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Inside:

New Transportation Consortium 4
Work Zone Awareness............. 4
Transportation Milestones............. 5
UMTRI Names & Faces.................7
Recent UMTRI Publications........... 8
Conferences & Events 9

on page 1:

Electronic Stability Control *Dramatically Reduces Crash Risk*

UMTRI

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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

Electronic Stability Control
Dramatically Reduces Crashes

A recent UMTRI study found that electronic stability control (ESC) systems dramatically reduce the likelihood of single-vehicle crashes. Paul E. Green, assistant research scientist, and John Woodrooffe, head of UMTRI's Transportation Safety Analysis Division, analyzed eight years of government vehicle crash statistics for approximately 1,500 fatal car crashes and 500 fatal SUV crashes. They found that ESC systems can reduce the odds of a fatal rollover crash by nearly 73 percent in sport utility vehicles (SUVs) and by nearly 40 percent in passenger cars. Nonfatal loss-of-control crash odds are reduced by 70 percent for SUVs and 55 percent for cars, with even more dramatic benefits in poor weather conditions. Fatal single-vehicle crashes were 50 percent less likely in SUVs with ESC and 31 percent less likely in cars with ESC.

"Electronic stability control is probably the most significant automotive safety technology since the seat belt," says Woodrooffe. "The evidence is overwhelming," Green adds. "Vehicles that have electronic stability control just don't go off the road in comparison to those without ESC."

To quantify the effects of ESC, researchers reviewed two data sources: the Fatality Analysis Reporting System (FARS) and the General Estimates System (GES).[1] FARS is a census file of all fatal involvements, while GES is a probability sample of mostly nonfatal involvements. The results of each analysis are detailed below.

[1] Both FARS and GES crash data is collected by the National Center for Statistics and Analysis under the authority of the National Highway Traffic Safety Administration (NHTSA).

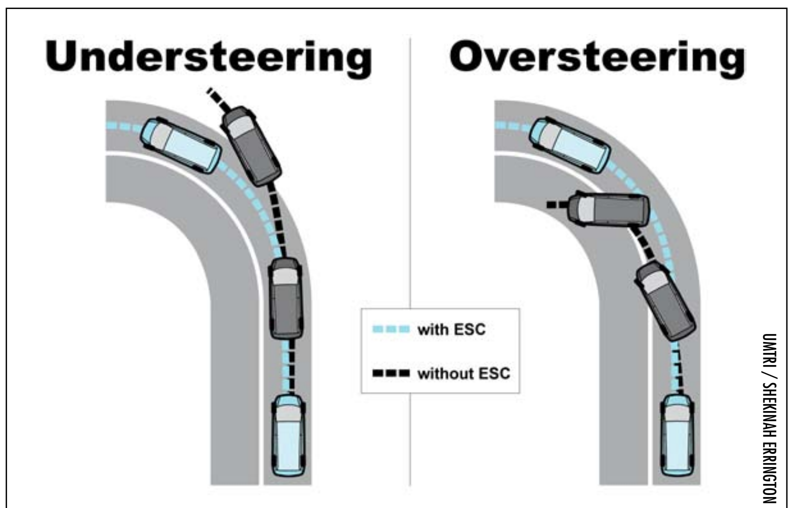
FARS Data Analysis

UMTRI researchers used FARS data to analyze vehicles of similar makes and models, but different model years. They assessed the effects of ESC on single-vehicle crashes, run-off-road crashes, rollover crashes, and crashes on roads that were not dry (e.g., wet roads, roads with snow, icy roads, and roads with sand, dirt, or oil). Each scenario is described below.

Single-Vehicle Crashes

To investigate the effects of ESC on single-vehicle crashes, researchers cross-classified passenger cars into a 2x2 contingency table (by presence or absence of ESC, and whether the vehicle was involved in a single- or a multiple-vehicle crash). Many of the passenger cars without ESC were older than passenger cars with ESC at the time of the crash, so researchers excluded data for vehicles that were older than three years to remove any effects of the age of the vehicle. The resulting percentage reduction in the odds of a single-vehicle crash for vehicles equipped with ESC was 35.8 percent for passenger cars and 51.8 percent for SUVs.

