

UMTRI

# RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • JANUARY–MARCH 2007 • VOLUME 38, NUMBER 1 •



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## UMTRI External Advisory Board Provides Strategic Direction

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ISSN 0739 7100

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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 (<http://www.umtri.umich.edu>). The subscription price is \$35 a year, payable by all subscribers except those who are staff members of a State of Michigan agency or an organization sponsoring research at the Institute. See the subscription form on the inside back cover. For change of address or deletion, please enclose your address label.

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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



## UMTRI External Advisory Board Provides Direction and Focus

*UMTRI* has developed a multidisciplinary approach to highway safety that may be unique in its diversity. Increasingly, safety does not stand alone as a research issue, and sustainability of transportation systems will require a broader research focus while offering many research challenges. UMTRI continually seeks to expand both its collaborative relationships with other organizations and its efforts to direct research towards the areas of greatest need, as perceived by its stakeholders, in the domain of transportation safety. To this end, and in consultation with the University of Michigan's Office for the Vice

President of Research and UMTRI's Steering Committee, UMTRI director Peter Sweatman established an external advisory board (EAB) to provide a more strategic dimension for UMTRI's transportation research and education activities. "My aim was to create and sustain a unique dialog on long-term transportation needs for the state of Michigan and for the nation," Sweatman says.

The EAB—which consists of about thirty members who represent business, industry, government, and academia—helps shape transportation research in an era of rapidly changing technology that will ultimately connect vehicles

and the infrastructure. EAB member Brent O. Bair, managing director of the Road Commission for Oakland County and former chairman of the board of the Intelligent Transportation Society of America, says, "The mix of people brought together on the EAB naturally leads to a rich exchange of ideas."

EAB members play a key role in advising UMTRI and the University on transportation issues and research priorities, as well as assisting UMTRI in maintaining leading-edge research capabilities that will serve emerging research challenges. They provide guidance on high-level transportation issues and a

*continued...*

context for UMTRI's future direction and development.

The EAB held its inaugural meeting in June 2005. Since that time, members of the board have provided input on UMTRI's research programs, organizational structure, sponsorship opportunities, strategic plan, and mission statement. Workshop groups were also created to address specific research areas such as the driver interface with vehicle-infrastructure integration, SAFETEA-LU research opportunities, energy and environmental research, and various areas within safety research.

The most recent meeting, in November 2006, highlighted the need for UMTRI to fully engage in transportation energy research. EAB

member Larry Oswald, chief executive officer of Global Electric Motorcars, a DaimlerChrysler company, strongly advocated this new direction. "UMTRI is well positioned to find ways to reduce transportation's consumption of carbon-based fuels without compromising safety, mobility, or accessibility," Oswald says.

EAB member Adrian Lund, president of the Insurance Institute for Highway Safety (IIHS), says UMTRI's goals parallel those of his organization. "The IIHS is looking for ways to deal with motor vehicle crashes and the resulting injuries and deaths, based on good scientific evidence. UMTRI is one of the few bodies of competent researchers working to identify effective strategies to reduce crashes." UMTRI's

first project with IIHS was a study in the 1970s about the dangers of holding babies on laps in cars. UMTRI has also worked with IIHS on injury issues with airbag deployment, and is currently investigating booster seat issues.

As a member of UMTRI's advisory board, Lund says he hopes "to help UMTRI maintain its good scientific focus on problems facing the industry, as an honest broker of how to address crashes to prevent injuries and death."

EAB member Michael Trentacoste, director of the Office of Safety R&D at FHWA's Turner-Fairbank Highway Research Center, says UMTRI helps government agencies with the implementation and conduct of research, as well as helping to organize industry and other partners for the conduct of research. "More importantly," he says, "UMTRI helps define the long-term opportunities, direction, and objectives of safety research."

