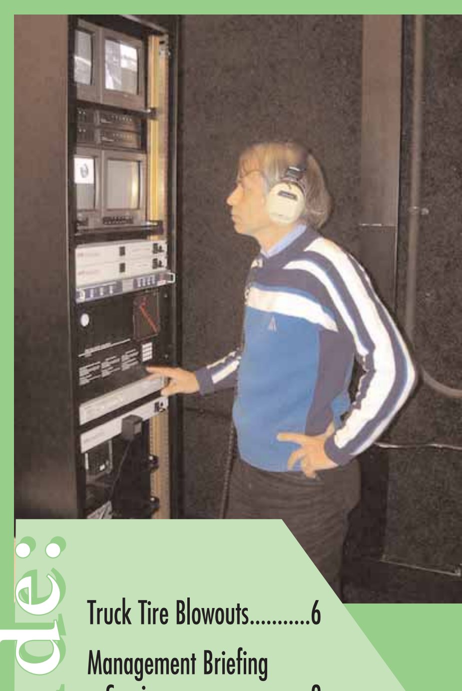
UMTRI

RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • APRIL–JUNE 2002 • VOLUME 33, NUMBER 2 •



UMTRI'S NEW SIMULATOR HELPS DRIVING SAFETY

on page 1

Inside:

Truck Tire Blowouts...........6
Management Briefing Seminars.......................9
Hot off the Press 11
Conferences & Events......14

UMTRI
RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • APRIL–JUNE 2002 • VOLUME 33, NUMBER 2 •

ISSN 0739 7100

Writer and Editor: Monica Milla
Designer and Cover Photographer: Shekinah Errington
Printer: UM 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 (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.

Transportation Tidbits

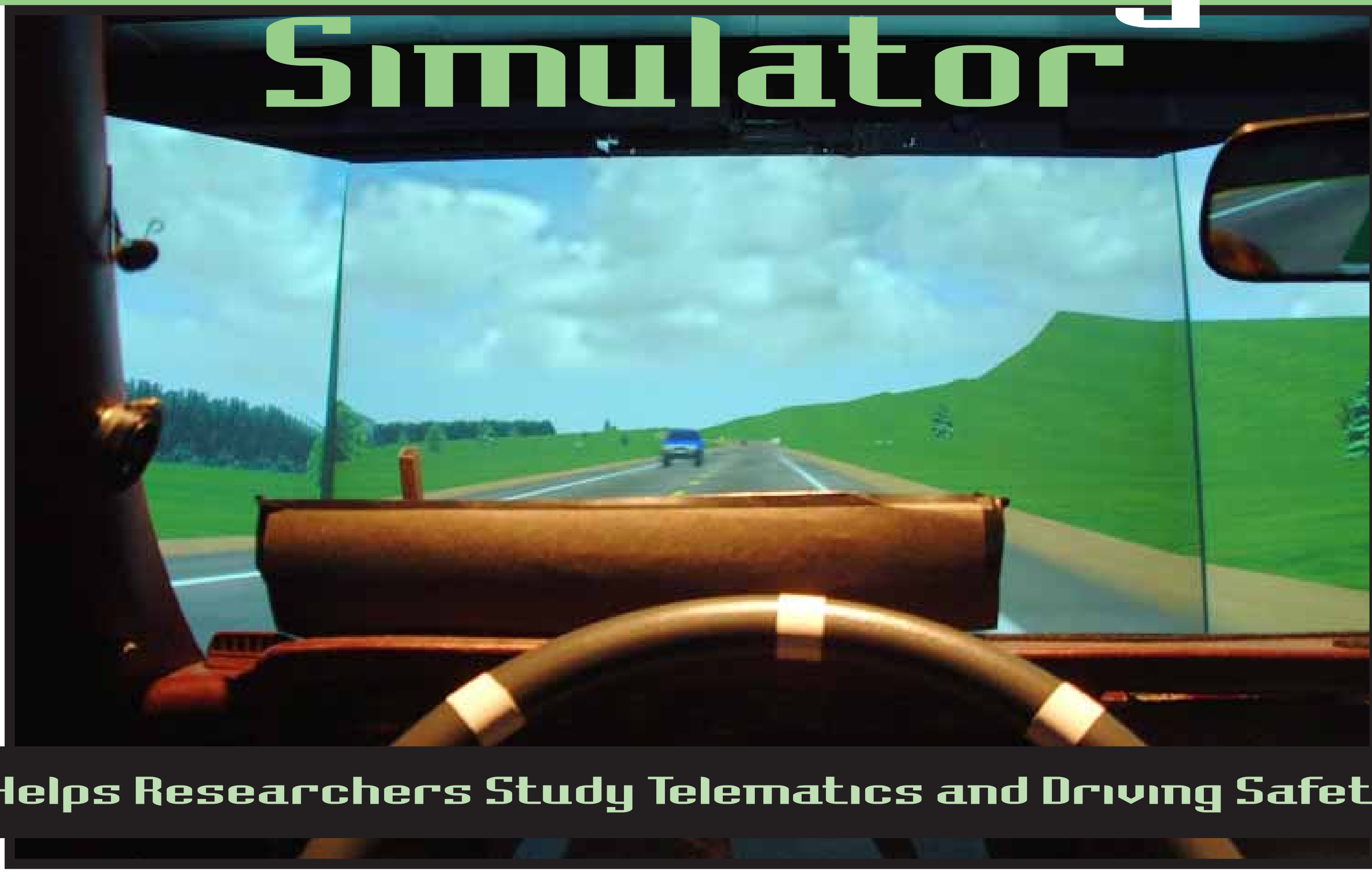
- The first Grand Prix race took place in Pau, France, in February, 1901. The winner's Panhard vehicle averaged just over 46 miles per hour.
- The first multilevel parking garage opened in London, England, in May, 1901. It had seven floors and an electric elevator raised cars to the upper levels.
- America's first transcontinental auto race took place in August, 1903, between New York City and San Francisco. The race was finished by Tom Fetch and M.C. Karrup in two Model F Packards, traveling an average of eighty miles per day for fifty-one days.‡
- In 1905, ignition locks, tire chains, spare tires, and folding car tops are invented.
- In 1915, American Franklin introduced placing the spare tire in the trunk of a car.
- Tilt-beam headlights were first introduced in 1915 by Cadillac.
- The first known use of an oil-warning light was introduced in 1925 in the Fiat 509 model.
- In 1925, the newly-formed U.S. Joint Board of State and Federal Highway Officials made road signs uniform in naming, numbering, color, and shape. The red octagonal stop sign was born!
- Route 66 was commissioned in 1926, and incorporated many pieces of existing roads. The "Mother Road" is 2,448 miles long, starting in Chicago and ending in Santa Monica. It crosses eight states and three time zones.§ RR

All facts from *On the Move: A Chronology of Advances in Transportation* by Leonard C. Bruno, **except**:

‡ This Day in Automotive History, http://historychannel.com

§ Historic Route 66, http://www.historic66.com/index.html

New Driving Simulator



UMTRI / MONICA MILLA

Helps Researchers Study Telematics and Driving Safety

Nancy Ross-Flanigan of UM News and Information Services contributed to this article.