Researchers also fit a generalized additive model to assess the effects of age and gender on the effectiveness of ESC. Young males were most likely to be involved in single-vehicle crashes for both cars and SUVs. However, the specific amount of reduction in the odds of a single-vehicle crash for a vehicle equipped with ESC depends on the age and sex of the driver. For example, the reduction for a thirty-year-old male car driver was 28.2 percent, and the



When a driver oversteers, the vehicle's rear wheels lose traction and the vehicle has a tendency to spin out of control. ESC automatically applies the outside front brake to counter this unintended spinning movement ("fishtailing"). When a driver understeers, the front of the vehicle slides to the outside of the road. ESC automatically applies the inside rear brake in an attempt to bring the vehicle back in line with its original intended direction.

continued...

reduction for a fifty-year-old female SUV driver was 48.5 percent.

For cars, men's likelihood of being involved in a single-vehicle crash decreases with age. For example, the predicted odds of a single-vehicle crash without ESC for a twenty-year-old male were 1.77, while the odds for a fifty-year-old male were 0.69. There was less of an age effect for women, except that they were slightly more likely to be involved in a single-vehicle crash between the ages of fifty and seventy.

For SUVs, the odds of single-vehicle crashes were highest for young drivers, declined for middle-age drivers, and then increased slightly for older drivers. At any age, females in SUVs with ESC had the lowest predicted odds of a single-vehicle crash.

Run-Off-Road Crashes

While ESC can mitigate running off the road in loss-of-control situations, other factors (such as fatigue, impaired vision, and drug or alcohol use) can also contribute to running off the road. Fortunately, the FARS database defines enough case and control variables to determine whether a vehicle was involved in a loss-of-control type crash. Thus, the estimated percentage reductions in the odds of running off the road were 34.8 percent for cars with ESC and 56.4 percent for SUVs with ESC.

Rollover Crashes

Another benefit derived from ESC technology is a reduction in the odds of vehicle rollover. In this regard, particular attention is given to SUVs since many studies have established the link between a higher likelihood of rollover in sport utility vehicles.[2] The estimated percentage reductions in the odds of rollover for vehicles equipped with ESC were 39.7 percent for passenger cars and 72.9 percent for SUVs.

Crashes on Nondry Roads

Researchers also studied the effects of ESC on roads where surface conditions were not dry (e.g., wet roads, roads with snow, icy roads, and roads with sand, dirt, or oil). However, because the majority of crashes occurred on dry surfaces, the sample size for nondry roads was considerably reduced.

The percentage reduction in the odds of a single-vehicle crash for vehicles equipped with ESC on nondry roads was 25.2 percent for cars and 30.4 percent for SUVs. However, these results are not statistically significant because the 95-percent-confidence interval contains 0.0 percent. The results were inconclusive due to a small sample size, so there was no proven significant reduction in the odds of a single-vehicle crash for vehicles with ESC when the surface condition is not dry. However, a similar analysis using the GES data led to significantly different findings (see Crashes on Nondry Roads in the next section on GES data).

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GES Data Analysis

Researchers next analyzed GES data to asses the effects of ESC on loss-of-control type crashes. Unlike the FARS data, which contains records of vehicles involved in fatal crashes, the GES data contains records of vehicles involved in nonfatal crashes, as well as a relatively small number of vehicles involved in fatal crashes. The GES data has a larger sample size than the FARS database, and an accident type variable that makes it possible to identify vehicles that ran off the road and whose crash outcomes were more likely to depend on the presence or absence of ESC. In addition, the accident type variable makes it possible to identify a more well-defined control group than is provided by the consideration of all multiple-vehicle crashes.

