

UMTRI

RESEARCH REVIEW

UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE

• APRIL-JUNE/JULY-SEPTEMBER 2003 •

• VOLUME 34, NUMBERS 2-3 •



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Transportation Tidbits

- The first steam road roller was used in the United States on June 4, 1869. At 15 tons and with four rollers, the steam-powered vehicle did a good job compacting road surfaces. 
- On April 25, 1901, New York became the first state to require license plates. Car owners had to register their name, address, and vehicle description with the office of the secretary of state. The state sent each owner a small license plate, at least three inches high, bearing the owner's initials.
- On September 24, 1908, the first factory-built Ford Model T was completed. Known as the “tin Lizzy,” the Model T revolutionized the automotive industry by providing an affordable, reliable car for the average person. When first introduced, the Model T cost \$850 and seated two people.
- On September 25, 1908, William C. Durant founded General Motors Corporation. Later that year, GM acquired the Buick Motor Company. 
- On April 15, 1924, Rand McNally released its first comprehensive road atlas of the country.
- The first U.S. federal gasoline tax went into effect on June 21, 1932. The Revenue Act of 1932 placed a one-cent-per-gallon tax on all motor fuels. The tax has never been repealed. 
- On July 19, 1934, Harold T. Ames filed a patent application for retractable headlamps. The design would later become one of the defining details on Ames' most triumphant project, the Cord 810.
- On July 6, 1955, the Federal Air Pollution Control Act was implemented. It provided federally-allocated funds for research into causal analysis and control of car-emission pollution. Concern over the effects of air pollution had mounted steadily in the U.S. as urban sprawl increased.
- On August 31, 1955, the world's first solar-powered automobile, designed by William G. Cobb, was demonstrated at the General Motors Powerama in Chicago. Today, solar car competitions are held all over the world, pitting design teams against each other in grueling races. The UM solar car team generally fairs quite well.
- On April 1, 1970, AMC introduced the Gremlin, America's first sub-compact car. (No fooling!)

Sources

All from This Day in Automotive History, www.historychannel.com, except , which are from *On the Move: A Chronology of Advances in Transportation* by Leonard C. Bruno.

Making *Simulated Drivers Sit Like Real Drivers*

UMTRI Researchers Create a Model for Predicting Driving Postures

In a recent study, researchers in UMTRI's Biosciences Division—Matt Reed, Carol Flannagan, Miriam Manary, and Larry Schneider—developed a statistical method for predicting automobile driving postures. The model was designed for use in posturing human-figure models in software packages used for vehicle interior design. It focuses on prediction accuracy for eye and hip locations, two of the most important posture characteristics for vehicle interior assessment.

Results were based on data from a study of 68 men and women in 18 different vehicle package and seat conditions. A series of independent regression models, coupled with data-guided inverse kinematics, were used to fit a whole-body linkage. Much of the posture data upon which the model is based was collected in the industry-sponsored affiliates program, ASPECT (Automotive Seat and Package Evaluation and Comparison Tools). The primary goal of the program was to develop a new generation of tools that can be used by packaging and human factors engineers to design and measure key features of vehicle seats and interior geometry. ASPECT participants included BMW, Chrysler, Ford, General Motors, Johnson Controls, Lear, Magna Interior Systems, PSA-Peugeot-Citroen, Toyota, Volkswagen, and Volvo. The American Automobile Manufacturers Association (now the Alliance for Automobile

Manufacturers) also supported the research through many years of grants to UMTRI to support research on driver positioning.

Industry Background

Vehicle interiors are now commonly designed using three-dimensional human representations that can be manipulated in a computer environment. These computer-aided-design (CAD) human models have increased

in sophistication with advances in computer technology, but their effective use has been hampered by the lack of valid methods to set the posture of the models in the simulated vehicle interior.

Without posture-prediction capability built into the model or available through other external data or statistical models, many of the most useful applications of the CAD human models are unreliable. For example, vision and reach assessments require an accurate starting posture for the particular manikin dimensions being used. In the absence of

continued...