UMTRI recently unveiled a new driving simulator that allows constructing complex virtual worlds with programmable and intelligently responding traffic. This technology helps researchers study in-vehicle devices, driver workload, the effects of age on driving, and driver behavior in general. It will also help answer crucial telematics questions such as: How dangerous is it to dial a cell phone while driving? To what extent do navigation systems, and other in-vehicle gadgets overload drivers? Do new devices, designed to warn drivers who are about to run off the road, really work?

Paul Green, a senior research scientist in UMTRI's Human Factors Division and head of the Driver Interface Group, says, "The issues we're studying with the simulator all have the potential to save significant numbers of lives. And with this new, state-of-the-art facility, UM can become a leader in an area that already is one of our proven strengths."

The driving simulator consists of a modified, full-sized automobile in a room with wall-sized screens. Computer-generated images simulate views of a roadway as seen through the windshield and in the rear-view mirror. The car is equipped to sound and feel like a real automobile cruising down the highway or driving on city streets. Video cameras inside the vehicle allow researchers to record views of the instrument panel, the driver's face, hands, and feet. In a typical experiment, a subject performs a task, such as dialing a cell phone, during a simulator run that resembles a typical driving situation, and researchers assess the impact on the person's driving.

The new simulator replaces a less sophisticated one that UMTRI had been using for seven years. The old simulator showed only simple scenes of a curving, two-lane road with light traffic; the new one allows for more realistic, complicated scenarios with intersections, expressway entrances and exits, heavier traffic, and pedestrians. UMTRI director Barry Kantowitz explains, "Our old simulator was no longer state-of-the-art, so we decided to upgrade to better meet the needs of our research sponsors and to remain competitive with other university simulators. The new simulator is an excellent investment, with four major projects lined up for its use this academic year."

continued...

The front screen of the new simulator is shown during construction and as the finished front panels.

The room for the new lab was previously used as offices and had to be completely converted.

PHOTOS ABOVE & AT LEFT: UMTRI / SHEKINAH ERRINGTON

The simulator project began after studying pages of specifications, forming a review committee, and investigating bids. GlobalSim (formerly KQ Corporation and before that, Hyperion Technologies) won the contract bid for the simulator hardware and software. Its DriveSafety Research Simulator (http://globalsim.com/drivesafetyresearch/index.htm) is also used by other universities and industry suppliers, with whom UM researchers can exchange simulated worlds and driving scenarios, and receive help in debugging them.

In the Beginning

The process for building the new telematics/simulation laboratory was quite involved. The location changed to another floor, to an area that was previously a set of offices. The electrical systems had to be entirely replaced, new walls were constructed, and the room (walls, ceiling, and floor) was soundproofed for optimal acoustics. While most of the equipment was new, some pieces were transferred from the existing facility. Most notably, the "buck," or test vehicle, took ten days to be moved and reconfigured, and the process involved many people's help. (The graphic timeline depicts how the move progressed.)

Christopher Nowakowski (formerly a research associate in the Human Factors Division, now at California PATH) was extensively involved in the process of setting up the simulator, from moving and ordering equipment to wiring. Jim Sayer, a research scientist in the Human Factors Division, is leading a project on road-departure warnings, in which Visteon is also involved. Bill Warden, an electrical engineer for Visteon working with Sayer and Green, found himself onsite at UMTRI and pitched in to provide essential assistance in cabling and reconfiguring the video system. Green says Warden was "the right person at the right time with the right skills. We really appreciate his help, going above and beyond the scope of the project."

UMTRI engineering technicians John Koch and Ben Powell were also kept busy with the construction, adding walls, and soundproofing the walls, floor, and ceiling (look for them in the timeline graphic). The walls were covered in black carpet to avoid reflections and as soundproofing. Green's wife, Cathy, created black curtains that can be pulled to keep the control center from the subjects' view, and Bernie Heston, a research secretary in the Human Factors Division, made the curtains for the workshop.

After about seven months of preparation, the new simulator is now up and running. The first pilot experiment concerning road departure warnings conducted by research assistants Brad Zylstra and Brian Cullinane is complete.

A more extensive set of auditory warnings is in progress and experiments on icon warnings and haptic warnings (seat shaker) will soon follow. In addition, research assistants Ken Mayer and Jason Schweitzer will compare the new simulator to the old one by repeating a study of dialing conducted on the old simulator with the same set of participants. At issue is whether people drive at the same speeds in both when given instructions about how fast to drive, if they weave more in one than the other, and if the tradeoffs between driving and performing an in-vehicle task are the same. Finally, Omer Tsimhoni and

Sound-proof ceiling panels are installed.

PHOTOS THIS PAGE: UMTRI / SHEKINAH ERRINGTON

April – June 2002

UMTRI staff disassembles the old simulator setup.

Dan Smith will be replicating a recently completed on-road study of driver workload.

Driving experiments usually take about two hours, an hour of which is actual driving time. During each driving simulation session, about 1 MB of data is recorded and a 90-minute video tape is filled.

The System: Nuts and Bolts [and Lots of Wires]

The simulator consists of three main parts: the buck (or car), the display areas that subjects see while driving, and the control room that houses system hardware and software, as well as researchers. There is also a nearby workshop for maintenance.

The Buck

The buck is the passenger interior of a real car, modified for the driving simulator. For example, its front and back ends have been replaced by removable panels that provide easy access to the test equipment. A simulated head-up display is created by projecting text from an LCD panel onto a Plexiglas screen that is mounted close to where a real windshield would be located. A vibration system or "shakers" have been added under the driver and passenger seats to simulate the feel of the road and to reduce motion sickness. (Motion sickness occurs because what people see in the road scene and the motions they feel are not the same.)