Using the accident type variable in the GES database, researchers defined cases as vehicles in crashes that ran off the roadway, and controls as vehicles involved in rear-end struck crashes. Based on the FARS data in the previous section, researchers analyzed the

2 Blower, D., Woodrooffe, J., Green, P.E., Matteson, A., Shrank, M. 2005. Determination of Events Leading to Sport Utility Rollover, *Transportation Research Record*, Journal of the Transportation Research Board, No.1908, Washington, D.C., pp. 180–186. Sponsor: TRW Automotive.
Blower, D.; Woodrooffe, J.; Green, P.E.; Matteson, A.; Shrank, M. 2004. Characterization of Pre-Roll Events of Sport Utility Vehicles: Data and Analysis. 65 p. Report No. UMTRI-2004-16. Sponsor: TRW Automotive. **http://hdl.handle.net/2027.42/3122**.

associations between the presence of ESC and percentage reductions in the odds of single-vehicle crashes. Multiple-vehicle crashes served as the basis for comparison with single-vehicle crashes.[3]

Overall, estimated percentage reductions were 54.5 percent for passenger cars and 70.3 percent for SUVs. No significant differences due to ESC were found between males and females, but middle-aged drivers of passenger cars and older drivers of SUVs tended to benefit most from the presence of ESC. Unlike the FARS data analysis, percentage reductions in the odds of loss of control for both passenger cars and SUVs equipped with ESC were significantly greater on roads that were not dry.

Loss-of-Control Crashes

Researchers analyzed GES data for crash years 1995 through 2003 to investigate the effects of the presence of ESC on vehicles in certain kinds of crashes.[4] To examine the effects of ESC on crashes associated with loss of control, researchers cross-classified passenger cars into a 2x2 contingency table (by presence or absence of ESC, and whether the vehicle was involved in a crash associated with loss of control). The reduction in the odds of involvement in a crash associated with loss of control when a vehicle was equipped with ESC as standard equipment was 54.5 percent for cars and 70.3 percent for SUVs.

Researchers also examined the effects of age and gender on the effectiveness of ESC in loss-of-control crashes. For cars, until the approximate age of sixty-eight, males without ESC had the highest predicted odds of a loss-of-control crash. Until the same age, females with ESC had the lowest predicted odds of a loss-of-control crash. However, unlike the FARS data analysis, in the GES data, young females tended to show the high odds of loss of control that were characteristic of young males, although to a lesser extent.

In addition, although the predicted benefits of ESC are the same for each gender, they differ according to age. For example, the percentage reduction in the odds of a loss-of-control crash for a twenty-year-old female with ESC in a car was 50 percent. These same results apply to a twenty-year-old male. However, the estimated reduction for a fifty-year-old female (58.1 percent) is different due to the interaction between age and ESC. The maximum reduction occurs at age forty-one (59.5 percent). This suggests that ESC technology could be most beneficial in reducing the odds of loss-of-control crashes for middle-aged drivers of passenger cars.

For SUVs, the benefits of ESC were approximately the same for males and females (though the odds of a loss-of-control crash were not). In SUVs without ESC, young males (under age thirty) and older males (over age seventy) had the highest predicted odds of a loss-of-control crash. This does not suggest, however, that males tended to benefit more from ESC technology than females. At any age, the predicted odds ratios are the same for males and females. For example, the percentage reduction in the odds of a loss-of-control crash for a twenty-five-year-old, regardless of gender, in an SUV equipped with ESC was 73.5 percent. Gender is irrelevant in this analysis with respect to the estimated effectiveness of ESC. The percentage reduction in the odds of a loss-of-control crash for a fifty-year-old in an SUV equipped with ESC, regardless of gender, was 62.1 percent. The minimum reduction occurs at age fifty-five (60.6 percent), with a steady increase in the percent of reduction after age fifty-five. This suggests that ESC technology could be particularly beneficial to older drivers of sport utility vehicles.

Crashes on Nondry Roads

Since ESC is designed to keep a vehicle on the road in loss-of-control situations, especially in understeering or oversteering conditions, an important question is whether ESC is more effective on wet or dry road surfaces. For the data collected from the GES database in this study, most crashes occurred on dry road surfaces, which resulted in a small sample size on nondry roads.