UGS PLM SOLUTIONS / JACK® HUMAN MODELING SOFTWARE



The Jack® human figure model is postured in automotive design software, using UMTRI's cascade (posture) prediction model. The model's regression functions can be used directly to predict driver eye, hip, and seat locations for people of various sizes in different vehicle package configurations. Jack is such an example.

accurate posture prediction, human CAD models are valuable primarily for visualization rather than for ergonomic assessment.

UMTRI's Posture Model

UMTRI's cascade (posture) prediction model (CPM) solves the posturing problem by combining regression functions with inverse kinematics guided by additional information from the input data set. The CPM is the first model for predicting driving posture that is published in an implementable form. Because the input dimensions are readily obtained from any vehicle package drawing, the regression functions can be used directly to predict eye locations, hip locations, or seat positions for people of various sizes. However, the full value of the model is realized when it is integrated into a digital human-modeling software package, so that the prediction results can be viewed immediately as whole-body postures in the vehicle package. The CPM can also be used as an independent check of prediction models that have been developed using other databases and methods.

Using the CPM, whole-body driving postures can be predicted with considerable accuracy. Importantly, the method can be applied to any human figure model, because the prediction methods are not limited to one particular linkage definition. The model prediction errors are largely independent of driver size and vehicle geometry, allowing a straightforward interpretation of prediction precision. The cascade model approach is designed to produce the best possible prediction of eye and hip locations, while also predicting the posture of the trunk and right limbs with reasonable accuracy.

Regression Modeling

A stepwise-regression technique was applied with the following potential regressors: stature, body mass index, sitting height divided by stature, seat height, steering wheel to ball-of-the-right-foot distance, and seat cushion angle. Predictions for the model were obtained using a series of submodels, each based on the results of the previous model. This provided the best possible prediction accuracy for hip and eye locations, the posture characteristics most important for ergonomic assessments of the driver's station. Hip location is closely related to seat position and lower-extremity posture, while eye location is critical for vision analyses. Among the conclusions of the original analysis were that seat height, steering wheel position, and seat cushion angle all have significant, independent effects on driver fore/aft seat position and posture.

An inverse kinematics submodel was used to fit the kinematic-linkage representation of the torso (pelvis, abdomen, thorax, neck, and head) to the predicted hip and eye locations. Regression analyses were performed using values of torso segment orientation and overall recline (hip-to-eye) angle after subtracting off subject means. The slopes of the regression functions estimate the average change in side view-plane orientation of each torso segment with a change in overall recline. These values were used to determine the relative motion in the torso as the torso segments were manipulated to match the predicted hip and eye locations. After the torso segment calculations, upper-extremity posture was calculated using inverse kinematics and calculated shoulder

UMTRI DRIVING POSTURE MODEL BENEFITS

The CPM represents important advances in predicting driving posture in that it allows:

- Prediction of postures for individual drivers (Current SAE models predict only population distributions of seat position or eye location)
- Application to any human figure linkage
- Direct prediction of hip and eye locations for maximum accuracy on these variables

and handgrip locations. Note that the locations of the hands on the steering wheel do not affect the torso posture. Rather, the torso posture and handgrip locations determine the upper-extremity joint angles. An analogous process is used to fit the thigh and leg segments to the predicted hip and ankle locations. **RR**

VEHICLE SEATING LABORATORIES

UMTRI has several automotive seating "bucks" that can simulate a wide range of vehicle interior geometries. These laboratory facilities are useful for studying driver positioning, vehicle-seated anthropometry, and occupant short- and long-term comfort of vehicle seat factors. The test facilities make it easy to quickly interchange and/or adjust the positions and orientations of many vehicle components, including seats, steering wheels, and pedals. By exchanging and/or adjusting these components, the seating bucks can be configured to simulate package geometries ranging from low-seat-height sporty vehicles to high-seat-height vans and light trucks—all during a single test session of a subject. Data acquisition systems are incorporated into each seating buck as needed to collect data on the three-dimensional locations of key body landmarks, body contours, and movements of body segments of seated drivers in relation to restraint systems and vehicle components.