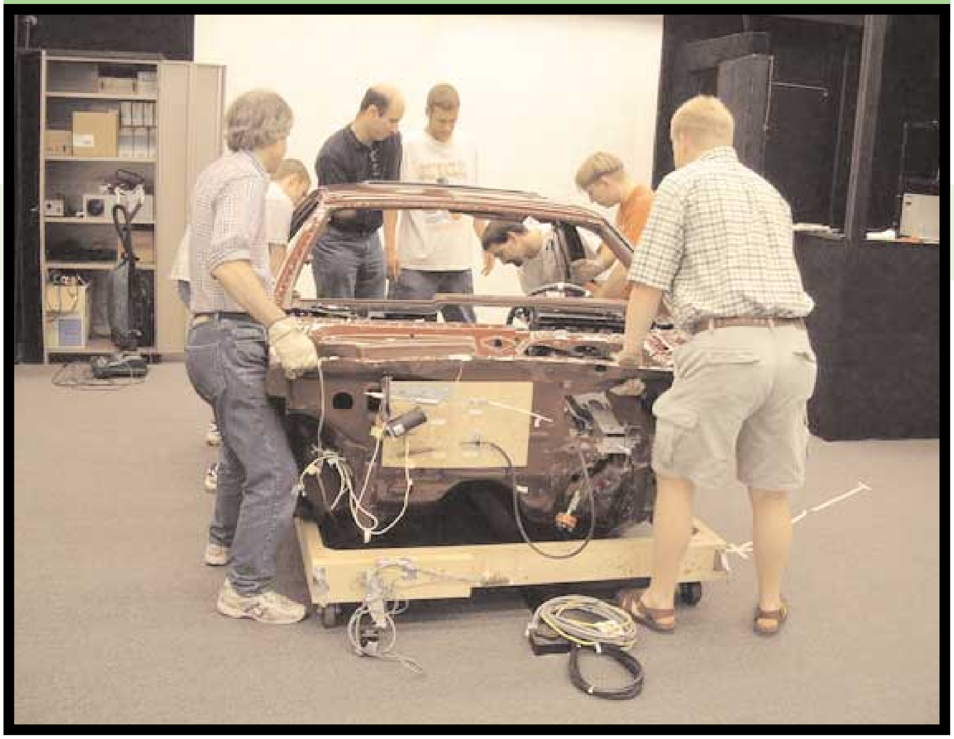
A computer-generated instrument panel has been configured to show the speedometer, tachometer, fuel gauge, and other displays. The readouts can be easily moved and sized, depending on what is needed for a particular study.

Several cameras in and near the vehicle record real-time video feedback of a person's actions/performance. A camera, mounted behind the driver's right shoulder, captures the driver's hand motions, the instrument panel, and the center console. Other cameras record the driver's face, the driver's feet, and various parts of the front and rear driving scenes. A yet-to-be-installed camera will provide a panoramic view of the console and the forward road scene.

A floater camera will be positioned so that the images of the driver, the scene, and some instrumentation can be captured into a software program that displays these images in real-time over the Internet. This is handy for sponsors and other offsite parties, who may be interested in watching an experiment take place. Green says, "Our goal was to create an 'any image, anywhere' system, with a huge number of monitor and screen display options, so any image from the experiment can be projected to any screen in the lab." It will also be used to communicate with the vendor, GlobalSim, when knotty problems arise.

continued...

UMTRI staff members move the buck to the new lab.



With the buck in place, the new video rack is installed.

June 2002

The Display Area

Four 11-foot-wide, floor-to-ceiling panels are used to display the road scene. Different driving "worlds" can be programmed in the software to create city or rural driving scenarios, with intersections and expressway entrances and exits, in heavy or light traffic and with varying road curvatures. Even various type of weather can be simulated. Three panels in front of the driver, each illuminated by a separate LCD projector, simulate the view one would have through the front windshield, and one panel behind the buck (illuminated by a fourth LCD projector) simulates what a driver would see in the rearview and side mirrors.

To make operating the LCD projectors easier, Dan Huddleson, an electronics technician in UMTRI's Engineering Research Division, identified hardware for a wireless universal remote, that Warden built and Koch and Powell installed. This device precludes both needing separate controllers and having to walk around the room to get the signals properly aimed.

The Control Room

The control room houses the behind-the-scenes heart of the simulation: hardware, software, and sound systems. All of the equipment is supported by a series of uninterruptible power supplies to ensure the system does not "crash" in the case of a power glitch or outage (thunderstorms and ice storms are not unheard of in Michigan).

The software lets researchers create driving environments specific to a particular study. This software has more capabilities than that of the old simulator. Green says, "It's more sophisticated, more capable, and more involved, but also more fragile than our Macintosh-based simulator." Indeed, its increased complexity, including use of the TCL ("tickle") programming language, means that it takes longer to get up to speed in creating the driving scenarios. Loading the driving worlds also takes a while, but the results are worth it.

The control room has numerous monitors for observing the operation of the simulator and the subject. The main simulator display shows the world in real time, usually from high above ("the God's eye view") to allow the experimenter to observe the driver's progress though the road network relative to traffic. In addition, there is also a large display to mimic either the instrument panel or the center console display. Two additional monitors show combinations of four images each from various cameras and image generators, and an additional monitor shows the four images being recorded on videotape. A 16-input, 16-output video switcher (some of whose input is from an 8x4 switcher) aids in controlling the video system. Four more monitors can display all 16 input images to the video system.

Using a 12-input/four-output audio mixer, sounds from computer and recording devices can be sent to drivers, primarily as warnings of various types, music, and speech output. There are two speaker systems in the vehicle, a four-speaker system for road noise and a ten-speaker system (from a Nissan Altima) to present sound from the audio warning and entertainment systems. In addition, these speaker systems make the driving experience quite

July 2002

Inputs and outputs to the new video system in the buck are installed.

The new lab is complete and the buck is taken for a "test drive."

PHOTOS THIS LAYOUT: UMTRI / SHEKINAH ERRINGTON

realistic. Speakers in the corner of the room provide sound when using the simulator as a demonstration tool. Four additional speakers in the control booth allow programmers to hear the sounds associated with whatever world they are currently developing.

Researchers can also communicate with the test subject via a microphone ("the voice of God"), and with another researcher in the car via a "golf microphone" and earpiece worn by the in-vehicle experimenter. (The latter keeps the subject from hearing the comments or instructions from the researcher in the control room. Experimenters are encouraged to speak quietly—as would a golf commentator—so they are not overheard.)

