

UMTRI

RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • JANUARY-MARCH 2013 • VOLUME 44, NUMBER 1 •



Product Innovation in the Age of CAFE

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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
-

Product Innovation in the Age of CAFE

Auto manufacturers will call upon a combination of technologies and vehicle types to meet corporate average fuel economy (CAFE) standards in the coming years. The standards require an average of 35.5 mpg by 2016 and 54.5 mpg by 2025 for a manufacturer's fleet of vehicles

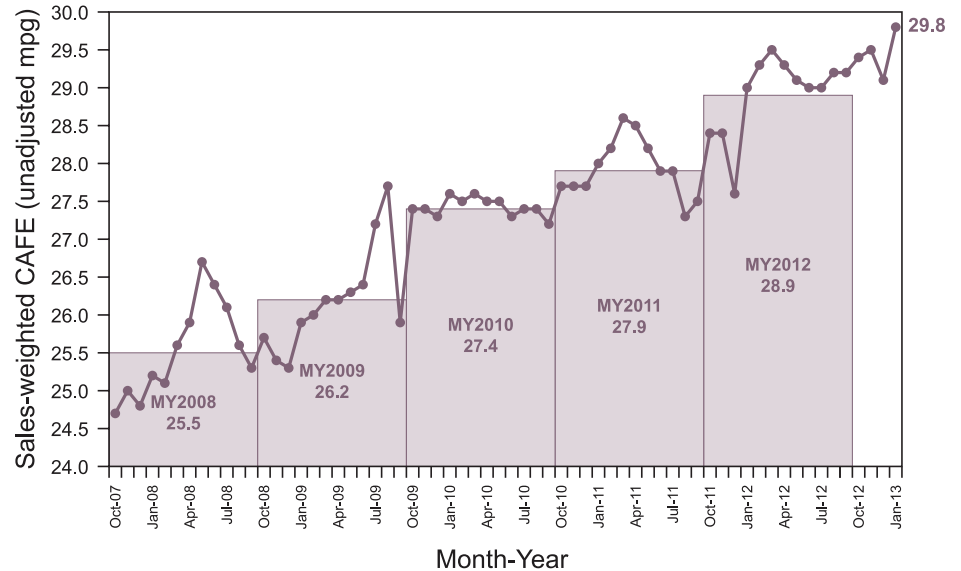
A new UMTRI conference, "Automotive Product Portfolios in the Age of CAFE," held on February 13 looked at how vehicles and automotive technologies are changing to meet fuel-efficiency standards. UMTRI assistant research scientist Bruce Belzowski introduced key questions and moderated the conference.

"The automotive industry has always been innovative, but the new CAFE regulations have forced the manufacturers and suppliers to look at completely new types of vehicles as well as new powertrains in order to meet future regulations," said Belzowski.

Monitoring Emissions and MPG

CAFE came into existence in 1975, yet the most dramatic changes in vehicle fuel efficiency and emissions reductions have occurred in the last five to six years.

UMTRI project manager Brandon Schoettle presented results from the Eco-Driving Index, a national index that estimates the average amount of greenhouse gases (GHG) produced monthly by individual drivers who purchased new vehicles, as well as estimating new-vehicle fleet fuel economy. According to Schoettle, average new-vehicle fuel economy is at a record high, 29.8 mpg (average unadjusted CAFE fuel



Michael Sivak and Brandon Schoettle
University of Michigan Transportation Research Institute

Sales-weighted CAFE (unadjusted mpg) values are shown for model year (MY) 2008 through 2012 vehicles.

economy) and 24.5 mpg (current average window sticker fuel economy) for the month of January 2013. Several factors are at work, he said.

"The rapid increase in new-vehicle fuel economy over the past five or six model years is a result of greater demand for more fuel-efficient vehicles by consumers as well as increased availability of such vehicles sold by manufacturers," said Schoettle. "These recent fuel-economy gains are similar in magnitude to the gains over the previous twenty years."

Because the Eco-Driving Index monitors only new vehicles, it does not reflect the fuel-economy of the fleet of vehicles currently on the road in the United States. According to Schoettle, it takes an average of twenty to twenty-five years for fleet turnover.

