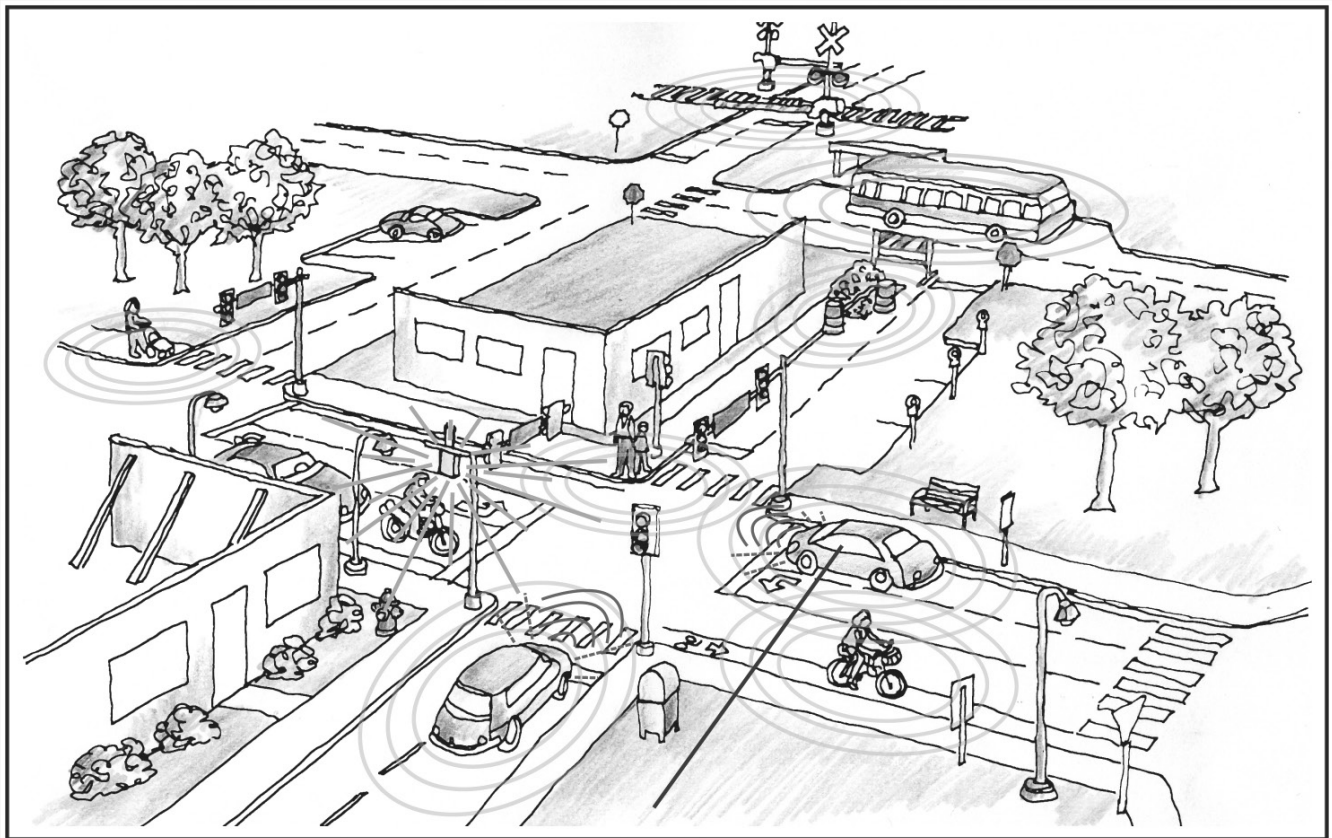


RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • JULY-SEPTEMBER 2013 • VOLUME 44, NUMBER 3 •



Mobility Transformation Facility

U-M Approves Plans for Connected- and Automated-Vehicle Test Environment

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UMTRI RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • JULY-SEPTEMBER 2013 • VOLUME 44, NUMBER 3 •

ISSN 0739 7100

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Layout & Printing: U-M Printing Services

The UMTRI Research Review is published four times a year by the Research Information and Publications Center of the University of Michigan Transportation Research Institute, 2901 Baxter Road, Ann Arbor, Michigan 48109-2150 (umtri.umich.edu). To subscribe, see the subscription form on the inside back cover. For change of address or deletion, please send us your address label or email umtri@umich.edu.

