of the Vice President for Research*

RR

Military Vehicle Seating: Keeping American Soldiers Safe

Transportation crashes have accounted for two-thirds of U.S. noncombat military deaths since 2000—a trend University of Michigan researchers are hoping to help reverse.

Research professor Matthew Reed and colleagues at UMTRI and the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) aim to make seating in military vehicles safer, more effective, and more comfortable for soldiers.

Previous studies of seated anthropometry—measurement of height, weight, and proportions of the human body—have not included the impact of protective gear worn by soldiers on their posture and body shape.

“Current and future military vehicle programs face major challenges in providing adequate accommodation for soldiers while ensuring performance and safety,” said Reed, who is also a research professor of industrial and operations engineering. “Current design guidance is based on outdated anthropometry.”



MATT REED, UMTRI

Reed says that military vehicle programs lack detailed information on soldier posture and body shape, including the effects of personal protective equipment for seat and vehicle interior layout.

Reed and colleagues collected data from more than 300 soldiers—men and women of all shapes and sizes—at three U.S. Army bases in 2012. Using laser scanning and three-dimensional measurements, they analyzed the vehicle seating positions of soldiers—both drivers and crew, with and without their protective equipment and other gear—relative to the steering wheel, pedals, foot position and seat height and angles.

“The Seated Soldier Study: New Data and Tools for Soldier-Centered Design of Vehicles” is the first large-scale study of soldier posture and body shape in seated environments. Results are being integrated into both commercial tools and into TARDEC’s internal design and assessment software, and will be integrated into more Army program tools and procedures.

The research was funded by TARDEC through the Automotive Research Center, a U-M-based U.S. Army Center of Excellence for modeling and simulation of ground vehicles at the College of Engineering. Reed and TARDEC colleagues gave the first public presentation of the research recently at the Automotive Research Center’s annual program review at U-M.

The research was also highlighted at the Second International Digital Human Modeling Symposium, June 11-13, at the Michigan Union on the U-M campus. Hosted by UMTRI and the OPEN Design Lab at Penn State University, the conference featured more than 80 research presentations from scholars and industry experts from around the world.

Bernie DeGroat, U-M News Service

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Is It Time for an Older-Driver Vehicle?

The world's population is aging: In the United States alone, one in five Americans will be age 65 or older by the year 2050. As we age, we're also continuing to drive. UMTRI research has shown that older drivers today keep their licenses longer than older drivers in the past, as a way to maintain mobility, independence, and quality of life.

As these factors come together, the time may be right to design a vehicle specifically for older drivers, according to researchers in UMTRI's Behavioral Sciences Group. In a 2012 report, UMTRI research professor David W. Eby and lead research associate Lisa J. Molnar note that older drivers are more likely to experience physical or mental limitations that can make driving more difficult. Declines in vision, hearing, and muscular flexibility, for instance, become more common as people age. A vehicle's technology could compensate for some of these deficits.

"There are several technologies that enhance safe and comfortable driving, such as back-up cameras, night-vision enhancement, lane-departure warning systems, navigation-assistance systems, and automatic crash-notification systems," explains Eby. "But not all features need to be high-tech. For example, simple vehicle adaptations, such as extra mirrors, spinner knobs, or hand-controlled throttles can benefit older people with certain health conditions that affect driving."

From a design standpoint, he adds, there are a number of categories where improvements could be made to accommodate the needs of older drivers, including getting in and out of the vehicle, seating comfort, visibility of the external driving environment, and dashboard controls.

The ultimate goal of these adaptations is to

improve the safety of older drivers as a group. As people age, they are more likely to have medical conditions and take medications that can make operating a personal vehicle more difficult. Even though many older drivers voluntarily self-regulate their driving to the times and places that they feel most comfortable, according to the report, crash rates (especially fatal crash rates) per licensed driver and per population are higher for older drivers than for any other age group except teenage drivers.

"In most cases, vehicle design changes that benefit older drivers will also benefit drivers of all ages," says Eby. "For crashworthiness, however, this may not be the case. Because of changes in older adults' bone structure, density, et cetera, optimal occupant protection systems would likely need to be different for young and older drivers."

While some of the safety advances and technologies mentioned in the report are already being incorporated in specific vehicles, says Eby, don't look for them all to be put into a single model anytime soon. The researchers caution that the marketing of such a vehicle could be complicated.



UMTRI BEHAVIORAL SCIENCES GROUP

"It is clear that older adults would not buy something marketed as a vehicle for an 'older person' or a 'disabled person,' so further research on how to market such a vehicle is needed," says Eby. "On the other

hand, if vehicle designs, automotive technologies, and crashworthiness systems are optimized to make the operation of a vehicle safer and easier for an older adult, there is an excellent opportunity to capitalize on these benefits in a marketing strategy for selling cars to older consumers."

Read the report: <http://deepblue.lib.umich.edu/handle/2027.42/89960> 

Hands-Free Technology in the Car: Is it Safe?

New in-car infotainment technologies may make driving more dangerous

A new study published by the AAA Foundation for Traffic Safety and carried out by researchers from the University of Utah has found that hands-free technology intended to make life easier and safer for motorists is in fact more dangerous than initially thought.