With everything in the new telematics/simulation lab now in place, and studies lined up for its use, UMTRI researchers will soon be able to answer some of the critical questions facing human factors professionals and those developing telematics in industry. RR

The back screen shows the view the driver sees in the rearview mirrors.

During the test runs, researchers monitor and record driver reactions, speed, location of the vehicle on the road, and many other factors.

Understanding Truck Tire Blowouts

Between 1995 and 1997 in the U.S., 62 people were killed and an estimated 663 were injured in truck crashes that involved tire blowout. Although the number is relatively low in comparison to the total number of fatalities (16,101) and injuries (an estimated 357,000) in truck crashes during the same period, truck tire blowouts are an important area of study. Zevi Bareket, senior research associate in UMTRI's Engineering Research Division, says, "A fatal truck accident due to a tire blowout is quite a rare occurrence, but when it does happen, in almost half the cases the truck driver is the only fatality." Maintenance issues are the major cause of tire blowout. In addition to increasing safety, properly maintaining the truck tire significantly increases its longevity and decreases the operating costs of a truck fleet.

A recent UMTRI research project, sponsored by the U.S. DOT Volpe Center, focused on compiling and reviewing truck crash data to better understand the severity, prevalence, causes, and likelihood of truck tire blowouts. The "Blowout Resistant Tire Study for Commercial Highway Vehicles" was conducted by Bareket; Dan Blower, assistant research scientist in UMTRI's Survey and Analysis Division and acting head of the Center for National Truck Statistics; and Charles MacAdam, research scientist in UMTRI's Engineering Research Division. The authors conducted a literature review and examined data from NHTSA's Fatality Analysis Reporting System (FARS) and UMTRI's Trucks Involved in Fatal Accidents (TIFA) file. The authors surveyed the truck tire industry on tire development and reported on industry-wide countermeasures to blowout. They also supplemented their new-technology survey by conducting searches through patent databases.

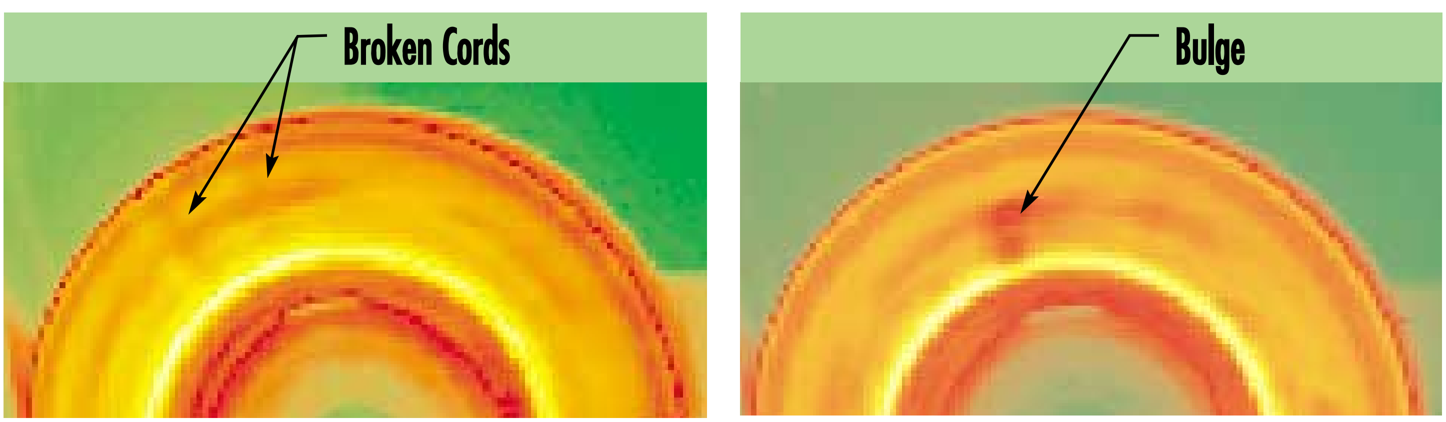
Cause and Occurrence

The crash data analysis revealed a very small percentage of fatal truck crashes associated with truck tire failures. However, the study found a linkage between fatal crashes involving truck tire blowouts and front tire (steering axle) involvement. In the data examined, 35 of 52 fatal-crash blowouts occurred on the front axle. In fact, Bareket says, "The front tire is typically what's meant in fatal-crash tire blowouts." Furthermore, front-axle tire blowouts in fatal truck crashes often involved loss of directional control.

The study also found that left-front blowouts are more frequently associated with multiple-vehicle fatal crashes, whereas right-front blowouts are more frequently associated with single-vehicle crashes. These findings mesh with the fact that left-front blowouts produce a leftward path disturbance to the truck (potentially into oncoming or adjacent traffic), whereas right-front blowouts produce rightward disturbances to the truck, which are more likely to involve road departure.

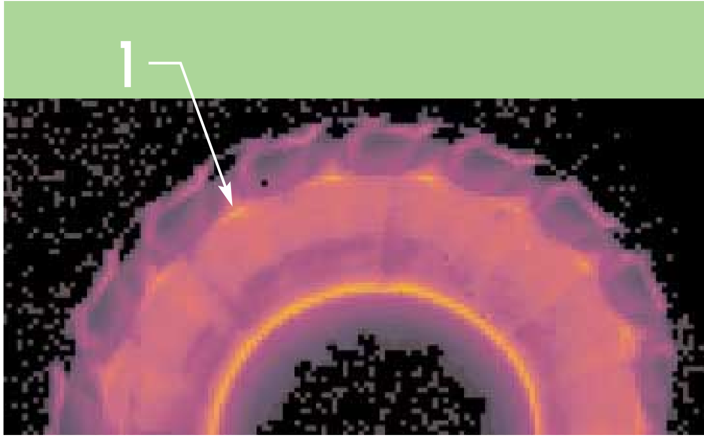
Further, the study found some industry and government concern that retreaded tires may not be as good as newly manufactured ones. (For example, regulations prohibit the installation of retreaded tires on the front axles of