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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

U-M Approves Plans for Connected- and Automated-Vehicle Test Environment

The University of Michigan (U-M) Board of Regents recently approved plans to proceed with the design of a unique environment for testing connected and automated vehicles. The facility, which simulates a dynamic urban environment, is a critical element of a joint project with industry and government to develop and implement an entire system of connected and automated vehicles on the streets of Southeastern Michigan by 2021.

“There have been a host of innovations in this arena in recent years, but one of the major challenges ahead is to ensure that these vehicles can perform safely and reliably in a complex urban setting,” said Peter Sweatman, direc-

tor of UMTRI and the U-M Mobility Transformation Center (MTC), which is leading the initiative. “Testing a workable system of such technologies in a realistic off-road environment is an essential step before a significant number of vehicles can be safely implemented on actual roadways.”

Occupying thirty acres at the university’s North Campus Research Complex, the novel test environment will include approximately three lane-miles of roads with intersections, traffic signs and signals, sidewalks, benches, simulated buildings, street lights, and obstacles such as construction barriers. Current plans call for the facility to be completed by the fall of 2014 at a cost

of about \$6.5 million.

“Connected and automated vehicles provide a new platform for safety improvements, better traffic movement, emissions reduction, energy conservation, and maximized transportation accessibility,” said Sweatman. “The new facility will help the MTC accelerate and integrate innovations that will lead to a commercially viable automated mobility system that will fundamentally transform mobility in our society.”

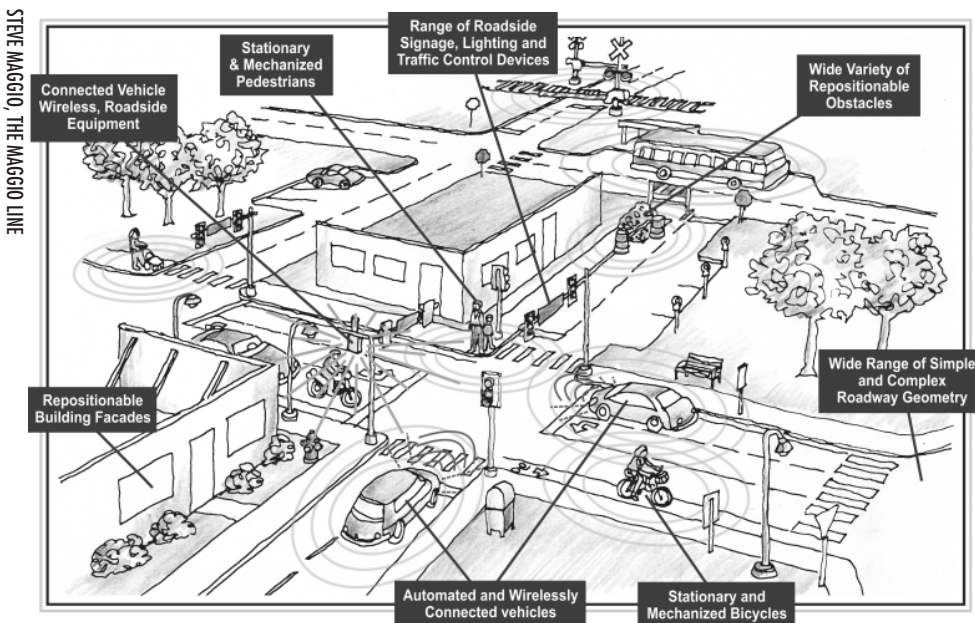
According to Stephen Forrest, vice president for research, the scope of the challenge goes far beyond technology.