Headlighting Highlights

UMTRI was well represented at the International Symposium on Progress in Automotive Lighting (PAL), held in Darmstadt, Germany, in September. Researchers from the Human Factors Division provided highlights of some of the headlighting research they are conducting.

Mike Flannagan, research associate professor, presented “Development of a Headlighting Rating System.” Analyses of accident data indicate that headlamps have considerable potential for increasing traffic safety, and that they should be regarded as important safety equipment. Nevertheless, at least in the United States, drivers appear to be more concerned

about glare from headlamps than about the seeing ability they provide. The U.S. National Highway Traffic Safety Administration (NHTSA) is investigating the possible benefits of a headlighting rating system for new vehicles that could be implemented as part of the new car assessment program (NCAP), and which would present information about headlighting to consumers in a format similar to the current NCAP crashworthiness ratings. Such a system might increase consumers’ interest in, and knowledge of, the safety potential of headlighting. This paper updated this effort.

Kåre Rumar, UMTRI visiting scholar (see UMTRI Research Review, volume 32, number 4), presented “Night Vision Enhancement Systems (NVES)—Research and Requirements.” The first NVES based on infrared technology is already on the market, and others are expected to follow shortly. There is little doubt that these systems have a considerable potential to increase driver visibility at night and thereby to increase nighttime traffic safety. However, there are also

several potential risks associated with the use of NVES. For instance, these systems might introduce new driver problems such as increased workload, cognitive capture, distraction, and undesirable compensatory reactions (for example, increased speed). Our knowledge about both the positive and the potentially negative effects of NVES is still limited. Rumar discussed important gaps in our knowledge about the effects of NVES

and indicated how these gaps could be addressed by future research. Finally, the paper made several preliminary proposals concerning the requirements that NVES should meet before they come into wide use.

Michael Sivak, head of the Human Factors Division, served on the PAL steering board and also presented “Driver Preferences for HID Headlamps.” Sivak presented driver preferences for HID versus tungsten-halogen U.S. low beams as found in two studies. In each study, subjects drove in actual traffic with cars equipped with either type of low beams. Of interest were subjective preferences in both unalerted conditions (in which the subjects were not told that the focus of the study was on headlighting) and alerted conditions (in which the subjects were told

to pay attention to the headlamp performance).

A total of 52 subjects of a variety of ages and both sexes participated in these two studies; none was involved in the lighting industry or lighting research. Overall, the results of these two studies suggested that drivers

strongly prefer HID headlamps, provided that they have somewhat extended driving exposure to them, and that they are told to pay attention to headlamp performance.

John Sullivan, assistant research scientist, presented “Driver’s Use of High and Low Beams,” which is coauthored by Flannagan. The tension between satisfactory roadway visibility and the need to minimize glare to other road users is responsible for one of the earliest and most primitive

continued...



MICROSOFT CORPORATION / MICROSOFT DIGITAL GALLERY LIVE



UMTRI / BRANDON SCHOETTLE

UMTRI BRIEFS

methods of adaptive frontlighting—the dipping of the main beam by the direct intervention of the vehicle operator. Despite nearly a century of reliance on the driver to judge when to switch between light distributions, surprisingly few studies have examined what drivers actually do on the roadway. This presentation reviewed the history and evolution of this basic function, its implied normative use, research on its actual use, and implications for the use of modern, automatic control of forward lighting. Sullivan also presented recently collected roadway data on the usage of high and low beams.

Elders on the Move

Researchers in UMTRI's Social and Behavioral Analysis Division recently published a full-color guide, *Promising Approaches to Enhancing Elderly Mobility*. The publication is written by Lisa Molnar, senior research associate; David W. Eby, research associate professor and principal researcher on the project; and Linda L. Miller, research assistant.