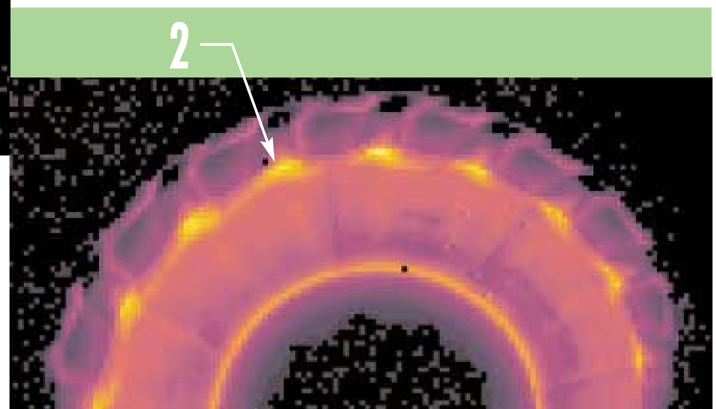
UMTRI / CECIL LOCKARD

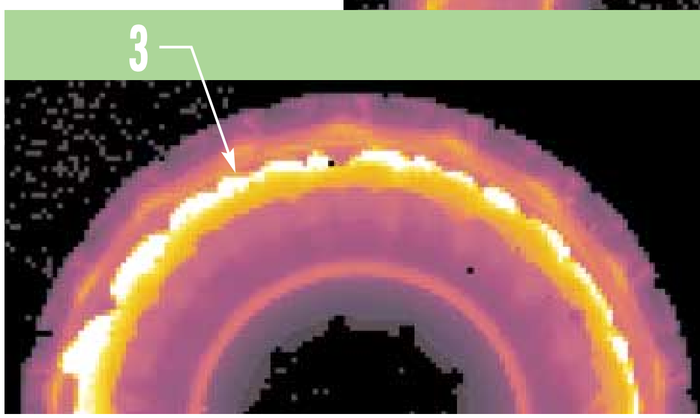


GRAPHICS COURTESY OF RAY SCHANDELMEIER, RADIAN, INC.

These thermal images show tire defects not easily apparent to the naked eye. The left graphic shows a tire with broken cords that are not externally apparent. The right graphic shows a bulge in the sidewall of a tire, which is only visible on close examination.







These infrared images show the stages of heat build-up on a tire, up until failure, during a test procedure.

GRAPHICS COURTESY OF RAY SCHANDELMEIER, RADIAN, INC.

certain types of heavy-duty vehicles such as buses.). But, in fact, retreads were not overly represented in fatal truck tire blowouts. Tire manufacturers do unanimously agree that inadequate maintenance is the leading cause for tire blowouts. Bareket says, "Low tire pressure and overloading are the main forms of poor maintenance that cause tire failure. Although keeping tires well-maintained is a significant cost for large fleets, the payoff, both in economics and safety, is well worth it." Because of control-loss ramifications, drivers usually check the front tires, which, when involved in blowouts, cause the most loss of control.

Many companies are educating drivers and fleets about tire maintenance and tire-pressure monitoring, including providing software to help manage tires. A driver who is educated in tire maintenance and who pays attention to the tires' condition and pressure will likely not have a blowout.

Technology and Prevention

Current research and development is looking to improve the lifespan and safety of tires and to foresee and prevent blowouts. "A tire can blow out of the blue — everything is fine one minute, then the truck runs over some obstacle in the road," says Bareket. "It can be unforeseen and not the fault of the tire or driver. By and large, though, most tire blowouts are caused by tire wear and are predictable. An underinflated or overloaded tire will get hotter and hotter with use and increased heat leads to a blowout. One approach is to define and detect tire deterioration patterns prior to a blowout."

The U.S. Army Tank-Automotive mand (TACOM) and Radian, an engineering services corporation, are developing an infrared (IR)-based system that detects defects and potential failures in the tire. The system characterizes different heat-buildup scenarios in the tires and relates them to potential types of failure. The goal of the system is to install such IR cameras in weighing stations. This would provide truck drivers or an enforcing authority with an immediate analysis of the tires' "health status" and a heads-up on any imminent failure to prevent the tire from going on the road again.

Tire manufacturers, fleets, and other suppliers also continue to search for ways to detect low tire pressure, which may lead to blowouts. Practically all tire companies are developing wireless electronic chips that are embedded in the tire to monitor pressure and/or heat. These systems are generically referred to as "smart tire" or "tire chip" technology. Some systems focus on extracting detailed information about pressure and temperature, while others focus on pass/fail criteria for determining when the pressure is too low or the temperature is too hot. Some applications continuously transfer the data results to the truck cab, while others are

continued...

transmitted only as alarms or warnings. Yet other systems do not transfer data to the cab at all, instead using scanners at truck stops and weigh stations to read the data periodically. Aside from normal cost considerations, technical challenges for implementing tire chips include making chips resilient enough to survive in the thin tread of a worn tire and to withstand the heat of tire retreading. In addition, the installation must survive the extremely flexible environment of the tire sidewall.

Several companies have developed technology solutions for truck tires that allow the tire to keep functioning after a puncture or blowout, without loss of traction and without the tire coming off of the wheel. Cost and complexity, however, limit the application of these solutions only to military vehicles. Other blowout-resisting designs, such as Goodyear's extended mobility tire, combine a reinforced sidewall that supports the tire and prevents it from collapsing in case of a flat tire, with a strengthened tire bead that holds the tire to the wheel after a puncture. These designs, however, are limited to passenger-car tires because they cannot support the weight associated with heavy-duty trucks. Currently, no blowout-resisting solution exists for such commercial vehicles.

It is hoped that with the combination of improved technology and better maintenance, tire blowouts will be even less likely in the future. Keep on truckin'! RR

Truck Tire Blowouts Statistics at a Glance

- **Between 1995 and 1997 in the U.S., 62 people were killed and an estimated 663 were injured due to truck tire blowout crashes.**
- **Tire defects are the second most common vehicle defect noted on trucks in fatal crashes (brakes are the most common). Still, accidents with coded tire defects are rare—only 0.87 percent of all trucks involved in a fatal crash.**
- **Tire blowouts accounted for 40 percent of tire defects coded for trucks involved in a fatal crash.**
- **Blowouts occur in 0.35 percent of fatal truck crashes, or 0.094 fatal truck crash involvements due to blowout per billion miles of travel.**
- **In fatal crashes involving blowout, 35 of 52 occurred on the front axle, 22 on the left steering tire, and 13 on the right steering tire.**
- **Front axle blowouts in fatal truck crashes nearly always involved a loss of control. Drive and trailer axle blowouts do not generally lead to a loss of control.**
- **Nearly 90 percent of blowout crashes involve only the truck, except in fatal crashes, where 44 percent of tire blowouts involved only the truck.**
- **Blowouts account for 0.25 percent of truck crash involvements of all severities.**

The SmarTire system consists of a strap-mounted sensor/transmitter attached to the wheel (below) and a control module, in the truck cab, that displays information about tire pressure and heat (inset). The display module also warns the driver of situations that could lead to truck tire blowout. *(The module shown is installed in a car; the truck module is the same design but displays information for each truck tire.)*

GRAPHICS COURTESY OF MARTIRE SYSTEMS, INC.