“Developing and implementing a realistic approach to moving both people and freight requires that we integrate scientific, technical, economic, social, and policy considerations,” he said. “The MTC will convene the required expertise from across campus as well as from industry and government to pave the way for the future.”

Forrest anticipates that the initiative holds great promise for innovation and change.

“The most exciting prospect is the enormous economic and technological opportunity MTC offers to our region and the U.S. by literally reinventing the automobile more than a century after its first introduction on our nation’s roadways,” he said.

Launched last spring, the MTC



Artist’s conception of a novel test facility that U-M researchers will use in work aimed at ushering in a new era of connected and automated vehicles. Covering more than thirty acres, the facility makes it possible to evaluate the performance of advanced vehicles operating on three lane-miles of roads with intersections, traffic signs and signals, sidewalks, benches, simulated buildings, street lights, and obstacles such as construction barriers.

Continued

Continued from page 1

builds on U-M's broad base of expertise and experience working with government and industry on transportation research over the years. With \$25 million in funding from the United States Department of Transportation (USDOT), U-M recently implemented the world's largest on-road vehicle-to-vehicle and vehicle-to-infrastructure model deployment in Ann Arbor, with more than 3,000 users. This project, which includes several industry participants, is providing data to inform future policy decisions by the USDOT.

Other activities under way in the region are also laying the foundation for the new mobility system. For example, the Michigan Department of Transportation is installing unique "smart" infrastructure across Southeastern Michigan. And the region's industrial powerhouse of automotive R&D is deeply engaged in automating vehicles for use by consumers and businesses.

Funding for the new research facility will be provided by the College of Engineering, the U-M Office of Research, the U-M Transportation Research Institute, the U-M Energy Institute, and the Office of the Provost, in partnership with the Michigan Department of Transportation.

Levels of Vehicle Automation

The National Highway Traffic Safety Administration (NHTSA) defines vehicle automation at four different levels: Level 1 is function-specific automation (cruise control, for instance); level 2 is combined-function automation (such as adaptive cruise control and lane centering technology); level 3 is limited self-driving automation, in which the vehicle controls all safety-critical functions but may, at times, require transition back to driver control; and level 4 is full self-driving automation.

The new facility in Ann Arbor will be focused on levels 2, 3, and 4, with a priority on the highest levels of automation, according to John Maddox, director of collaborative program strategies at UMTRI. Most passenger cars are designed to operate within an existing roadway infrastructure amid many other vehicles, Maddox explains, making it essential that they communicate with each other and with the infrastructure.

"To get to higher levels of automation, the vehicle has to be significantly connected," said Maddox. "By acting in concert, vehicles can do a better job of avoiding each other and navigating the road environment."

Maddox offered several examples of situations in which there is added value if a vehicle can "learn" from other automated vehicles in the vicinity:

- **Platooning.** Cars or trucks are grouped together to save fuel and increase efficiency. The vehicles must be wirelessly connected to each other to maintain a close, constant distance.

- **Route guidance.** A number of vehicles in concert can do a better job together, particularly if one vehicle maps a route first, and other vehicles can use that.
- **Operation around vulnerable road users.** Using connected technology (including DSRC, cellular, as well as blue tooth), vehicles can do a much better job of avoiding pedestrians and cyclists.



U.S. DOT

Simulated Urban Environment

The new facility will be designed to test challenging urban-traffic scenarios, including intersections, chaotic traffic flow (such as merging), operating around vulnerable road users, and nighttime and inclement weather operation. Automated-vehicle technology relies partly on radar and cameras, which have the same limitations as the human eye, Maddox explained, and could be affected by obstacles (such as buildings) or rain and snow that obscure roadway lane markings or signage. "We'll be testing critical scenarios where there's no clear line of sight," he said.