As far as his role on the UMTRI EAB, Trentacoste says, "UMTRI has been a leader in the past and we want to point it to areas in the future that need its expertise. The EAB is looking for opportunities for improving all transportation aspects related to highway safety." **RR**



UMTRI / SHERMAH ERINGTON

# UMTRI's Role in Vehicle-Infrastructure Integration

After a century of motorization, our world of personal mobility still consists of the somewhat independent elements of vehicle, infrastructure, and driver. Vehicle-infrastructure integration (VII) aims to integrate these components through a nationwide deployment of a communications infrastructure on roadways and in all production vehicles. The resulting VII systems will provide totally new and purposeful ways to improve safety and mobility.

With VII, vehicles will serve as data collectors and transmit traffic and road condition information from every major road within a transportation network. The data, which will not be used to identify drivers, can be used in many ways, from warning drivers that it is not safe to enter an intersection and suggesting alternate routes to

avoid traffic tie-ups, to more quickly notifying drivers of warranty recalls. Transportation agencies could also use this data to implement strategies to relieve traffic congestion.

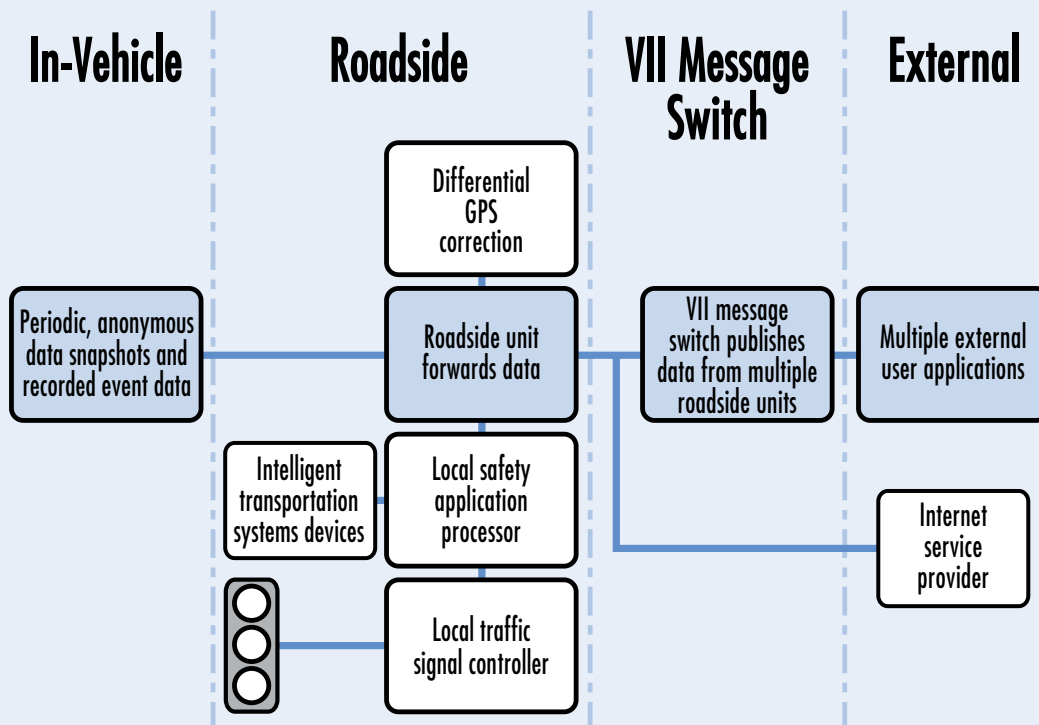
VII became firmly grounded when dedicated short-range communication (DSRC) at 5.9 GHz was set aside for licensing by VII applications. Nationally, VII will be implemented through a cooperative venture of the U.S. Department of Transportation, the automotive industry, the American Association of State Highway and Transportation Officials, and state departments of transportation. The U.S. DOT has awarded significant funding for critical safety applications that are being developed collaboratively by the major players in the U.S. auto market under the VII Consortium (VII-C).