He noted that while there was a spike in overall fuel economy during the two months of the government's Cash for Clunkers program in 2009, there was a subsequent dip due to reduced demand for fuel-efficient vehicles in the month following the program. Over the long term, however, fuel economy has generally increased at a steady rate since October 2007. (See *Fuel Economy Monitoring graph above.*)

Evolution not Revolution

In order for manufacturers to meet CAFE standards for their vehicle product portfolios, they'll need to use a range of technologies, among them gas-powered engines, hybrids, electric vehicles, and diesels. Significant fuel-efficiency gains can also be realized, for instance, by improving air conditioning

Continued

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and fuel-injection systems, as well as reducing tire rolling resistance.

CAFE standards do not mandate specific technologies, but rather automakers can choose which technologies to adopt, according to Jeff Alson of the U.S. Environmental Protection Agency (EPA), which developed the new CAFE targets in collaboration with the National Highway Traffic Safety Administration (NHTSA).

“We think the industry can meet our standards by refining technologies that people are already familiar with,” said Alson, a senior engineer in the U.S. EPA’s Office of Transportation and Air Quality. The EPA’s projection for the lowest-cost way to achieve model year 2025 compliance includes improvements for gasoline vehicles (downsized, turbocharged, direct injection engines; 8-speed transmissions; lightweight materials to reduce mass; better tires and aerodynamics), a moderate increase in hybrids, and a small market share for plug-in vehicles.

Footprint-Based System

CAFE standards are “footprint-based,” or measured by the area defined by where a vehicle’s tires touch ground. Each vehicle footprint has a CO₂ emissions-reduction target as well as a fuel-economy target, with smaller vehicles having more stringent targets than larger vehicles. Each manufacturer has a unique fleet-wide compliance level depending on the footprints of the vehicles it sells. There are also separate footprint curves for cars and light trucks.

As part of the rule-making process, U.S. EPA and NHTSA will conduct an evaluation in 2018 to assess important factors such as technology innovation, consumer acceptance, and fuel prices, explained Alson, which is appropriate since standards have been set thirteen years in the future. The midterm evaluation could lead to a full range of outcomes; that is footprint curves could remain the same, could be made more stringent, or could be made less stringent.

All told, manufacturers need to offer a range of vehicle products and technologies to meet GHG emissions targets and CAFE standards in the years to come.

“There are goals for 2016, 2020, and 2025, and companies must respond quickly to meet their goals,” said Belzowski. “How they do it, is up to them, but I think the pressure of the goals requires that they develop strategies to meet them.”

The UMTRI conference was sponsored by the University of Michigan Office of the Vice President of Research and was part of UMTRI’s Focus on the Future automotive research conference series. To see conference presentations, go to www.umtri.umich.edu/divisionPage.php?pageID=514.

The next event in the series will be “Inside Japan: Understanding the Current and Future Japanese Domestic and Global Automotive Industry” on April 17, 2013. **RR**

Global Symposium on Connected Vehicles and Infrastructure

UMTRI is pleased to join the Michigan Department of Transportation (MDOT), the City of Ann Arbor, Texas A&M Transportation Institute, and the Intelligent Transportation Society of America (ITSA) to host the first Global Symposium on Connected Vehicles and Infrastructure, May 14–16, 2013, at the University of Michigan.

The three-day event will serve as a global forum for the exchange of ideas, strategies, and advancements in connectivity between road users and roadway infrastructure. The symposium will bring together leaders in government, industry, and academia to further technological innovation, behavioral sciences, policy and economic development, and to foster the deployment of connected vehicles and infrastructure.

Participants will include representatives of the ITS, automotive, infrastructure, and IT industries; roadway managers, vehicle and infrastructure researchers; and developers, practitioners, and policy makers working to promote connectivity for the advancement of transportation safety, mobility, and sustainability.

The symposium will feature an array of speakers representing leadership in both the public and private sectors who will address connected-vehicle policy, technology, and deployment. The symposium will be held in a single-track format that will include individual presentations with updates from experts at the cutting edge of critical topics, as well as expert plenary and roundtable discussions to create a dialog that moves this effort forward.