Cyber security is also critical. Because the vehicles transmit and receive so much information, researchers have to be concerned about malicious attacks on both vehicles and the infrastructure and will be able to test this in a safe, controlled environment.

The testing facility, a dedicated research facility designed to test vehicles in a simulated urban environment, is among the first of its kind in the United States. The facility will complement ongoing connected-vehicle research at UMTRI involving typical drivers on actual roadways.

"The whole concept of the facility is that it's contiguous with the on-road test environment, which will enable tests to continue when a vehicle drives from the public road into the off-road facility," said Maddox. "We anticipate having a variety of drivers at the facility—professionally trained test drivers, everyday drivers, and eventually, no drivers."



New ATLAS Center Takes Integrated Approach to Transportation Safety

The U-M Transportation Research Institute has received a \$1.4 million grant from the U.S. Department of Transportation to establish a new center to improve transportation safety.

The Center for Advancing Transportation Leadership and Safety, or the ATLAS Center, will be headed by UMTRI in partnership with the Texas Transportation Institute at Texas A&M University.

“We are very pleased to be given the opportunity for two of the largest transportation safety research institutes to work together to solve the most pressing transportation problems facing our nation,” said ATLAS director David Eby, a research professor at UMTRI.

The center will sponsor research, education and technology transfer activity to find integrated, innovative solutions for transportation safety that draw upon many disciplines, among them public health, engineering, medicine, psychology, sociology, public policy, and education.

Research Initiatives

Three of the center’s early projects will focus on alcohol-impaired nighttime driving; child safety in cars; and reducing fatalities, injuries and societal costs of heavy-truck crashes.

Alcohol-impaired nighttime driving. TTI researchers will explore how a driver’s performance is affected by two factors in combination: visual impairment due to alcohol consumption and reduced visual information at night. The research will expand upon data collected during TTI research at its Riverside closed-course facility and takes advantage of TTI’s expertise in visual performance, human factors and traffic control devices. The research will be led by Melisa Finley, Paul Carlson, and Laura Higgins at TTI.

Child safety in cars: An international collaboration. UMTRI has been invited to participate in an international collaborative research project competitively awarded to Monash University Accident

Research Centre (MUARC) in Australia. The international study will use innovative naturalistic driving methods to observe and quantify the positions of child occupants in cars and identify the injury effects of out-of-position status and its impact on driver distraction.

The study involves instrumenting the vehicles of parents with children in child safety seats and recording how children sit in these seats and their parents’ interactions with their children, under actual driving conditions. The project will also include a knowledge, attitudes, and self-reported behavioral survey of parents. David Eby and Lisa Molnar of UMTRI are participating partners in advisory roles, and the ATLAS Center funding will allow UMTRI to become a U.S. data collection site for the study.

Reducing the fatalities, injuries, and societal costs of heavy-truck crashes. This project will provide additional characterization of the crash-injury problem, current crashworthiness, and the potential benefits of crashworthy structures in heavy, straight trucks and in truck cabs and trailers. UMTRI and TTI will jointly collect and develop this information by analyzing crash and travel datasets to identify the frequencies and costs of different types of heavy truck crashes and to estimate the benefits that crashworthy structures in heavy trucks could have on reducing deaths, injuries, and societal costs associated with heavy truck crashes. The research will be led by Chiara Silvestri Dobrovolny of TTI, Jonathan Rupp of UMTRI, and Daniel Blower of UMTRI.

Education and Technology Transfer

As part of its mission, the ATLAS Center will support educational partnerships and promote technology-transfer activities. The Atlas Center will support visiting researchers and practitioners to present their work locally, assist researchers in using resources for developing and commercializing any technologies derived from research funded by the Center, encourage publication of research results in peer-reviewed journals, and jointly host an annual ATLAS Center transportation conference.

According to Eby, the initial DOT grant will fund the center’s first year with the expectation that it will be renewed for the next three to five years. The ATLAS Center Associate Directors are Robert Wunderlich (TTI) and Lisa J. Molnar (UMTRI).