ESC had greater potential in crash avoidance on nondry than dry roads: For passenger cars, the estimated percentage reductions in the odds of a loss-of-control crash were 40 percent on dry surface and 75.2 percent on a nondry surface. For SUVs, the percentage reduction was 52.5 percent on dry surfaces and 88.2 percent on surfaces that were not dry.

For more information, you can access the full report, *The Effectiveness of Electronic Stability Control on Motor Vehicle Crash Prevention*, at **http://hdl.handle.net/2027.42/39110**. RR

3 This strategy was based on the idea that single-vehicle crashes are more likely associated with loss of control in which ESC technology could play a beneficial role. Multiple-vehicle crashes served as the control group since outcomes for vehicles in those crashes are presumed to be independent of the presence or absence of ESC technology.

4 Passenger cars of model years from 2000 to 2004 were identified with ESC available as standard equipment. Cars of similar makes and models, of model years from 1995 to 1999 and without ECS, were also identified.

UMTRI BRIEFS

Strategic Worldwide Transportation 2020

UMTRI Forms Consortium to Reduce Traffic Fatalities Worldwide

UMTRI has initiated a new research consortium, Strategic Worldwide Transportation 2020. The consortium will address the sobering predictions about the worldwide public health effects of road transportation: In 2020, road crashes are predicted to result in 2.3 million fatalities worldwide (compared with 1.2 million in 2002). Furthermore, because road fatalities include a disproportionate number of young people, road accidents in 2020 are predicted to be the third leading cause of years of life lost plus years lived with disability (compared with being the ninth leading cause in 2002).

These predictions are based on the assumption that current trends will continue. The goal of Strategic Worldwide Transportation 2020 is to use the best worldwide scientific resources to change these trends so that the actual toll of road traffic in future years will be substantially lower than predicted.

Strategic Worldwide Transportation 2020 is envisioned as an initiative that combines forecasting of future motorization trends and emerging technologies with estimating the effects of these changes on safety. Safety is considered from a worldwide perspective, incorporating the unique social, cultural, and economic circumstances in key developed and developing countries.

Strategic Worldwide Transportation 2020 currently has three members (Continental, Ford, and Toyota) and five contributors (ArvinMeritor, Autoliv, IBM, TRW, and Visteon).

For more information on the consortium, please visit **www.umich.edu/~umtriswt** or contact Michael Sivak at **sivak@umich.edu**.

National Work Zone Awareness Week

National Work Zone Awareness Week took place throughout the U.S. on April 3–9, 2006.

A national media event was held in Washington, D.C., on April 4 at a work-zone location near the Lincoln Memorial.

One-thousand traffic cones were set on The National Mall in Washington D.C. to symbolize the approximate number of people killed in roadway work zones each year.[1] To illustrate the high number of motorists killed in work zones each year (the ratio is four motorists to every one worker[2]), black sashes were affixed to cones to represent motorists, while fluorescent yellow-green sashes represented workers. The National Work Zone Memorial was also on display during the event. This 26-foot display contains the names of men, women, and children killed in roadway work zones across the country. The display is mobile and can be shipped to any location across the country to promote work-zone safety year-round.

PHOTOS: AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION / JAMES BARON

On April 4, 1,000 traffic cones were set on The National Mall in Washington D.C. to symbolize the approximate number of people killed in roadway work zones each year.

1 The actual number for 2004 is 1,068 (*Traffic Safety Facts 2004: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System.* 2006. National Highway Traffic Safety Administration, Washington, DC. Report No. DOT HS 809 919.).

2 *Traffic Safety Facts 2004* (as above).

Because this year's National Work Zone Awareness Week focused on nighttime work zones, the event began at sunset. The featured guest speaker was Bill Shuster, a Pennsylvania state representative who sponsored language in the transportation bill (SAFETEA-LU) regarding night work zones.

For information on UMTRI research on road worker visibility, see "Daytime Conspicuity of Pedestrians" in volume 36, number 1 of *UMTRI Research Review* (**www.umtri.umich.edu/library/pdf/rr36_1.pdf**) and "The Importance of Being Seen" in volume 32, number 3 of *UMTRI Research Review* (**www.umtri.umich.edu/library/pdf/rr32_3.pdf**).