In Michigan, the Michigan Department of Transportation (MDOT) has partnered with automotive manufacturers and suppliers, universities, the telecommunications industry, and several transportation organizations to form a VII initiative. Kirk T. Steudle, director of MDOT, says, "VII is the biggest advance in passenger and commercial transportation since the inception of the interstate highway system. Test results provide clear, measurable evidence that VII increases transportation safety, mobility, and security."

UMTRI has been active in developing and evaluating advanced safety systems involving driver assistance for well over a decade. UMTRI director Peter Sweatman says, "Deploying VII applications will provide us with a better understanding of real-world traffic conditions, including models and databases that capture how drivers

*continued...*

VII will improve driver safety and reduce delays on busy highways by integrating vehicles, infrastructure, and drivers through a nationwide communications infrastructure. Vehicles will serve as data collectors and transmit traffic and road condition information from every major road within a transportation network.



FEDERAL HIGHWAY ADMINISTRATION / MODIFIED FROM PB PARADYNE



**IVBSS team members visited UMTRI in March for a project update. Here the group examines a test vehicle. Clockwise from driver's seat: Shelley Row—ITS Joint Program Office; Jim Sayer—UMTRI; Tim Tiernan—Visteon; Jack Ference and Steve Sill—NHTSA; and Debby Bezzina—Visteon.**

manage the motion of their vehicle, how drivers share the driving task safely with other tasks, and how to provide safe and effective driver interfaces.”

The Integrated Vehicle Based Safety Systems (IVBSS) program for NHTSA is a good example of a VII-related application. It combines four warning applications, filtered and prioritized, into a single system that communicates to the driver through a single human-machine interface. In a field operational test (FOT) with drivers going about their normal business, UMTRI will track measurable changes in driver behavior, based on driving scenarios identified by poring over many miles of naturalistic driving data from previous FOTs.

Recently, Michigan has moved to the forefront of VII, with strong leadership from the Michigan Department of Transportation (MDOT). For example, MDOT has established a VII test bed in southeast Michigan for evaluating

all types of VII applications, as well as providing a focus on business systems for maximizing VII benefits to highway agencies. The test bed resides in a conurbation characterized by free-ways and major arterials with DSRC transmitters installed on the roadside (including 32 signalized intersections) and in vehicles. Transmission equipment has been installed in several test vehicles and on various traffic signal poles near the Traffic Operation Center of the Road Commission for Oakland County (RCOC). Video is streamed from one vehicle to another and from the RCOC facility to the vehicles. Ford Motor Company has carried out similar demonstrations in Dearborn.

Preparations are underway for several thousand OEM fleet vehicles to be equipped with DSRC and operated in test bed areas. The OEM will gain data on maintenance status and component performance, and MDOT and its partners will obtain data on asset

management and safety, such as low surface friction and emergency response. The first round of OEM-wide VII applications is being developed through VII-C in Novi. The package focuses primarily on safety applications (such as electronic brake lights, intersection warnings, and curve speed warning), which can benefit consumers even when only a few VII-equipped vehicles are present in the traffic stream.

UMTRI is working with MDOT to communicate VII research progress and results through the newsletter *Michigan VII Update*, which is available on both the MDOT ([tinyurl.com/3dg8am](http://tinyurl.com/3dg8am)) and UMTRI ([www.umtri.umich.edu](http://www.umtri.umich.edu)) websites.

For more information on the nationwide VII initiative, see [www.its.dot.gov/vii/](http://www.its.dot.gov/vii/). **RR**

# Baby-Boomer Bikers Dominate Roads—But at a Cost

Motorcycling in Michigan, as in the rest of the United States, is on the rise. In fact, today's baby boomers account for nearly two-thirds of all motorcyclists in Michigan—and, unfortunately, a rising number of crashes and deaths.