UMTRI-Toyota Leadership in Transportation Seminar Series



Sören Hess, general manager of the CAR 2 CAR Communication Consortium, was the featured speaker in the UMTRI-Toyota Leadership in Transportation Seminar Series on September 12 at the University of Michigan.

The CAR 2 CAR Communication Consortium is a nonprofit, industry-driven organization initiated by European vehicle manufacturers. Its mission is to develop and deploy Cooperative ITS (C-ITS) all over Europe. Hess is also chairman of ETSI TC Intelligent Transport Systems, which is developing standards on application and facility layer, transport and access layer, management, and security.

The UMTRI-Toyota Leadership in Transportation Seminar Series features lectures and conversations with global leaders that explore the future of transportation, from safety, mobility, and the environment to connected and automated technology.

Upcoming seminars in 2014 will feature the following speakers:



February 13:
Bryant Walker Smith. Smith is a fellow at the Center for Internet and Society at Stanford Law School; a fellow at the Center for Automotive Research at Stanford (CARS), and a lecturer in law at Stanford Law School. He writes, speaks, and teaches on the legal and policy aspects of increasing automation. He also chairs the Emerging Technology Law Committee of the Transportation Research Board

of the National Academies. He is a member of the New York Bar and a former transportation engineer who has worked on infrastructure issues in the United States and throughout Europe.



March 13:
Matthew Rizzo, MD. Rizzo is a professor of neurology, engineering and public policy at the University of Iowa. He is director of the provost's university-wide Aging Mind and Brain Initiative; vice chair for Translational Research in Neurology; director of the Division of Neuroergonomics (including instrumented vehicles and driving simulators), and senior attending physician in the Memory Disorders Clinic. He has conducted research in driver attention and fitness to drive for two decades funded by the NIH, CDC, and industry. Dr. Rizzo was the first to integrate high-fidelity simulators into clinical settings and has developed some of the most advanced instrumented vehicles in experimental and naturalistic settings to study driver-performance research.

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Shope Honored with Prestigious Widmark Award

UMTRI research professor emerita Jean T. Shope was presented with the prestigious Widmark Award for outstanding, sustained and meritorious contribution to the field of alcohol, drugs and traffic safety. The International Council on Alcohol, Drugs, and Traffic Safety (ICADTS) presented the award to Shope at the group's August meeting in Brisbane, Australia.

"I'm very thrilled and honored," said Shope, who is a research professor in UMTRI's Young Driver Behavior and Injury Prevention Group.

Shope is a recognized expert in the prevention of injury as it pertains to teen and young adult drivers, driver education, and graduated driver licensing. She has worked in the areas of adolescent health promotion and risk reduction for over thirty years, and in the area of adolescent and young adult driving for over twenty years.

She began conducting research at UMTRI in 1991 and served as the institute's associate director from 2006 to 2012 and as the head of the Social and Behavioral Analysis Division from 1995 to 2005. Shope is also a research professor in the Department of Health Behavior and Health Education at the U-M School of Public Health, where she has been on the faculty since 1979.

Shope chaired the Transportation Research Board Committee on Alcohol, Other Drugs, and Transportation (ANB50), served on the National Academies Committee on Contributions from the Behavioral and Social Sciences in Reducing and Preventing Teen Motor Vehicle Crashes, and was secretary of the International Council on Alcohol, Drugs, and Traffic Safety. In 2005, she was the recipient of the University of Michigan's Research Faculty Achievement Award, and in 2013, she was the recipient of the Cornell University-New York Hospital School of Nursing Distinguished Alumni Award.



UMTRI research professor emerita Jean T. Shope (left) accepts the Widmark Award from ICADTS president Mary Sheehan at the group's recent meeting in Australia.