The guide is intended as a resource for community professionals interested in developing programs to enhance elderly mobility. While each community will have to tailor its efforts to fit its own unique character and that of its elderly population, much can be gained from learning about existing programs and practices. Based on extensive review of the literature and discussions with several experts in aging-related fields, the authors identify several areas in which promising approaches to enhancing elderly mobility have been developed in the U.S. and elsewhere. These areas include screening and assessment, education and training, vehicle adaptations

and advanced technology, roadway design, and alternative transportation. For each area, the guide contains:

- An introductory section on why the area is important for enhancing elderly mobility
- Identification of the important components of promising approaches
- Descriptions of current practices and programs that appear especially promising for enhancing elderly mobility
- Brief summaries of these highlighted practices and programs, as well as other practices and programs that show promise for enhancing elderly mobility

The authors highlighted practices and programs that they felt stood out, particularly in terms of their scientific basis, comprehensiveness, or timeliness. The promising practices and programs included in the guide are in various stages of development. Some are still considered experimental, but represent innovative approaches that have considerable potential for enhancing mobility. The five areas in the guide are interdependent and mutually supporting, and should be viewed collectively as part of a comprehensive approach to enhancing elderly mobility.

You can view *Promising Approaches to Enhancing Elderly Mobility* at www.umtri.umich.edu/library/docs/97337.pdf. This is a temporary URL. The permanent URL, available in early 2004, will be <http://name.umdl.umich.edu/97337>.



Above: The cover of the recently produced guide, *Promising Approaches to Enhancing Elderly Mobility*.

Heavy Truck Dynamics Course

UMTRI researchers presented an annual heavy truck dynamics course for UM's Center for Professional Development in July. The four-and-a-half day course, Mechanics of Heavy-Duty Truck Systems, included a computer lab session and a tour of UMTRI's vehicle laboratory.

Participants gained an understanding of the fundamental mechanical and dynamical principles that determine the braking, handling, and ride properties of pneumatic-tired vehicles. They examined how the special mechanical and geometric properties of heavy trucks and their components determine the specific performance qualities of this class of vehicle. And finally, the studied the methods and tools available for analyzing truck behavior.

Bob Ervin, research professor and former head of the Engineering Research Division, presented sessions on the rollover processes, offtracking at very low speeds, and directional response/nonlinear analysis. Paul Fancher, se-nior research scientist emeritus, taught sections on the mechanical and thermal properties of brakes and brake actuation systems, basic properties of heavy truck components, directional response/linear analysis, and automatic speed and headway control. Both Fancher and Ervin presented information the mechanics of the pneumatic tire.

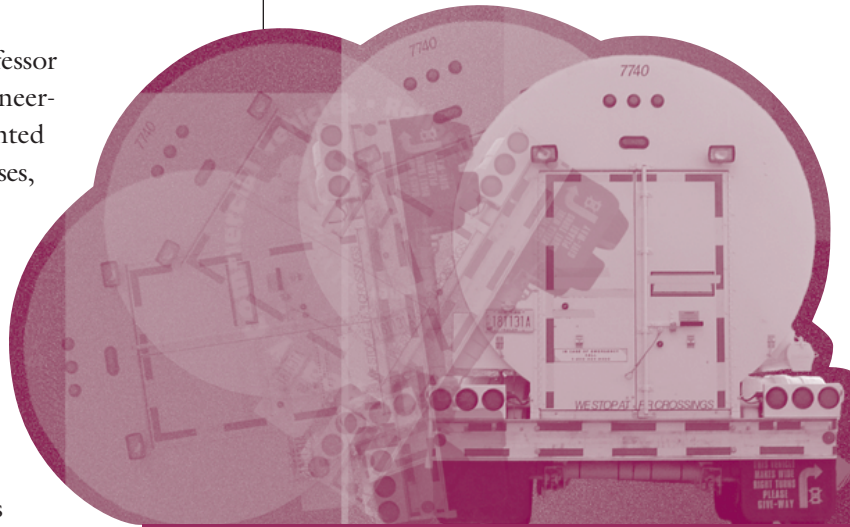
Thomas Gillespie, UMTRI research professor, lectured on steering systems, vehicle structures and layout, and the ride behavior of heavy-duty trucks. Chris Winkler, research scientist, presented information on four-wheeled vehicle properties,

heavy truck suspensions, and measurement and estimation of the mechanical and inertial properties of heavy-truck components. He also provided an overview of UMTRI's laboratory facilities.