In a recent study, UMTRI researchers Lidia Kostyniuk and Adam Nation found that the number of motorcyclists 45 and older killed in crashes nearly quadrupled from 2001 to 2005. Crashes among this age group increased more than 60 percent during that time, compared with a 6 percent drop in the number of crashes for younger motorcycle riders. In the study, which was sponsored by the Michigan Office of Highway Safety Planning, Kostyniuk and Nation examined trends and patterns of motorcycle crashes, and also analyzed motorcycle registrations and license endorsements records in Michigan from 2001 through 2005.

“The aging of the motorcycling population in Michigan may be contributing to the increase in motorcycle fatalities,” says Kostyniuk. “As people age, their bodies become more fragile and their chances of dying as a result of a crash increase. This may well explain the increase in overall motorcycle fatalities that occurred in Michigan in 2005, a 54 percent increase from the year before.”

During the period 2001 through 2005, the number of motorcycle crashes overall increased by 9 percent, while motorcycle registrations rose 32 percent (to more than 250,000) and licensed motorcyclists increased 9 percent (to nearly 500,000).

The crash rate per licensed rider jumped more than 30 percent for older motorcyclists, but just 6 percent for motorcycle riders under 45. Younger bikers are still nearly three times as likely to be involved in a crash, and are more likely to be cited for hazardous actions, such as speeding, reckless driving, and careless or negligent driving.

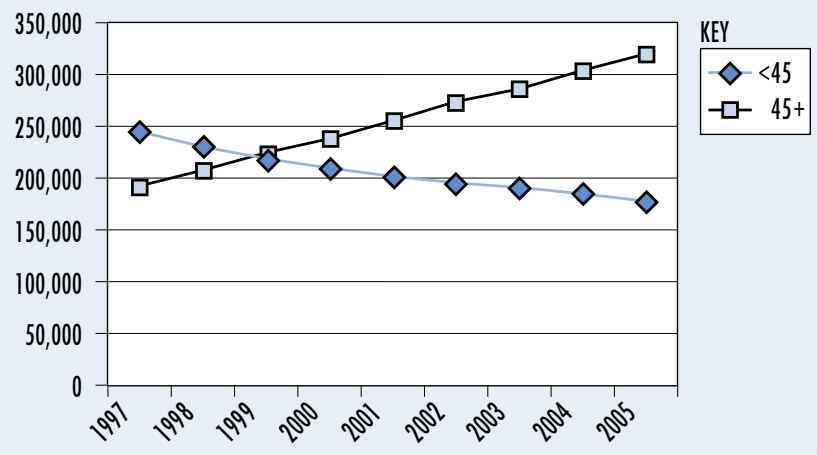
About half of all motorcycle crashes, for both younger and older riders, involve other vehicles—whose drivers are more likely to be at fault. More than 60 percent of drivers of these other vehicles engaged in hazardous actions, such as failing to yield or failing to maintain a clear distance between their vehicle and the motorcycle, and about 30 percent of them were ticketed. Conversely, about half of motorcyclists involved in a crash with another car or truck drove hazardously, though only about 15 percent were cited. Unfortunately, nearly two-thirds of fatalities and about half of all injuries to motorcycle riders in Michigan occur in crashes with other vehicles.

Overall, the UMTRI study found that motorcycles were involved in about 12 percent of all fatal vehicle crashes in 2005—a 32 percent increase since 2001. The total number of all vehicle crashes resulting in death decreased by 15 percent over the same period. Likewise, the number of nonfatal injury motorcycle crashes increased by 11 percent during that time, but decreased 18 percent for all vehicles.