Specific sessions will include:

- Vehicle-to-vehicle communication applications
- Vehicle-to-infrastructure communication applications
- Policy considerations in security, privacy, liability, and data ownership
- Standards and specifications to accelerate deployment and support continuing innovation
- Economic development opportunities in a connected transportation system
- Connectivity applications and opportunities for transportation and urban planning
- The policy of implementing and managing a connected infrastructure
- Connectivity for vulnerable road users
- Connectivity applications to address environmental/energy use issues.

To receive more information about the symposium, go to <http://www.umtri.umich.edu/divisionPage.php?pageID=512>.

RR



Improving Road Safety: Lessons from Europe

Tougher drunk-driving laws, lower speed limits, and stricter seat-belt laws are the best ways to reduce traffic deaths in the United States, according to UMTRI researchers.

“Despite recent major improvements in road safety in the United States, the current safety level is far below the level of the best-performing countries,” said UMTRI research professor Michael Sivak.

Sivak and colleague Juha Luoma, an UMTRI visiting research scientist from the VTT Technical Research Centre of Finland, compared the amount and kinds of fatal crashes in the United States, United Kingdom, Sweden and the Netherlands.

They found that the number of road deaths has fallen in all four countries since 2006. However, the fatality rate per population is much higher in the United States—124 deaths per million people, compared with 43 in the United Kingdom, 42 in Sweden, and 40 in the Netherlands.

Sivak and Luoma say that the average annual distance driven per capita in the United States is about twice that of the three European countries.

“The U.S. is a much larger country than any of the others,” Luoma said. “Furthermore, land use and urban planning differ substantially between the U.S. and Europe. Most U.S. cities were designed in such a way that transportation depends heavily on personal vehicles.”

However, the increased amount of driving in the United States does not fully account for the differences in road safety, the researchers say. Several methods that have likely contributed to better road safety in the United Kingdom, Sweden and the Netherlands should be adopted in the United States, as well, they add.

These include:

- Lower blood-alcohol-content limits, random breath testing, and wider use of alcohol ignition interlocks.
- Lower speed limits (especially in urban areas), special speed limits and compulsory speed limiters for heavy vehicles, and use of speed cameras and/or intelligent speed adaptation.
- Primary seat-belt laws that cover both front and rear occupants and installation of advanced seat-belt reminders.
- A policy focus on reducing overall fatalities, not on reducing the fatality rate per distance driven.
- New strategies to reduce distances driven by improving urban planning and encouraging more public transportation and telecommuting.

“The implementation of effective new countermeasures in the U.S. requires raising the awareness of the general public and of the decision makers concerning the much higher safety level in the best-performing countries and of the effectiveness of various countermeasures that have been implemented elsewhere,” Sivak said. “The countermeasures to be recommended would lead to only limited restrictions on driver behavior but would likely result in substantial benefits in terms of human life saved, suffering avoided, and expenses reduced.”

See the full report: <http://deepblue.lib.umich.edu/bitstream/handle/2027.42/95704/102922.pdf>

--Bernie DeGroat, U-M News Service

RR

Integrated Mobile Observation 2.0

UMTRI is one of several partners in a project to instrument Michigan Department of Transportation (MDOT) fleet vehicles with devices that collect mobile data and pictures during winter weather events. The project, Integrated Mobile Observation (IMO) 2.0, is funded by the U.S. Department of Transportation, Research and Innovative Technology Administration (RITA), as part of the Federal Highway Administration's Road Weather Management Program.

The eighteen-month project began in October 2012. Bruce Belzowski and Ralph Robinson of UMTRI serve as principal investigators on the project in collaboration with Steven Cook, MDOT system operations and maintenance engineer, who serves as program manager.

The IMO project will use sixty MDOT fleet vehicles that manage the I-94 corridor during the winter months. Twenty of the vehicles will be MDOT snow plow trucks in southwest Michigan, and forty will be light- and medium-duty vehicles.

The MDOT vehicles will be instrumented with location-based smartphone technology that provide a Bluetooth connection to a surface monitoring device and a small module that plugs into the diagnostic port to collect data from the vehicle controller area network (CAN) bus.