Guest lecturers included Mike Sayers of Mechanical Simulation Corporation (formerly of UMTRI), and Dick Radlinski of Radlinski & Associates (formerly of NHTSA). Sayers spoke on computer analysis methods and elementary and special computer models. Radlinski presented a session on the braking capabilities of heavy-duty trucks.

ERD staff members Zevi Baraket, Mike Campbell, Bob Goodsell, John Koch, and Ben Powell provided out tours and computer setup and troubleshooting.

Note: Thanks to Beth Boyd of UM's Center for Professional Development for providing content information.



UMTRI's annual heavy truck dynamics course covered the mechanical and dynamical principles that determine the braking, handling, and ride properties of heavy trucks.

Tilt Test: All Systems Go

Earlier this year, Chris Winkler of UMTRI's Engineering Research Division (also see previous UMTRI Brief) conducted a tilt test on a GoTract, a device that installs telephone utility poles. Exponent, a failure analysis consulting

continued...



UMTRI researchers conducted a tilt test on a GoTract, a device that installs telephone utility poles, to help validate a software model.

firm, had previously commissioned UMTRI to run center-of-gravity and inertia tests on the GoTract to help them develop a computer model to analyze a rollover accident. The recent tilt test helped validate that software model.

UMTRI Publication Awards

The 2003 UMTRI best publication award was presented on May 29 to Kathy Klinich, Gregory Hulbert (UM Department of Mechanical Engineering), and Larry Schneider for their article, "Estimating Infant Head Injury Criteria and Impact Response using Crash Reconstruction and Finite Element Modeling," which appeared in the *Stapp Car Crash Journal*.

Jonathan Rupp, Matt Reed, Chris Van Ee, Shashi Kuppa (NHTSA), Stewart Wang (UM Medical Center), James Goulet (UM Medical Center), and Larry Schneider received the UMTRI research excellence award for "The Tolerance of the Human Hip to Dynamic Knee Loading," which appeared in the *Stapp Car Crash Journal*.

Both articles are online at www.umtri.umich.edu/library/reports.html#Pubs.



2003 UMTRI publication award winners (left to right) Larry Schneider, Biosciences Division head, Jonathan Rupp, senior research associate, Kathy Klinich, senior research associate engineer, and Matt Reed, associate research scientist, pose in UMTRI's impact sled lab.



UMTRI BRIEFS

It's a Building! It's a Bus!

Staff in UMTRI's Engineering Research Division recently tested a new model bus for New Flyer of St. Catharine's, Ontario. Research scientist Chris Winkler, engineering research associate Steve Karamihas, and engineering technicians John Koch and Ben Powell examined the bus's front suspension and steering system and how they affected braking and steering inputs.

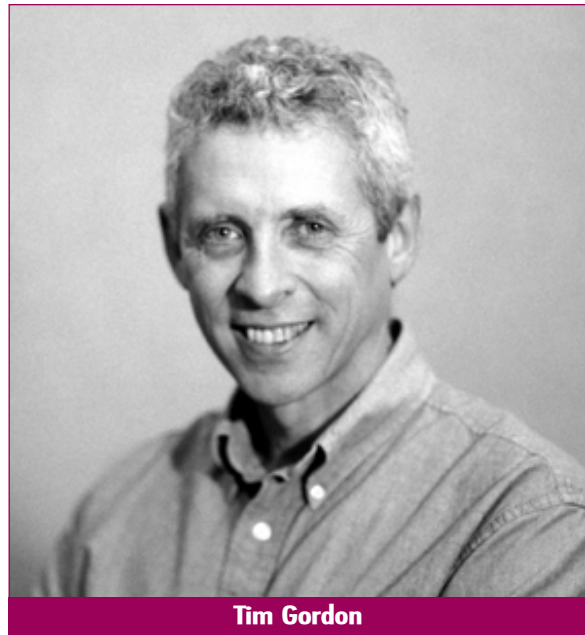
Winkler says, "We discovered the vehicle pulled to the left under braking, apparently due



to flexing of the solid front axle. It's hard to diagnose such things without a facility like UMTRI's." The project was sponsored by New Flyer and ArvinMeritor. **RR**