Because changes in motorcyclists' behavior could possibly explain the increase in fatalities, researchers also examined the incidence of hazardous actions, drinking, and helmet use. However, none of these factors played a role. The overall pattern of hazardous actions did not change over the five years examined. There was a 5 percent

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## Motorcycle Endorsements by Age



In recent years, the number of licensed motorcyclists in Michigan has increased for people over age 45 and decreased for those under age 45. In 2005, 64 percent (320,220) of all motorcycle endorsements were held by riders 45 and older.

decrease in motorcycle crashes in which a motorcyclist or other driver had been drinking, and a 13 percent decrease in the number of fatalities from these crashes. A majority of motorcyclists involved in crashes since 2001 (about 97 percent) wore a helmet. Of those wearing a helmet, about 3 percent were killed, 20 percent sustained severe injuries, 54 percent suffered minor injuries, and 23 percent were not injured at all. Among helmetless bikers who crashed, 5 percent were killed, 30 percent were severely injured, 53 percent had other injuries, and 12 percent were not hurt.

Researchers also found that most motorcycle crashes occur on dry roads (more than 90 percent), in good weather (more than 75 percent), and during the day (about 70 percent). The peak months of motorcycle crashes were June, July, and August. The peak days were Saturdays followed by Sundays, and the peak hours were between 3:00 and 6:00 p.m.

Although Michigan data was used in the study, overrepresentation of older motorcyclists in crashes is a national trend. The large proportion of older motorcyclists is a new phenomenon and little is known about their motorcycling activities. Kostyniuk says, "Many questions still need to be addressed. How long have they been riding motorcycles? What are their skill levels, and how are they affected by age? How vulnerable are older motorcyclists to injury and death, given a crash? What type of occupant protection might help them? Obtaining answers to these questions will help to develop programs, methods, and technologies that will enable motorcyclists to continue

their activities as safely as possible."

The report, *Motorcycle Crash Trends in Michigan: 2001–2005*, is available online at <http://hdl.handle.net/2027.42/48740>.

## Better Gas Mileage Would Help U.S. Automakers

A recent UMTRI study found that financially-strapped domestic automakers could turn their losses to profits at the expense of foreign car companies by improving fuel-economy performance across their model lineups. While Ford would reap the greatest profits, all three major U.S. automakers stand to lose billions if they do not improve fuel economy.

"The Big Three now acknowledge that high gas prices and their overdependence on fuel-inefficient SUVs and pickup trucks have adversely affected markets," says Walter McManus, head of UMTRI's Automotive Analysis Division and principal researcher in the study. "The findings of our report prove in sharp detail the Detroit automakers' long-term vulnerability to volatile gas prices and show that improved fuel economy fleet-wide—above and beyond current regulation—is the key not just to their survival but their success, even if the price of gas goes down."

Looking ahead to the 2010 model year, the study examines three possible gas-prices—\$3.10, \$2.30, and \$2.00 per gallon—in two different scenarios: one in which automakers follow a business-as-usual approach making only those fuel-economy improvements mandated by law, and one in which they employ a proactive strategy using off-the-shelf technology to make more ambitious increases to fuel economy, without changing their projected mix of vehicle types.

To model these scenarios, researchers first assessed the manufacturers' ability to incorporate technologies to improve the fuel economy performance of their overall fleet without changing their product portfolios. Next, they reviewed historical and forecasted rates of technological improvement, and developed a comprehensive approach based on engineering assessments and a detailed product-plan forecast for calendar year 2010. (They created a unique forecast for each manufacturer based on its vehicle models, engines, and



COURTESY OF BONNIE MCKE / KEVIN POND





The report found that automakers could turn their losses into profits by improving fuel-economy performance across their model lineups.

transmissions planned for 2010 to estimate near-term fleet-wide potential.) Finally, to ensure that the package makes financial sense for the manufacturer and consumer, researchers incorporated a decision-making rule to determine what level of technology to apply based on the package's incremental cost and a consumer test of willingness to pay.

Using this methodology, researchers found that if all automakers follow a proactive strategy, Ford has the most opportunities to improve fuel economy fleet-wide and can narrow its fuel-economy disadvantage against the Japanese automakers more than its U.S. rivals. At \$3.10 a gallon, domestic automakers could increase profits by \$2 billion collectively (\$1.4 billion at Ford, \$500 million at GM, and \$100 million at DaimlerChrysler), while Japanese automakers could lose up to \$600 million. Even at \$2 per gallon, the Big Three could increase profits by \$1.3 billion, while the Japanese could lose \$300 million.