Using data from simulations and on-road driving, researchers measured how engaging in different activities while driving affected cognitive distraction—distraction arising from mental effort. Talking on the phone, whether handheld or hands-free, presented a level of cognitive distraction that is similar to talking with passengers about subjects not related to the primary task.

Listening to the radio led to a smaller level of cognitive distraction, and driving while carrying out complex mental tasks led to the highest levels of cognitive distraction. What was most striking from the data, though, was that using in-car, text-to-speech devices that allow the driver to access email and text messages led to substantially higher cognitive distraction than cell phone use or talking with passengers.

With increasing investment in in-car information technologies that are designed to make driving a safer and better experience, these findings highlight the importance of understanding how seemingly helpful technology innovations may have unintended consequences.

The University of Michigan (U-M) Risk Science Center supports evidence-based decision-making on health risks associated with



PHOTO PROVIDED BY AAA

technological, social, and economic change.

“If the implementation of complex in-car technology continues without a sophisticated understanding of the risks and benefits, we risk creating a significant public safety issue,” said Andrew Maynard, director of the U-M Risk Science Center. “The challenge facing automakers and electronics manufacturers is to think more intelligently about the benefits and dangers posed by in-car hands-free and voice recognition devices.”

U-M Risk Science Center and UMTRI

The U-M Risk Science Center is currently working with UMTRI to better understand distraction and driving.

“Using a fleet of cars equipped with sensors and cameras, we are able to identify causes of distraction and also how these affect the behavior of the car,” said UMTRI research professor Ray Bingham. “By comparing how the car moves when the driver is distracted with an ideal driving scenario, we are hoping to develop an algorithm that is sensitive to driver distraction.”

One aim of this research is to better understand how to introduce information technology innovations into cars that increase safety and usability without increasing the risks associated with distraction while driving.

According to AAA, the number of infotainment systems in new cars is expected to increase five-fold by 2018. With the recent announcement by Apple, Inc. that it will be launching an iOS 7 in-car infotainment system that makes use of the Siri voice-activated communications interface, there is a greater need than ever to ensure that the safety of tomorrow’s cars is based on science not speculation.

For more information on the study see www.aaafoundation.org

*By Ishani Hewage
U-M Risk Science Center*

*Article originally published on the
U-M Risk Science Center Risk Sense blog. See
www.risksense.org*

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Seay-Ostrowski Honored for Outstanding Research Service

MICHIGAN PHOTOGRAPHY



UMTRI business administrator Catherine Seay-Ostrowski was one of three University of Michigan staff members honored by the Office of the Vice President for Research (OVPR) for outstanding

research service at a special ceremony on Tuesday, May 14, at the U-M Michigan League.

Seay-Ostrowski and Linda Chadwick (College of Engineering) each received a Distinguished Research Administrator Award. Donna Mulkey (Center for Human Growth and Development) received the OVPR Exceptional Service Award.

“With a budget of \$1.27 billion, U-M’s research operation is one of the largest of any university worldwide,” says Stephen Forrest, Vice President for Research. “It would be impossible to successfully administer such a complicated and wide-ranging operation without the energy, skill, and hard work exemplified by these award winners.”

The Distinguished Research Administrator Award honors individuals from any unit at the university who have demonstrated over a number of years distinguished service exemplifying the goals of professional research administration. Each winner receives an honorarium and an award plaque.

Seay-Ostrowski has held various positions and leadership roles in her 23 years at the University of Michigan. She has been at UMTRI since 2005. Prior to her current position at UMTRI, Seay-Ostrowski held departmental administrative roles in the U-M Department of Oceanic, Atmospheric and Space Sciences and the Office of Undergraduate Admissions.

She regularly presents and serves on panels at national conferences related to research administration and human resources. [RR](#)

Shope Receives Distinguished Alumni Award

UMTRI



Jean T. Shope, research professor emerita in the UMTRI Young Driver Behavior and Injury Prevention Group, recently received the Distinguished Alumni Award from the Cornell University–New York Hospital School

of Nursing. Shope gave the featured address, “Understanding Teens, Parents, and Driving: Public Health Progress and Challenges in Injury Prevention,” at the Cornell University–New York Hospital Alumni Day in New York City on April 27.

Dr. Shope received her BSN degree from Cornell University, MSPH degree from the University of Minnesota, and a PhD degree from Wayne State University, then completed a post-doctoral fellowship at the University of Michigan. Dr. Shope has an extensive background in funded behavioral science research, much of it regarding school health education, adolescent substance use, adolescent driving, older drivers, and graduated driver licensing. [RR](#)

UMTRI NAMES & FACES

Most UMTRI reports are available in full text online. See the website address at the end of the citation. Please contact the UMTRI Library at 734-764-2171 or umtridocs@umich.edu to inquire about the availability of other publications listed here.

Journal Articles

Cai, H.; Green, P.A.; Kim, J.J. 2013. "Estimating the Legibility of a Single Letter E Viewed at Different Display Angles." *Applied Ergonomics*, vol. 44, no. 4, pp. 575-587, DOI:10.1016/j.apergo.2012.11.010.