Transportation Milestones

50th Anniversary of the Interstate Highway System

June 29, 2006, marked the golden anniversary of the road system that transformed America. The United States interstate highway system—a collection of 46,717 miles of concrete and asphalt that links and moves America—was signed into law as the Federal-Aid Highway Act of 1956. President Eisenhower signed the law, without much fanfare, from a hospital bed where he was recovering from an illness.

Eisenhower first realized the need for an interstate highway system in 1919 when he was a lieutenant colonel in the Army staffing a coast-to-coast convoy of 81 military vehicles. During the 62-day trip, the vehicles had to contend with breakdowns, mud, rough roads, and bridgeless river-crossings. Even if bridges existed, the heavy military vehicles often broke through the decks. The creation of an interstate highway system was a main component of Eisenhower's domestic policies when he was elected president.

The federal government covered 90 percent of the cost of constructing the interstate system, and called for road design standards to accommodate traffic levels twenty years into the future. The system was to cover 41,000 miles of road, including 2,000 miles of existing toll roads, and be completed by 1975. In fact, the huge undertaking required more time: 35,000 miles were complete by 1975 and today one remaining section of interstate—a connection north of Philadelphia to close a gap in I-95—remains to be built.

Three of the earliest interstates built were the Pennsylvania Turnpike, I-44 and I-70 in Missouri, and I-70 in Kansas. In 1966, interstates were required to have at least four lanes with no at-grade railroad crossings. Existing toll roads could continue as interstate toll roads if they met interstate standards. In 1990, President Bush changed the original name for the interstate system, the National System of Interstate and Defense Highways, to the Dwight D. Eisenhower System of Interstate and Defense Highways.

For more information on interstate highways, see FHWA's interstate website, **www.fhwa.dot.gov/interstate**.

continued...

Interstate Fun Facts

- **I-90, which runs from Boston to Seattle, is the longest interstate at 3,081 miles. I-80, which covers 2,907 miles between New York City and San Francisco, is the second longest interstate.**
- **I-878 in New York City is the shortest interstate at 0.7 miles long.**
- **The highest number of an interstate route is I-990 north of Buffalo, New York. The lowest number is I-4 across Florida.**
- **Alaska is the only state without interstate routes.**
- **Interstates carry nearly 60,000 people per route-mile per day.**
- **Interstate routes that run east-west end in an even number, and those that run north-south end in an odd number.**
- **If the first digit of a three-digit interstate route number is odd, it is a spur into a city. If it is even, it goes through or around a city.**

Source: Dwight D. Eisenhower Library, ***www.eisenhower.utexas.edu/highway.htm***

MDOT Celebrates 100 Years

The Michigan Department of Transportation (MDOT) celebrated its 100th anniversary throughout 2005 with various events throughout the state. MDOT was created in 1905 as the State Highway Department.

At the time MDOT was founded, Michigan roads (like those throughout the U.S.) were made of sand, mud, and clay, and were treacherous to horse-drawn vehicles and early automobiles. Bicycle clubs, such as the League of American Wheelmen, led an effort to reform roads nationwide. Michigan's first state highway commissioner, Horatio Earle, was a bicyclist and vowed to conquer what he termed "The Mighty Monarch Mud." Known as "the father of good roads," Earle helped open Michigan to commerce and tourism.

MDOT revolutionized U.S. highway travel. Working with the Wayne County Road Commission, the agency paved the nation's first mile of concrete on Woodward Avenue in Detroit in 1909. It responded to growing automobile tourism by opening the first state-operated information center near New Buffalo in 1935. During World War II, Michigan's first four-lane divided expressway carried workers from the Detroit area to Ford's Willow Run bomber plant in Ypsilanti. In 1973, MDOT expanded to include ports, buses, aeronautics, marine, railroads, and nonmotorized transportation in its transportation program.