Data sets that will be collected from vehicles include a camera image of road conditions, location, time, direction, accelerometer, road surface and air temperature, humidity, dew point, ABS, traction control, wheel speed, and wind shield wiper status. Not all data sets will be captured on all vehicles. The snowplow trucks will collect location and road-surface condition data but not CAN bus data. Cellular communication via smartphone will send data once every five minutes to six servers, one of which is located at UMTRI, for post processing.

Project data will be used to develop applications that support UMTRI's connected-vehicle activities, such as the Safety Pilot Model Deployment, and to help support MDOT's operations and maintenance initiatives. **RR**



MICHIGAN DEPARTMENT OF TRANSPORTATION

UMTRI at 92nd Annual TRB Meeting

UMTRI researchers joined transportation professionals from around the world at the 92nd annual meeting of the Transportation Research Board (TRB), held in Washington, D.C., January 13-17. The 2013 TRB meeting set a new attendance record of 11,700.

The TRB annual meeting program covers all transportation modes, with more than 4,000 presentations in nearly 750 sessions and workshops addressing topics of interest to all attendees, among them policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions.

Several UMTRI staff members represented UMTRI's newest initiative, the Center for the Management of Information for Safe and Sustainable Transportation (CMISST) at TRB. UMTRI assistant research scientist Carol Flannagan participated in a session entitled "International Benchmarking on Road Safety: Network for International Road Traffic and Accident Database," led by Terry Shelton of the National Highway Traffic Safety Administration (NHTSA) and Fred Wegman of the Institute for Road Safety Research (SWOV). Flannagan discussed data linkages in the United States.

UMTRI research associate professor Jonathan Rupp, Carol Flannagan of UMTRI, and Clay Mann from the University of Utah presented the poster "Measuring Serious Injuries in Traffic Crashes" as part of a session entitled "Safety: Performance, Data, and New Advances." A CMISST booth hosted by Mary Helen Eschman of UMTRI promoted the center and its capabilities.

Renée St. Louis of UMTRI's Behavioral Sciences Group presented "Strategies for Moving States from Secondary to Primary Enforcement Seat Belt Laws" during the session "Addressing Challenges to Increasing Seat Belt Use: Policy and Enforcement Approaches."

UMTRI information resources manager Bob Sweet presided as chair over the annual meeting of the TRB Information Services Committee, attended as a member of the Transportation Research Thesaurus Subcommittee of the Library and Information Services in Transportation (LIST) Committee, and attended the LIST Committee meeting as a friend of the committee.

Lidia Kostyniuk, research scientist in UMTRI's Behavioral Sciences Group, was co-author on two papers presented at TRB: "Fuel Use and Optimality of Assignments in Multi-Vehicle Households: Trends from 2001-2009" by Bolon, Keoleian, and Kostyniuk; and "Beyond the Built Environment at Home: Does Compact Development along Commuting Routes Reduce Driving and Conserve Fuel" by Wang, Grengs, and Kostyniuk.

Ray Bingham, head of UMTRI's Young Driver Behavior and Injury Prevention Group, attended the preconference TRB Human Factors Workshop, "Recent Advances in Young Driver Research: New Analytic Approaches from Recent and Ongoing Research," where he and Dr. Anuj Pradhan conducted a workshop session on the design and use of psychological priming in experimental simulator research. Bingham also gave a presentation entitled, "Randomized Controlled Trial on Effects of Event-Based



Carol Flannagan and Mary Helen Eschman distribute materials at the CMISST booth.




MIKE WARRING, WASHINGTON OFFICE

UMTRI director Peter Sweatman (right) talks with Bob Skinner, executive director of the National Research Council's Transportation Research Board at a reception hosted by UMTRI as part of TRB's 92nd annual meeting.

Feedback on Performance in Novice Drivers,” and moderated a session entitled, “Outcomes for 18-Year-Old Drivers Following Implementation of Graduated Driver Licensing” on January 15. He is also a member of the Alcohol, Drugs, and Driving Committee, and a member and secretary of the Young Driver Subcommittee, and he attended both committee meetings.