Green, P.A.; Park, J.S. 2013. "Evaluation of a Navigation Radio Using the Think-Aloud Method." *International Journal of Vehicular Technology*, vol. 2013, article ID 705086, 12 pp., DOI:10.1155/2013/705086.

Lo, V.E.; Green, P.A. 2013. "Development and Evaluation of Automotive Speech Interfaces: Useful Information from the Human Factors and the Related Literature." *International Journal of Vehicular Technology*, vol. 2013, article ID 924170, 13 pp., DOI:10.1155/2013/924170.

Macy, M.L.; Freed, G.L.; Reed, M.P. 2013. "Child Passenger Restraints in Relation to Other Second Row Passengers: An Analysis of the 2007–2009 National Survey of the Use of Booster Seats." *Traffic Injury Prevention*, vol. 14, no. 2, pp. 209-214, DOI:10.1080/15389588.2012.700748.

Reed M.P.; Ebert-Hamilton, S.M.; Klinich K.D.; Manary, M.A., Rupp, J.D. 2013. "Effects of Vehicle Seat and Belt Geometry on Belt Fit for Children with and without Belt Positioning Booster Seats." *Accident Analysis and Prevention*, vol. 50, January 2013, pp. 512-522, DOI:10.1016/j.aap.2012.05.030.

Sivak, M. 2013. "Air Conditioning versus Heating: Climate Control is More Energy Demanding in Minneapolis than in Miami." *Environmental Research Letters*, vol. 8, no. 18, 014050, DOI: 10.1088/1748-9326/8/1/014050.

Zakrajsek, J.S.; Shope, J.T.; Greenspan, A.I.; Wang, J.; Bingham, C.R.; Simons-Morton, B.G. 2013. "Effectiveness of a Brief Parent-Directed Teen Driver Safety Intervention (Checkpoints) Delivered by Driver Education Instructors." *Journal of Adolescent Health*, vol. 53, no. 1, pp. 27-33, DOI:10.1016/j.jadohealth.2012.12.010.

Technical Reports

Karamihas, S.M.; Senn, K. 2012. Curl and Warp Analysis of the LTPP SPS-2 Site in Arizona. Report no. FHWA-HRT-12-068. <http://www.fhwa.dot.gov/publications/research/infrastructure/pavements/ltp/12068/12068.pdf>

The research documented in this report was sponsored by the Federal Highway Administration.

Sivak, M. 2013. Effects of Vehicle Fuel Economy, Distance Travelled, and Vehicle Load on the Amount of Fuel Used for Personal Transportation: 1970-2010. Report no. UMTRI-2013-10.

<http://hdl.handle.net/2027.42/96632>

The research documented in this report was sponsored by UMTRI's Sustainable Worldwide Transportation program.

Sivak, M. 2013. Predicting Vehicle Sales from GDP in 48 Countries: 2005-2011. Report no. UMTRI-2013-6.

<http://hdl.handle.net/2027.42/96442>



June 2013

International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design
June 17-20; Bolton Landing, New York
<http://drivingassessment.uiowa.edu/>

National Association of Regional Councils (NARC)
June 23-26; Philadelphia, Pennsylvania
www.narc.org

International Conference on Ecology & Transportation
June 23-27; Scottsdale, Arizona
http://www.icoet.net/ICOET_2013/

ITE Midwestern District Meeting
June 26-28; Milwaukee, Wisconsin
<http://www.midwesternite.org/2013conference/>

July 2013

National Congestion Pricing Conference
July 9-10; Seattle, Washington
www.trb.org/calendar

Eighth SHRP 2 Safety Research Symposium
July 11; Washington, D.C.
<http://trbsymposium.eventbrite.com/#>

AASHTO Research Advisory Committee and TRB State Representatives Annual Meeting
July 14-18; Baton Rouge, Louisiana
http://www.ltrc.lsu.edu/rac_13/registration.php

Workshop on the Future of Road Vehicle Automation
July 16-19; Palo Alto, California
www.trb.org/calendar

Powertrain Strategies for the 21st Century
July 24; Ann Arbor, Michigan
<http://umtri.umich.edu/divisionPage.php?pageID=265>

August 2013

ITE Annual Meeting and Exhibit
August 4-7; Boston, Massachusetts
<http://www.ite.org/meetings/index.asp>

CAR Management Briefing Seminars
August 5-8; Traverse City, Michigan
<http://www.cargroup.org/>

Transportation & Infrastructure Summit
August 6-9; Irving, Texas
<http://www.transportationsummit.com/>

COTA International Conference of Transportation Professionals
August 13-16; Shenzhen, China
www.nacota.org/Events_CICTP.html

National Rural ITS Conference
August 25-28; St. Cloud, Minnesota
<http://www.nritisconference.org/>

International Council on Alcohol, Drugs and Traffic Safety Conference
August 25-28; Brisbane, Queensland, Australia
www.t2013.com

September 2013

Preventing Injury: From Research to Practice to People
September 30-October 1
www.injurycenter.umich.edu

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