For more information, see the Michigan Department of Transportation website, **www.michigan.gov/mdot100**. RR

Michigan Transportation Firsts

- **The world's first international underwater automobile tunnel was built in 1930, connecting Detroit, Michigan, with Windsor, Ontario, Canada.**
- **The world's first freeway-to-freeway interchange was created in 1955 in Detroit. It allowed motorists to make turns "simply by moving in the direction they wish to go."**
- **The nation's first mile of concrete highway was built in 1909 in Detroit.**
- **The nation's first road centerline was painted in 1911 near Trenton, Michigan.**
- **The nation's first highway materials testing lab opened in 1912 at the University of Michigan in Ann Arbor.**
- **The nation's first four-way, red-yellow-green electric traffic light was installed in 1918 in Detroit. The light was invented by Detroit police officer William Potts.**

Source: Michigan Department of Transportation, ***www.michigan.gov/mdot100/***

UMTRI Board Member Appointed to NAE

Dr. Priya Prasad, a member of UMTRI's External Advisory Board and a technical fellow/ manager of the Safety Research Department at Ford, has been elected to the National Academy of Engineering (NAE). The NAE selected him for "outstanding accomplishments in automotive safety and impact biomechanics leading to safer vehicles and the saving of many lives." Election to the NAE is among the highest professional distinctions accorded to an engineer. Academy membership honors those who have made outstanding contributions to engineering research, practice, or education, including significant contributions to the engineering literature and to the pioneering of new and developing fields of technology.

Prasad will serve in NAE's bioengineering section, focusing on policy issues and helping establish the future of automotive engineering excellence and competitiveness in the United States.

As a member of UMTRI's External Advisory Board, Prasad helps UMTRI look to the future. He says, "UMTRI is moving in the right direction with its focus on reducing both transportation-related fatalities and injuries, as well as reliance on nonrenewable energy. The NAE is also working toward reducing crash-related fatalities to zero. Through its unbiased, interdisciplinary research, UMTRI is in an excellent position to advise the industry in how to meet these goals."

Looking to 2020, Prasad feels that if the current trends continue, there will be 2 million fatalities from crashes worldwide (compared with about 1.18 million today), and roadway fatalities will become the third major cause of death and disability in the world. (They are currently the eleventh leading cause.[1]) To avoid this scenario, Prasad feels the transportation industry should also focus on ways to reduce accidents that occur through goods transport, and to explore what it will take to stop using nonrenewable resources. He says, "I would also like to see UMTRI expand its focus worldwide, as transportation safety issues play a much greater role in developing countries like China and India." (For related stories, see "Strategic Worldwide Transportation 2020" on page five and "China's Automotive Future" in volume 36, number 4 of *UMTRI Research Review*, **www.umtri.umich.edu/library/pdf/rr36_4.pdf**.)

UMTRI / SHEKINAH ERRINGTON

Priya Prasad spoke at UMTRI's fortieth anniversary symposium last summer.

Prasad has been involved in automotive safety research for over 30 years. He has made seminal contributions to automotive safety technology and is known internationally as one of the leading experts in automotive safety. He is widely recognized in the industry as a preeminent leader in this area of science and technology. He has conducted pioneering research in analytical and physical testing methods (including vehicle offset crash testing; development and validation of human anatomical computer models for the brain, neck, thorax, lumbar spine, and chest) and developed injury criteria for children. He was instrumental in defining the need and requirements of occupant crash simulation leading to the widespread use of modeling in the automotive industry worldwide. He has contributed to major innovations in Ford vehicles to protect occupants in side and offset crashes, minimize vehicle compatibility issues, and the development of improved airbag systems.

Prasad is a member of the Stapp Association Advisory Committee and a cochair of the 2006 Stapp Conference, in both of which UMTRI staff members are also active. He holds a B.S. in mechanical engineering from Bihar College of Engineering, and an M.S. in mechanical engineering and a Ph.D. in biomechanics from Wayne State University. He will be inducted into the National Academy of Sciences in October, 2006. RR

[1] Peden, Margie; Scurfield, Richard; Sleet, David; Mohan, Dinesh; Hyder, Adnan A.; Jarawn, Eva, and Mathers, Colin, editors. *World Report on Road Traffic Injury Prevention.* World Health Organization: Geneva 2004.