Management Briefing Seminars Help Automotive Industry Members Connect

For five days in August, over one-thousand representatives of the international automotive industry converge in northern Michigan to attend the Management Briefing Seminars. Participants come to listen, network, and learn from one another through a series of presentations, panel discussions, and social events. The annual event is in its thirty-seventh year and takes place in Traverse City, Michigan, a resort town near the shores of Lake Michigan's Grand Traverse Bay. The event is sponsored by the Center for Automotive Research (CAR) at Altarum, the Center for Professional Development (CPD) at the University of Michigan College of Engineering, and the Office for the Study of Automotive Transportation (OSAT) at UMTRI. The three organizations collaborate in offering focused sessions to help attendees stay in touch with the latest thinking and latest developments of the wide variety of issues facing the automotive industry.

CAR conducts research in significant issues related to the future direction of the global automotive industry and organizes and conducts forums of value to the automotive community. CPD is a world leader in providing lifelong learning for engineers and technical professionals. For over forty-five years, CPD has served more than 100,000 participants with short courses, professional certification programs, conferences, and media-based graduate degree programs. OSAT provides research, analysis, information, and communication forums on current developments and future direction of the international industry. OSAT serves all industry stakeholders, including manufacturers, suppliers, retailers, labor, scholars, government, the media, and the general public.

Mike Flynn, director of OSAT, says, "The conference is an excellent opportunity for members of the automotive industry to get together to discuss issues facing the industry and their respective organizations. The information and materials from the presentations and panel sessions clarify

continued...

PHOTOS THIS PAGE COURTESY OF ALATARUM

Dave Cole, president of CAR, and Mike Flynn, director of OSAT, address the crowd at an outdoor event at a recent Management Briefing Seminar (above). Attendees of the yearly event enjoy both informative panel discussions and presentations (top of page) and networking at special events and meals (left).

Attendees of the Management Briefing Seminars enjoy the amenities of the Grand Traverse Resort in Traverse City, Michigan.

many issues, and spark formal and informal discussions that continue the learning process."

Presenters address a general program theme as well as specific topics of interest to various groups of attendees. For example, the 2002 theme was "The Future of Auto: Fast, Fun, and Scary," and other topics included the following:

- New business models and supplier survival
- The value of connectivity/integration: critical supply chain issues
- Creating value in the supply chain through information exchanges
- The issue of pricing: fixing the broken business model
- World class manufacturing in an intensely competitive environment
- Developing a collaborative business model for the tool and die industry
- New program launches for suppliers: achieving customer satisfaction and meeting business objectives
- World class product process development: creating value through collaboration
- World class value chain management: cost-cutting collaborative partnerships

Over the years, speakers have included many CEOs from the major domestic and international automobile manufacturers, cabinet-level representatives from the federal government, top-level executives from automotive supplier firms, senior UAW leaders, and automotive analysts.

Presenters at this year's conference included auto industry heavy-hitters William Clay Ford, Jr., chairman and CEO of Ford Motor Company; Dieter Zetsche, president and CEO of the Daimler Group; Hiroyuki Yoshino, president and CEO of Honda; and Robert Lutz, chairman of General Motors North America. (You can find all speakers' presentations at http://www.mbs2002.org/pres.asp.)

Over thirty exhibitors included the Automotive Industry Action Group, IBM, Sun Microsystems, and Cisco Systems, just to name a few. Thirty-six event sponsors included Ford Motor Company, General Motors, DaimlerChrysler, Hewlett-Packard, and many others.

The 2003 Management Briefing Seminars will take place August 4–8. Stop by the website periodically for more details (http://www.mbs2002.org/ for now, to be changed to http://www.mbs2003.org/ next year). RR

Book Chapters

Green, P. 2001. "Where do drivers look while driving (and for how long)?" Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 34 p. *Human Factors in Traffic Safety.* Tucson, Lawyers and Judges Publishing Company, 2001, Ch. 4, pp. 77-110. UMTRI-95509 A01.

Kostyniuk, L.P.; Shope, J.T.; Molnar, L.J. 2001. "Driving reduction/cessation among older drivers: toward a behavioural framework." Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 2001 p. Hensher, D., ed. *Travel Behaviour Research: The Leading Edge.* Oxford, Pergamon, 2001, pp. 783–795. UMTRI-95295.

Conference Papers

Blower, D.; Krishnaswami, V.; Putcha, D.; Svenson, A. 2001. "Analysis of truck-light vehicle crash data for truck aggressivity reduction." Michigan University, Ann Arbor, Transportation Research Institute, Systems Analysis Division/ Michigan University, Ann Arbor, Transportation Research Institute, Engineering Research Division/ National Highway Traffic Safety Administration, Washington, D.C. Published by SAE International, Warrendale, Pa. 10 p. *Truck Safety and Driver Issues.* Warrendale, SAE, 2001, pp. 7–16. Report No. SAE 2001-01-2726. UMTRI-95567 A02.

Flannagan, M.J.; Sivak, M. 2001. "Feasibility of developing a headlighting rating system." Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 8 p. Schmidt-Clausen, H.-J. *Progress in Automobile Lighting: Proceedings of the Symposium,* Utz, 2001, pp. 275–282. UMTRI-95217 A09.

Guzman, L.G.; Hammett, P.C. 2001. *Analysis and design of slow build studies during sheet metal assembly validations.* Michigan University, Ann Arbor, Transportation Research Institute, Office for the Study of Automotive Transportation. 7 p. Report No. SAE 2001-01-3052. UMTRI-95393.

Kostyniuk, L.P.; Wargelin, L.; Purvis, C.; Vaughn, K. 2001. *Improving the accuracy of trip-chaining information in activity/travel surveys.* Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division/ MORPACE International, Farmington Hills, Mich./ Metropolitan Transportation Commission, Oakland, Calif. International Conference on Transport Survey Quality and Innovation, 5–11 Aug. 2001, Kruger Park, South Africa, 29 p. UMTRI-95331.