However, if all automakers follow a business-as-usual approach, the study shows that at \$3.10 a gallon, U.S. automakers could lose as much as \$3.6 billion in profits, compared with a smaller loss of \$800 million for Japanese automakers. At \$2 a gallon, domestic automakers would fare better than their Japanese counterparts, with profits between \$1.2 billion and \$1.4 billion, compared with \$300 million for the Japanese.

"What is surprising is that each automaker is financially safer if it follows a proactive fuel-economy strategy, regardless of what the competitors do," McManus says. "Sure, Ford might not capture sales if its competitors make a better car that has high fuel economy, but what is certain is that Ford cannot capture those sales without higher fuel economy."

The study also estimated the impact of strategic choices by automakers on U.S. employment. At \$3.10 a gallon, a market-wide proactive fuel-economy strategy could save nearly 35,000 jobs at GM, Ford, and DaimlerChrysler, while costing foreign automakers with plants in North America more than 19,000 jobs. In contrast, a business-as-usual approach could result in Big Three job losses of nearly 43,000, compared with less than 1,900 job cuts at the foreign transplants.

McManus says the report delivers important information to policymakers, as well as to automobile company management, labor unions, and shareholders. His recommendations include:

- Establishing a formal coalition of industry, labor, government, and nonprofits with a mandate to develop federal policies designed to dramatically increase the fuel economy of all vehicles in the United States.
- Enhancing regulatory rationality and certainty.
- Supporting development of advanced technologies.
- Building a domestic supply chain for advanced-technology, fuel-efficient vehicles.

"Automakers must decide their fuel-economy strategies for 2010 today, knowing neither the future fuel prices nor the decisions their competitors have made," McManus says. "Our report provides stark evidence that the riskiest thing domestic automakers could do is continue business as usual. Deploying new technologies takes time and money to accomplish, and time and money are in short supply in Detroit. While management is currently focused on cutting capacity through massive layoffs, they need to undertake a deep transformation to much more fuel-efficient fleets to avoid going under. The dilemma the Detroit automakers face is that while they may believe that they cannot afford to make fuel economy a high priority, in actuality, it turns out that they cannot afford not to."

The full report, *Can Proactive Fuel Economy Strategies Help Automakers Mitigate Fuel-Price Risks?*, is available online at [www.umtri.umich.edu/url.php?c](http://www.umtri.umich.edu/url.php?c) to members of the Automotive Analysis Division's Affiliates Program (nonmembers may contact Jan Eveswell at [jeveswel@umich.edu](mailto:jeveswel@umich.edu)).

# UMTRI BRIEFS

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For a related report on fuel economy, see “The Link Between Gasoline Prices and Vehicle Sales” at [www.umtri.umich.edu/content/McManusBusinessEconomics.pdf](http://www.umtri.umich.edu/content/McManusBusinessEconomics.pdf).

## UMTRI Sponsors U-M Solar Car Team

UMTRI, whose mission includes participating in the education and training of students, has become a silver-level sponsor of the University of Michigan (U-M) Solar Car Team. Corporate sponsors, such as UMTRI, provide the team with the necessary material and financial capital to remain at the forefront of technology.

The U-M Solar Car Team is a nonprofit, student-run organization whose purpose is to design, finance, build, and race a solar-powered vehicle in competitions around North America and the world. The team is dedicated to the development of its members as teammates, educators, and leaders, and to the education of the potentials of alternative energy technology.

For the last year and a half, over a hundred U-M students have been working on the development

of the University’s ninth-generation vehicle, Continuum, to compete in the Panasonic World Solar Challenge (WSC) in late October, 2007. This race will span 1,800 miles of Australian Outback from Darwin, Northern Territory, to Adelaide, South Australia. (Before traveling to Australia, the team plans to run two routes: the North American Mock Race in June and the North American Solar Rally in July.)