Recent UMTRI Publications

Some 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.

Conference Papers

Flannagan, M.J.; Mefford, M.L. 2005. "Distance Perception with a Camera-Based Rear Vision System in Actual Driving." In *Driving Assessment 2005: Proceedings of the 3rd International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*, p. 58–65.
The research documented in this paper was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Sayer, J.R.; Mefford, M.L.; Shirkey, K.; Lantz, J. 2005. "Driver Distraction: a Naturalistic Observation of Secondary Behaviors with the Use of Driver Assistance Systems." In *Driving Assessment 2005: Proceedings of the 3rd International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*, p. 262–268.
The research documented in this paper was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Sayer, T.B.; Sayer, J.R.; Devonshire, J.M. H. 2005. "Assessment of a Driver Interface for Lateral Drift and Curve Speed Warning Systems: Mixed Results for Auditory and Haptic Warnings." In *Driving Assessment 2005: Proceedings of the 3rd International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*, p. 218–224.
The research documented in this paper was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Journal Articles

Devonshire, J.M.; Sayer, J.R. 2005. "Radiant Heat and Thermal Comfort in Vehicles." *Human Factors*, vol. 47, no. 4 (Winter 2005), p. 827–839.
The research documented in this article was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Eby, D.W.; Bingham, C.R.; Vivoda, J.M.; Ragunathan, T. 2005. "Use of Booster Seats by Michigan Children 4–8 Years of Age." *Accident Analysis and Prevention*, vol. 37, no. 6 (Nov. 2005), p. 1153–1161.
The research documented in this article was sponsored by the Michigan Department of Community Health and the Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

Elliott, M.R.; Shope, J.T.; Raghunathan, T.E.; Waller, P.F. 2006. "Gender Differences among Young Drivers in the Association between High-Risk Driving and Substance Use/Environmental Influences." *Journal of Studies on Alcohol*, vol. 67, no. 2 (Mar. 2006), p. 252–260.
The research documented in this article was sponsored by the National Institute on Alcohol Abuse and Alcoholism.

Sivak, M.; Schoettle, B.; Flannagan, M.J.; Minoda, T. 2005. "Optimal Strategies for Adaptive Curve Lighting." *Journal of Safety Research*, vol. 36, no. 3 (2005), p. [281]–288.
The research documented in this article was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Sivak, M.; Schoettle, B.; Flannagan, M.J. 2006. "Mercury-Free HID Headlamps: Glare and Colour Rendering." *Lighting Research and Technology*, vol. 38, no. 1 (2006), p. [33]–40.
The research documented in this article was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Sivak, M.; Schoettle, B.; Flannagan, M.J. 2005. "Recent Trends in the Performance of Tungsten-Halogen and HID Low-Beam Headlamps in the U.S." *Leukos*, vol. 1, no. 4 (Apr. 2005), p. 61–72.
The research documented in this article was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Technical Reports

Green, P.E.; Woodrooffe, J. 2006. *The Effectiveness of Electronic Stability Control on Motor Vehicle Crash Prevention*. 46 pp. Report No. UMTRI-2006-12. **http://hdl.handle.net/2027.42/39110**.
The research documented in this article was sponsored by Continental Teves.

Luoma, J.; Sivak, M.; Flannagan, M.J. 2006. *Effects of Dedicated Stop-Lamps on Nighttime Rear-End Collisions*. 15 pp. Report No. UMTRI-2006-15.
The research documented in this report was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Mefford, M.L.; Flannagan, M.J.; Bogard, S.E. 2006. *Real-World Use of High-Beam Headlamps*. 11 pp. Report No. UMTRI-2006-11.
The research documented in this report was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety.