New Faculty Join UMTRI's Young Driver Group

Two new faculty members recently joined UMTRI's Young Driver Behavior and Injury Prevention Group.



Anuj K. Pradhan is an assistant research scientist in UMTRI's Young Driver Behavior and Injury Prevention Group. He joined UMTRI in June 2013 after a postdoctoral fellowship as a visiting fellow in the Intramural Research Training

Award program at the National Institutes of Health. Pradhan holds MS and PhD degrees in industrial engineering (human factors) from the University of Massachusetts Amherst.

Pradhan is interested in the etiology of injuries and fatalities due to motor-vehicle crashes from a human-factors and behavioral standpoint. He is interested in conducting relevant studies using a variety of methodologies in order to uncover and disseminate evidence that can contribute to the safe mobility of road users, that can inform policy, and that can lead to technological and educational innovations for improving the road-safety record and for reducing injury.

His research covers driver behavior and traffic safety with a focus on young and novice drivers, particularly for risky behaviors and other risk factors for injuries; training and intervention, including parental management and feedback methodology; and, distraction detection and mitigation. He has worked on a number of research projects in these areas using various approaches and methodologies including driving simulation, test tracks, naturalistic methods, and observational methods.

Pradhan's current research focus is on a structured, multidimensional approach to attain a deeper understanding of various novice-driver behaviors and risk factors, using experimentation techniques with driving simulation, eye track-

ing and naturalistic datasets. He is also interested in studying and understanding driving behavior, particularly for novice drivers, by studying particular and unique subgroups of the driving population such as high-risk drivers, nonneurotypical drivers, and drivers with medical conditions or under the influence of prescription medication.



Lisa Buckley joined UMTRI's Young Driver Behavior and Injury Prevention Group as an assistant research scientist. She received her PhD from Queensland University of Technology (QUT) in 2008.

In July 2013, she moved to UMTRI from the Centre for Accident Research & Road Safety-Queensland, QUT where she was a senior research fellow (through the Vice-Chancellor's Research Fellowship Scheme).

Before joining UMTRI, Buckley was a principal investigator on a number of projects, including a randomized cluster-controlled trial of a school-based injury-prevention program for early adolescents (funded by the Australian Research Council-Discovery Projects). She served as supervisor for PhD students on related projects, such as examining the role of first aid in preventing injury, the potential for population-delivered programs to address behavior change for high-risk youth, and the role of school connectedness in reducing transport and other injuries.

Buckley's overall research expertise overlies health-behavior-change program development, implementation, and evaluation including the translation of theory to evidence-based practice. She has focused behavior-change research in efforts to reduce adolescent and young-adult injury, primarily around the use of alcohol, experience of violence, and road-related risk behaviors. Her work focuses on protective factors to reduce harm, particularly through supportive relationships with friends, parents, and teachers and motivation to adopt healthy behavior. She has a particular interest in the role of passengers and the way in which they can promote driving safety.

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UMTRI Faculty Promotions

Five UMTRI faculty members were promoted on September 1, 2013.



Carol Flannagan has been promoted to associate research scientist. Flannagan is a member of UMTRI's Biosciences Group and also coleads the Center for the Management of Information for Safe and Sustainable Transportation (CMISST). She joined UMTRI in 1991 after completing her PhD in mathematical and experimental psychology at the University of Michigan. She also holds an MA in applied statistics from U-M and a BA in psychology from St. Lawrence University. Flannagan's research interests include statistical methods, modeling and analysis of crash and driving data. She has performed extensive analyses of various crash databases to identify injury patterns and trends, has developed methods for analysis of transportation-safety data, and has modeled the benefits of a variety of safety countermeasures, including occupant protection and crash-avoidance technologies.