The team is currently working on the second prototype of the vehicle, which incorporates the most aggressive vehicle redesign in the team’s history. Recent changes and additions to WSC regulations will require additional design<sup>1</sup> and safety modifications. UMTRI will participate in a safety design review and provide input into overall vehicle safety.

The previous U-M solar car, Momentum, won the 2005 North American Solar Challenge, a competition to design, build, and race solar-powered cars in a cross-country event. The U-M team completed the 2,495-mile race from Austin, Texas, to Calgary, Alberta, Canada, in 53 hours, 59 minutes, and 43 seconds. **RR**

<sup>1</sup> For example, the driver will sit upright, instead of lying down in the car; the driver will have a steering wheel, instead of using push-and-pull levers; and solar panels will be limited to six square meters. The changes mean more drag and slower speeds.



UNIVERSITY OF MICHIGAN / SOLAR CAR TEAM

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## Journal Articles

Reed, M.P.; Ebert-Hamilton, S.M.; Manary, M.A.; Klinich, K.D.; Schneider, L.W. 2006. "Improved Positioning Procedures for 6YO and 10YO ATDs Based on Child Occupant Postures." 52 p. *Stapp Car Crash Journal*, vol. 50 (Nov. 2006), pp. 337-388. Report No. SAE 2006-22-0014.

Rouhana, S.W.; Kankanala, S.V.; Prasad, P.; Rupp, J.D.; Jeffreys, T.A.; Schneider, L.W. 2006. "Biomechanics of 4-Point Seat Belt Systems in Farside Impacts." 32 p. *Stapp Car Crash Journal*, vol. 50 (Nov. 2006), pp. 267-298. Report No. SAE 2006-22-0012.

## Technical Reports

Blower, D.; Matteson, A. 2006. *Evaluation of 2005 Louisiana Crash Data Reported to Motor Carrier Management Information System Crash File*. 38 p. Report No. UMTRI-2006-37. <http://hdl.handle.net/2027.42/49329>.

The research documented in this report was sponsored by the Federal Motor Carrier Safety Administration.

Green, P.E.; Matteson, A. 2006. *Evaluation of 2005 Ohio Crash Data Reported to Motor Carrier Management Information System Crash File*. 37 p. Report No. UMTRI-2006-36. <http://hdl.handle.net/2027.42/49328>.

The research documented in this report was sponsored by the Federal Motor Carrier Safety Administration.

Green, P.E.; Matteson, A. 2006. *Evaluation of Maryland crash data reported to Motor Carrier Management Information System crash file*. 41 p. Report No. UMTRI-2006-24. <http://hdl.handle.net/2027.42/49330>.

The research documented in this report was sponsored by the Federal Motor Carrier Safety Administration.

LeBlanc, D.; Sayer, J.; Winkler, C.; Ervin, R.; Bogard, S.; Devonshire, J.; Mefford, M.; Hagan, M.; Bareket, Z.; Goodsell, R.; Gordon, T. 2006. *Road Departure Crash Warning System Field Operational Test: Methodology and Results. Volume 1: Technical Report*. 307 p. Report No. UMTRI-2006-9-1. <http://hdl.handle.net/2027.42/49242>.

The research documented in this report was sponsored by the National Highway Traffic Safety Administration.

LeBlanc, D.; Sayer, J.; Winkler, C.; Ervin, R.; Bogard, S.; Devonshire, J.; Mefford, M.; Hagan, M.; Bareket, Z.; Goodsell, R.; Gordon, T. 2006. *Road Departure Crash Warning System Field Operational Test: Methodology and Results. Volume 2: Appendices*. 358 p. Report No. UMTRI-2006-9-2. <http://hdl.handle.net/2027.42/49244>.