McGehee, D.V.; Dingus, T.A.; Green, P.A.; Lee, J.D.; Tijerina, L. 2001. "Panel discussion: attentional factors in telematics voice and non-voice interfaces." Iowa University, Iowa City, Public Policy Center/ Virginia Polytechnic Institute and State University, Blacksburg, Transportation Institute/ Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division/ Iowa University, Iowa City, Department of Industrial Engineering/ Ford Motor Company, Scientific Research Laboratories, Dearborn, Mich. 3 p. *Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting.* Minneapolis/St. Paul, Minn., Human Factors and Ergonomics Society, 2001, pp. 1568–1570. UMTRI-95543 A41.

Reed, M.P.; Manary, M.A.; Flannagan, C.A.C.; Schneider, L.W. 2001. "New tools for vehicle interior design." Michigan University, Ann Arbor, Transportation Research Institute, Biosciences Division. 3 p. *Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting.* Minneapolis/St. Paul, Minn., Human Factors and Ergonomics Society, 2001, pp. 1138–1140. UMTRI-95543 A14.

Rumar, K. 2001. "Intensity of high beam headlights." Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 20 p. Schmidt-Clausen, H.-J. *Progress in Automobile Lighting: Proceedings of the Symposium,* Utz, 2001, pp. 829–848. UMTRI-95218 A09.

Rumar, K. 2001. "Night traffic and the zero vision." Statens Vaeg- och Trafikinstitut, Linkoeping (Sweden)/ Michigan University, Ann Arbor, Transportation Research Institute. 10 p. Schmidt-Clausen, H.-J. *Progress in Automobile Lighting: Proceedings of the Symposium,* Utz, 2001, pp. 849–858. UMTRI-95218 A10.

Sivak, M.; Flannagan, M.; Schoettle, B.; Nakata, Y. 2001. "Quantitative comparisons of the benefits of applying adaptive headlighting to the current U.S. and European low-beam patterns." Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 16 p. Schmidt-Clausen, H.-J. *Progress in Automobile Lighting: Proceedings of the Symposium,* Utz, 2001, pp. 942–957. UMTRI-95218 A12.

Tsimhoni, O.; Green, P. 2001. "Visual demand of driving and the execution of display-intensive in-vehicle tasks." Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 5 p. *Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting.* Minneapolis/St. Paul, Minn., Human Factors and Ergonomics Society, 2001, pp. 1586–1590. UMTRI-95543 A24.

Journal Articles

Eby, D.W.; Molnar, L.J. 2002. "Importance of scenic byways in route choice: a survey of driving tourists in the United States." Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 12 p. *Transportation Research Part A,* Vol. 36A, No. 2, Feb. 2002, pp. 95–106. UMTRI-62595.

Eby, D.W.; Molnar, L.J. 2001. "Older drivers: validating a self-assessment instrument with clinical measures and actual driving." Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 1 p. *Gerontologist,* Vol. 41, Special Issue No. 1, Oct. 2001, pp. 370. UMTRI-95340.

continued…

Eby, D.W.; Molnar, L.J. 2001. "In-vehicle route guidance preferences of driving tourists." Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 19 p. *ITS Journal*, Vol. 6, No. 3, 2001, pp. 261–279. UMTRI-62647.

Eby, D.W.; Fordyce, T.A.; Vivoda, J.M. 2002. "A comparison of safety belt use between commercial and noncommercial light-vehicle occupants." Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 7 p. *Accident Analysis and Prevention.* Vol. 34, no. 3 (May 2002), pp. 285–291. Sponsored by Michigan Office of Highway Safety Planning, Lansing. UMTRI-62648.

Elliott, M.R.; Waller, P.F.; Raghunathan, T.E.; Shope, J.T. 2001. "Predicting offenses and crashes from young drivers' offense and crash histories." Michigan University, Ann Arbor, Department of Biostatistics/ Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division/ Michigan University, Ann Arbor, Institute for Social Research. 12 p. *Crash Prevention and Injury Control*, Vol. 2, No. 3, 2001, pp. 167–178. Sponsored by National Institute on Alcohol Abuse and Alcoholism, Rockville, Md. UMTRI-62570.

Kostyniuk, L.P. 2000. "Theoretical foundations of travel choice modeling [book review]" Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 3 p. *Transportation Research Part A*, Vol. 34A, No. 8, Nov. 2000, pp. 648–651. UMTRI-62646

Siegel, J.H.; Loo, G.; Dischinger, P.C.; Burgess, A.R.; Wang, S.C.; Schneider, L.W.; Grossman, D.; Rivara, F.; Mock, C.; Natarajan, G.A.; Hutchins, K.D.; Bents, F.D.; McCammon, L.; Leibovich, E.; Tenenbaum, N. 2001. "Factors influencing the patterns of injuries and outcomes in car versus car crashes compared to sport utility, van, or pick-up truck versus car crashes: crash injury research engineering network study." New Jersey Medical School, Newark/ Maryland University, Baltimore, National Study Center for Trauma/EMS/ Michigan University, Ann Arbor, Transportation Research Institute, Biosciences Division/ Washington University, Seattle, Harborview Injury Prevention and Research Center/ Dynamic Sciences, Woodland Hills, Calif. 16 p. *Journal of Trauma*, Vol. 51, No. 5, Nov. 2001, pp. 975–990. UMTRI-62569.

Technical Reports

Devonshire, J.M.; Sayer, J.R. 2002. *The effects of infrared-reflective and antireflective glazing on thermal comfort and visual performance: a literature review.* Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. Published by Ann Arbor, Mich.: University of Michigan, Transportation Research Institute. 92 p. Sponsored by Michigan University, Ann Arbor, Transportation Research Institute, Industry Affiliation Program for Human Factors in Transportation Safety. Report No. UMTRI-2002-4. UMTRI-95816.

Eby, D.W.; Kostyniuk, L.P.; Miller, L.L.; Vivoda, J.M. 2001. *Child safety seat use in Michigan.* Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 47 p. Sponsored by Michigan Office of Highway Safety Planning, Lansing; National Highway Traffic Safety Administration, Washington, D.C. Report No. UMTRI-2001-26. UMTRI-95196.

Green, P.; Flynn, M.; Vanderhagen, G.; Ziomek, J.; Ullman, E.; Mayer, K. 2001. *Automotive industry trends in electronics: year 2000 survey of senior executives.* Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division/ Michigan University, Ann Arbor, Transportation Research Institute, Office for the Study of Automotive Transportation. 105 p. Report No. UMTRI-2001-15. UMTRI-95197.