UMTRI research professor Jean Shope was a coauthor on the paper “Delaying the Inevitable? Effect of Graduated Driver Licensing on 18-Year-Old Drivers in Florida, Michigan, and Maryland,” presented by Johnathon Ehsani. Shope was also coauthor on the paper “Randomized Controlled Trial on Effect of Event-Based Feedback on Performance of Novice Drivers. She attended the Young Driver Subcommittee meeting as a member, and the Alcohol, Other Drugs and Transportation meeting, as well as the ICADTS board meeting.

The 93rd annual TRB meeting will be held January 12-16, 2014, in Washington, D.C. See <http://www.trb.org/AnnualMeeting2014/annualmeeting2014.aspx> 

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

Hu, J.; Rupp, J.D.; Reed, M.P. 2012. "Focusing on Vulnerable Populations in Crashes: Recent Advances in Finite Element Human Models for Injury Biomechanics Research." *Journal of Automotive Safety and Energy*, vol. 3, no. 4, pp. 295-307, http://www.journalase.com:8080/Jweb_qcaqyjn/EN/Y2012/V3/I4/295.

Sivak, M. 2013. "Female Drivers in the U.S., 1963-2010: From a Minority to a Majority?" *Traffic Injury Prevention*, vol. 14, no. 3, pp. 259-260, DOI: 10.1080/15389588.2012.755736.

Technical Reports

Eby, D.W.; Molnar, L.J.; Kostyniuk, L.P.; St. Louis, R.M.; Zanier, N.; Kellman, D.; 2012. Recommendations for Meeting the Mobility Needs of Older Adults in Rural Michigan. MDOT report no. RC-1592. <http://hdl.handle.net/2027.42/95709>

The research documented in this report was sponsored by the Michigan Department of Transportation.

Hu, J.; Blower, D.F. 2012. Estimation of Seatbelt and Frontal-Airbag Effectiveness in Trucks: U.S. and Chinese Perspectives. Report no. UMTRI-2013-2. <http://hdl.handle.net/2027.42/95707>

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

Kostyniuk, L.P.; St. Louis, R.M.; Zanier, N.; Eby, D.W.; Molnar, L.J. 2012. Transportation, Mobility, and Older Adults in Rural Michigan. Project no. OR 10-037. <http://hdl.handle.net/2027.42/91979>

The research documented in this report was sponsored by the Michigan Department of Transportation.

Luoma, J.; Sivak, M. 2012. Why is Road Safety in the U.S. Not on Par with Sweden, the U.K., and the Netherlands? Lessons to Be Learned. Report no. UMTRI-2013-1. <http://hdl.handle.net/2027.42/95704>

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

Schoettle, B.; Sivak, M. 2012. Road Safety in Two European Megacities: London and Paris. Report no. UMTRI-2012-29. <http://hdl.handle.net/2027.42/94548>

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

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March 2013

Smart Parking Symposium
March 18-19; Berkeley, California
<http://www.itsa.org/events/smartparkingsymposium>

Michigan Traffic Safety Summit
March 26-28; East Lansing, Michigan
www.michigan.gov/msp/0,1607,7-123-1593_3504---,00.html

April 2013

SAE World Congress and Exhibition
April 16-18; Detroit, Michigan
<http://www.sae.org/congress/>

International Highway Technology Summit
April 16-18; Beijing, China
www.trb.org/Calendar

ITS America 23rd Annual Meeting and Expo
April 22-24; Nashville
www.itsa.org

Lifesavers National Conference on Highway Safety Priorities
April 14-16; Denver, Colorado
<http://www.lifesaversconference.org/>

May 2013

TRB National Transportation Planning Applications Conference
May 5-9; Columbus, Ohio
<http://www.trbappcon.org/>

Global Symposium on Connected Vehicles and Infrastructure
May 14-15; Ann Arbor, Michigan
<http://www.umtri.umich.edu/divisionPage.php?pageID=512>

Road Safety on Four Continents
16th International Conference
May 15-17; Beijing, China
<http://www.vti.se/RS4C>

SAE Noise and Vibration Conference
May 20-23; Grand Rapids, Michigan
<http://www.sae.org/events/nvcl>

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CONFERENCES & EVENTS

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