Sullivan, J.M.; Flannagan, M.J. 2006. *Implications of Fatal and Nonfatal Crashes for Adaptive Headlighting*. 29 pp. Report No. UMTRI-2006-1.
The research documented in this report was sponsored by UMTRI's Industry Affiliation Program for Human Factors in Transportation Safety. RR

Conferences & Events

WTS Annual National Conference
May 17–19, Dallas, Texas
www.wtsinternational.org

National Association of Regional Councils Fortieth Annual Conference
June 17–20, San Antonio, Texas
www.narc.org/pubs/main/Conferences.cfm

National Transportation Management Conference
June 25–30, Portland, Oregon
www.transportation.org/meetings/30.aspx

Environmental Stewardship in Transportation (TRB Summer Conference)
July 9–11, Chicago, Illinois
www.trb-adc60.org

Work Zone Traffic Control Summer Workshop
July 23–26, Jackson, California
www.trb.org/calendar/event.asp?id=319

International Symposium on Transportation Technology Transfer
July 30–August 3, St. Petersburg, Florida
www.t2symposium.org

The Evolution of Logistics and Supply Chain Management in China
August 2–3, Shanghai, China
www.cscmp.org/China06/index.asp

Second International Symposium on Road Safety
August 5, Hong Kong, China
http://geog.hku.hk/ISRS2006

National Rural ITS Conference
August 13–16, Big Sky, Montana
www.2006nrits.org

Ninth International Conference on Applications of Advanced Technology in Transportation
August 13–16, Chicago, Illinois
www.asce.org/conferences/AATT2006

Diesel Engine-Efficiency and Emissions Research Conference
August 20–24, Dearborn, Michigan
www1.eere.energy.gov/vehiclesandfuels/resources/conferences/deer/index.html

Telematics Europe 2006
September 5–6, Berlin, Germany
www.telematicsupdate.com/europe2006

Third Annual Ontario Road Safety Symposium
September 13–14, Toronto, Canada
www.roadsafetynetwork.com/orss2006.htm

ETC 2006: European Transport Conference
September 18–20, Strasbourg, France
www.aetransport.org

IRCOBI Conference: The Biomechanics of Impact
September 20–22, Madrid, Spain
www.ircobi.org

Pan-American Conference of Traffic and Transportation Engineering (PANAM XIV)
September 20–23, Las Palmas, Canary Islands
www.panam06.com

ARTBA Annual Convention
September 26–29, San Diego, CA
www.artba.org RR

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Transportation Tidbits

- On May 2, 1918, the General Motors Corporation acquired the Chevrolet Motor Company of Delaware.
- Construction started on the first drive-in theatre in Camden, New Jersey, on May 19, 1933. The project was the brainchild of Richard M. Hollingshead and cost $30,000 to complete. The theatre opened on June 6, 1933, with an admission price of 25 cents per car plus 25 cents per person, not to exceed a total of $1.00.*
- On April 28, 1939, Powell Crosley produced America's first miniature, or "bantam," car. The car was a foot shorter and a 100 pounds lighter than the prewar Volkswagen Bug and far smaller than anything on the American market at the time. Unfortunately, the car's price, which was not significantly lower than a full-size car, prohibited the car's popularity.
- The Land Rover was introduced at the Amsterdam Auto Show on April 30, 1948. The vehicle featured four-wheel drive and a 1.6 liter engine. It was introduced with a canvas top and optional doors.
- On June 5, 1951, Gordon M. Buehrig received a United States patent for his "vehicle top with removable panels." The invention would eventually appear as a T-top on the 1968 Chevrolet Corvette Stingray. Unlike the roof of a convertible car, which folds down or retracts, the T-top consists of a solid, non-removable bar and removable panels.
- On June 7, 1954, Ford Motor Company formed a styling team to design an entirely new car, which later became known as the Edsel. The move was made to meet the public's demand for high-horse-powered and heavily styled cars that boasted much chrome and many accessories. During the years between the car's conception and its production in 1957, however, the American economy took a downturn and people were now looking for economy cars. RR

SOURCES:

All from This Day in Automotive History, www.historychannel.com/tdih, except *, which is from The Drive-In Theater, www.driveintheater.com.

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