Heidingsfelder, M.; Benecchi, A.; Dergis, M.; Rasche, J.; Flynn, M.S.; Senter, R.; Belzowski, B. 2001. *Automotive system integrators: spiders or flies in the e-Business web?* Roland Berger Strategy Consultants/ Michigan University, Ann Arbor, Transportation Research Institute, Office for the Study of Automotive Transportation. 56 p. Report No. UMTRI-2001-25. UMTRI-95575.

Kostyniuk, L.P.; Streff, F.M. 2001. *Evaluation of Michigan's Office of Juvenile Justice Delinquency Prevention FY98 CUD and FY99 EUDL grants.* Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 55 p. Sponsored by Michigan State Office of Highway Safety Planning, Lansing. UMTRI-95330.

Majeske, K.D.; Hammett, P.C. 2001. *Identifying sources of variation in sheet metal stamping.* Michigan University, Ann Arbor, Business School/ Michigan University, Ann Arbor, Transportation Research Institute, Office for the Study of Automotive Transportation. 23 p. Report No. Working Paper 01-009. UMTRI-95385.

Matteson, A.; Blower, D. 2001. *Trucks involved in fatal accidents factbook 1999.* Michigan University, Ann Arbor, Transportation Research Institute, Center for National Truck Statistics. 106 p. Sponsored by Federal Motor Carrier Safety Administration, Washington, D.C. Report No. UMTRI-2001-41. UMTRI-48532 A36.

Hot Off The Press

Rumar, K. 2002. *Night vision enhancement systems: what should they do and what more do we need to know?* Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. Published by Ann Arbor, Mich.: University of Michigan, Transportation Research Institute ; Springfield, Va. : National Technical Information Service. 52 p. Sponsored by Michigan University, Ann Arbor, Transportation Research Institute, Industry Affiliation Program for Human Factors in Transportation Safety. Report No. UMTRI-2002-12. UMTRI-95648.

Sivak, M.; Flannagan, M.J.; Schoettle, B.; Mefford, M.L. 2002. *Driving performance with and preference for HID headlamps.* Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 19 p. Sponsored by Michigan University, Ann Arbor, Industry Affiliation Program for Human Factors in Transportation Safety. Report No. UMTRI-2002-3. UMTRI-95510.

Sivak, M.; Flannagan, M.J.; Schoettle, B.; Nakata, Y. 2002. *Performance of the first generation of HID headlamps in the U.S.* Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division/ Michigan University, Ann Arbor, Transportation Research Institute, Biosciences Division. Published by Ann Arbor, Mich.: University of Michigan, Transportation Research Institute. 26 p. Sponsored by Michigan University, Ann Arbor, Transportation Research Institute, Industry Affiliation Program for Human Factors in Transportation Safety. Report No. UMTRI-2002-14. UMTRI-95818.

Sullivan, J.M.; Flannagan, M.J.; Schoettle, B. 2002. *The appearance of bending light from other vehicles.* Michigan University, Ann Arbor, Transportation Research Institute, Human Factors Division. 29 p. Sponsored by Michigan University, Ann Arbor, Industry Affiliation Program for Human Factors in Transportation Safety. Report No. UMTRI-2002-2. UMTRI-95511.

Vivoda, J.M.; Eby, D.W. 2001. *Safety belt use in Wayne County communities: fall 2001.* Michigan University, Ann Arbor, Transportation Research Institute, Social and Behavioral Analysis Division. 54 p. Sponsored by Michigan Office of Highway Safety Planning, Lansing; National Highway Traffic Safety Administration, Washington, D.C. Report No. UMTRI-2001-39. UMTRI-95195. RR

To Subscribe to the *UMTRI Research Review*...

Complete the form below and send it with a check for $35 made out to the University of Michigan. This entitles you to a one-year subscription to the *UMTRI Research Review*.

Name ____________________ Date ____________

Title ____________________ Organization ____________________

Address ____

City ____________________ State ____________ Zip ____________
include +4

Mail your check for $35 and the form above to:

• Monica Milla, Editor • UMTRI Research Review • University of Michigan Transportation Research Institute • 2901 Baxter Rd • Ann Arbor, MI 48109-2150 •

Conferences & Events

CIREN's 9th Quarterly Meeting
August 22, Seattle, Washington
http://depts.washington.edu/hiprc/ciren.htm

AVEC 2002, 6th Symposium on Advanced Vehicle Control
September 9–11, Hiroshima, Japan
http://www.jsae.or.jp/index_e.html

2002 IRCOBI Conference—Biomechanics of Impact
September 18–20, Munich, Germany
http://www.ircobi.org/interface.htm

18th World Congress of International Traffic Medicine Association
September 22–25, Cairo, Egypt
http://www.itma2002.com

Vision First International Congress
September 24–25, Rouen, France
http://www.sia.fr/

Human Factors and Ergonomics Society 46th Annual Meeting
September 30–October 4, Baltimore, Maryland
http://hfes.org/meetings/2002menu.html

46th Annual Conferences of the Association for the Advancement of Automotive Medicine
September 29–October 2, Tempe, Arizona
http://www.carcrash.org/biocourse.html

9th World Congress on Intelligent Transport Systems
October 14–18, Chicago, Illinois
http://www.itsa.org/worldcongress.html

SORIC '02: Safety on Roads
October 21–23, Manama, Bahrain
http://www.uob.edu.bh

SAE's Convergence 2002
October 21–23, Detroit, Michigan
http://www.convergence2002.org

Fit to Drive? Impairment Through Drink and Drugs
October 22, London, England
http://www.pacts.org.uk/conferences.htm

46th Annual STAPP Car Crash Conference
November 11–13, Ponte Vedra Beach, Florida
http://www.stapp.org/2002info.html

National Partnership for Highway Quality Conference
November 14, Salt Lake City, Utah
http://www.nphq.org/whatsnew_conference.htm

Professionalism in Driver Training Systems
November 15–16, Goa, India
http://www.irte.com/interconf.htm

SAE 2002 International Truck and Bus Meeting
November 18–20, Detroit, Michigan
http://www.sae.org/truck

Airbag 2002: 6th International Symposium on Sophisticated Car Occupant Safety Systems
December 2–4, Karlsruhe, Germany
http://www.airbag2000plus.de RR

University of Michigan
UMTRI
Transportation Research Institute
2901 Baxter Rd
Ann Arbor MI 48109-2150

Non-Profit Organization
U.S. Postage
PAID
Ann Arbor, MI
Permit No. 144