The research documented in this report was sponsored by the National Highway Traffic Safety Administration.

Sivak, M.; Schoettle, B.; Flannagan, M.J. 2006. *Mirror-Mounted Turn Signals and Traffic Safety*. 14 p. Report No. UMTRI-2006-33.

The research documented in this report was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety. 

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# CONFERENCES & EVENTS

**TRB 86th Annual Meeting**  
January 21–25, Washington, D.C.  
[www.trb.org/meeting](http://www.trb.org/meeting)

**Road Safety and Traffic Management**  
February 14–16, Cairo, Egypt  
[www.trafficegypt.com](http://www.trafficegypt.com)

**NAPA Annual Meeting**  
February 17–21, San Francisco, California  
[www.hotmix.org](http://www.hotmix.org)

**Road Safety Congress 2007**  
February 26–28, Stratford-upon-Avon, England  
[www.rosipa.org.uk/road](http://www.rosipa.org.uk/road)

**Michigan Traffic Safety Summit**  
March 13–15, E. Lansing, Michigan  
<http://tinyurl.com/2z9j5j>

**Transportation Research Forum Annual Meeting**  
March 15–17, Boston, Massachusetts  
[www.trforum.org/forum](http://www.trforum.org/forum)

**World of Asphalt 2007**  
March 19–22, Atlanta, Georgia  
[www.worldofasphalt.com](http://www.worldofasphalt.com)

**Workshop on Intelligent Transportation**  
March 20–21, Hamburg, Germany  
[wit.tu-harburg.de](http://wit.tu-harburg.de)

**Lifesavers 2007: National Conference on Highway Safety Priorities**  
March 25–27, Chicago, Illinois  
[www.lifesaversconference.org](http://www.lifesaversconference.org)

**ITE Conference and Exhibit**  
March 25–28, San Diego, California  
[www.ite.org/conference](http://www.ite.org/conference)

**GIS for Transportation Symposium**  
March 26–28, Nashville, Tennessee  
[www.gis-t.org](http://www.gis-t.org)

**National Work Zone Awareness Week**  
April 2–6, Nationwide  
<http://tinyurl.com/2xyppj>

**APA National Planning Conference**  
April 14–18, Philadelphia, Pennsylvania  
[www.planning.org/2007conference](http://www.planning.org/2007conference)

**SAE World Congress**  
April 16–19, Detroit, Michigan  
[www.sae.org/congress](http://www.sae.org/congress)

**TRB Visibility Symposium**  
April 17–18, College Station, Texas  
[www.visibilitysymposium.com](http://www.visibilitysymposium.com)

**Ergonomics Society Annual Conference**  
April 17–19, Nottingham, England  
[www.ergonomics.org.uk/page.php?s=20&p=89](http://www.ergonomics.org.uk/page.php?s=20&p=89)

**Design-Build in Transportation Conference**  
April 18–20, Minneapolis, Minnesota  
[www.designbuildtransportation.com](http://www.designbuildtransportation.com)

**United Nations Global Road Safety Week**  
April 23–29, Worldwide  
[www.who.int/roadsafety/week](http://www.who.int/roadsafety/week)

**ITS Canada Conference**  
April 29–May 1, Niagara Falls, Canada  
[www.itscanada.ca/niagara2007](http://www.itscanada.ca/niagara2007)

**International Road Safety Exhibition**  
May 3–5, Riva del Garda, Italy  
[www.sissonline.it](http://www.sissonline.it)

**Bus and Paratransit Conference / International Bus Roadeo**  
May 4–19, Nashville, Tennessee  
[www.apta.com/conferences\\_calendar/bus](http://www.apta.com/conferences_calendar/bus)

**TRB National Transportation Planning Applications Conference**  
May 6–9, Daytona Beach, Florida  
[www.lctr.fiu.edu/trb-appcon](http://www.lctr.fiu.edu/trb-appcon) 



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