Kathleen Klinich has been promoted to associate research scientist. Klinich is a member of UMTRI's Biosciences Group. She earned a PhD in mechanical engineering from the University of Michigan and BS and MS degrees in mechanical engineering as well as a BA in technical writing from Case Western Reserve University. Her research focuses on protecting occupants in motor-vehicle crashes. She has experience in evaluating child-passenger-safety issues, analyzing motor-vehicle crashes and crash databases, crash-dummy design, laboratory reconstruction of real-world loading events, injury-criteria development, occupant-anthropometry and posture evaluation, and finite-element modeling.



David LeBlanc has been promoted to associate research scientist. LeBlanc is head of UMTRI's Engineering Systems Group. He holds a PhD in aerospace engineering from the University of Michigan, and MS

and BS degrees in mechanical engineering from Purdue University. LeBlanc's work focuses on the automatic and human control of motor vehicles, particularly the design and evaluation of driver-assistance systems. He is currently the program manager of the Road Departure Crash Warning System Field Operational Test, which is a project operated under a cooperative agreement with the U.S. DOT under the Intelligent Vehicle Initiative. He is the author of several publications in the area of vehicle dynamics and automotive crash-warning systems.



Matthew Reed has been promoted to research professor. He is head of UMTRI's Biosciences Group and also a research professor in the U-M Department of Industrial and Operations Engineering and directs the Human Motion Simulation Laboratory in the Center for Ergonomics. Reed's research focuses on physical ergonomics, engineering anthropometry, and vehicle safety. He has conducted research on occupant restraint systems, emphasizing investigation of airbag-induced injuries, crash-dummy-positioning procedures, belt restraints, and child passenger safety. He has developed tools for the ergonomic design of vehicle interiors, including widely used posture-prediction and motion-simulation algorithms for use with digital human figure models. He has also conducted extensive research in engineering anthropometry and computational modeling of human anatomy.



John Sullivan has been promoted to associate research scientist. Sullivan is a member of UMTRI's Human Factors Group. He earned a PhD in experimental psychology from the University of Michigan and a BA in psychology from Brooklyn College, City University of New York. Sullivan has conducted several research projects focused on the influence of visibility, particularly at night, on driving performance and subjective experience. He has also directed the experimental design and the analysis of driver performance in field studies of new driver-assistance technologies including adaptive cruise control, rollover advisory systems, and night-vision systems. He has also examined the link between ambient light level and fatal crashes.

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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.

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

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

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CONFERENCES & EVENTS

November 2013

American Public Health Association
November 2-6; Boston, Massachusetts
www.apba.org/meetings/AnnualMeeting

Innomobility
November 6-7; Greenville, South Carolina
<http://innomobility.com/2013/>

Stapp Car Crash Conference
November 11-13; Orlando, Florida
www.stapp.org

Inside China: Understanding the Current and
Future Chinese Automotive Industry
November 13; Ann Arbor, Michigan
www.umtri.umich.edu/divisionPage.php?pageID=47

December 2013

International Conference on Connected
Vehicles and Expo
December 2-6; Las Vegas, Nevada
www.iccve.org/

January 2014

TRB 93rd Annual Meeting
January 12-16; Washington, D.C.
www.trb.org/AnnualMeeting2014/AnnualMeeting2014.aspx

February 2014

UMTRI-Toyota Leadership in Transportation
Seminar Series
February 13; Ann Arbor, Michigan
UMTRI-ToyotaRSVP@umich.edu

March 2014

UMTRI-Toyota Leadership in Transportation
Seminar Series
March 13; Ann Arbor, Michigan
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April 2014

SAE World Congress & Exhibition
April 8-10; Detroit, Michigan
<http://www.sae.org/congress/>

Global Symposium on Connected Vehicles and
Infrastructure
April 21-23; Ann Arbor, Michigan
<http://www.umtri.umich.edu/>

Lifesavers National Conference on Highway
Safety Priorities
April 27-29; Nashville, TN
<http://www.lifesaversconference.org/>

September 2014

ITS World Congress on Intelligent Transport
Systems
September 7-11; Detroit, Michigan
<http://www.itsa.org/events/2014-world-congress>

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