Tim Gordon Joins UMTRI as Engineering Research Division Head

Tim Gordon joined UMTRI in September as the head of the Engineering Research Division (ERD). Tim hopes to develop research opportunities for ERD with car companies, as well as multi-disciplinary research in dynamics control with federal government agencies. He says he's happy to be taking over such a well-run organization. Tim comes to UMTRI from Loughborough University in Leicestershire, England, where he was a Ford professor of automotive engineering. His main research areas included vehicle dynamics and control, with special emphasis on advanced and nonlinear methods and applications within automotive engineering. Along with representatives of Loughborough



Tim Gordon

University, Ford, UM, and Aachen University, he helped coordinate the masters program in automotive engineering. His research projects involved suspensions, hybrid-vehicle controls, and interactive handling dynamics for improved safety. integrated driveline control, neural network implementation of integrated suspension controllers, active control of vehicle handling dynamics, novel co-simulation methods applied to vehicle dynamics models, and control algorithms for an automated driver. Prior to that, Tim was a professor in mathematics at Loughborough. He possesses under graduate and graduate degrees in applied mathematics from Cambridge University.

In his spare time, Tim enjoys playing and watching soccer, golfing, swimming,

music, and reading. He moved to Ann Arbor with his wife, Anne, a preschool teacher, and their daughters Jenny, 17, and Alice, 14. Son Matthew, 20, attends university in England.

ERD's former division head, Bob Ervin, has moved to a project-leader role and will remain at UMTRI through 2004 to complete current project commitments.

Former UMTRI Director, Pat Waller, Passes Away

Patricia Fossum Waller, who served as UMTRI's director from 1990 to 2000, died at her home on August 15, following a nine-month battle with metastatic colon cancer. Dr. Waller, 70, was trained as a clinical psychologist and had a distinguished career as a leading research scientist and advocate for policy reform in the area of transportation safety and injury control. She was a noted scientist and talented administrator who inspired others through her life and actions. Her special areas of research interest included the older driver, pedestrian safety, alcohol and driving, heavy truck safety, driver licensing, and social aspects of transportation systems. She worked tirelessly to ensure that research find

ings were implemented through legislative and administrative measures, and that injury control and the health and human dimensions were incorporated into the national transportation agenda. She was widely read in many aspects of history and society, traveled extensively, loved to engage in debate and conversation with those around her, and was closely involved in her church and community. She devoted herself to pursuing



Pat Waller

UMTRI / KATHLEEN CROCKETT RICHARDS

excellence in every aspect of her life. Through her example, she was an inspiration to friends and colleagues and influenced the career paths of numerous fellow scientists.

Dr. Waller received numerous honors during her career, most recently including the Transportation Research Board's

Roy W. Crum Award for Outstanding Achievement in Transportation Research (1995), the International Council on Alcohol, Drugs, and Traffic Safety's Widmark Award for Outstanding Contributions to the Advancement of Knowledge on Alcohol, Drugs, and Traffic Safety (1995), the National Highway Traffic Safety Administration's Special Award of Appreciation (1999), and the National Safety Council's

Distinguished Service to Safety Award (2003).

A memorial service in celebration of her life was held in October in Chapel Hill, North Carolina. Her family established the Patricia F. Waller Scholarship Fund through the University of Michigan, which supports graduate student research in transportation science. Donations to the fund can

be made care of James Thomson at UMTRI at the address on the back of this journal. **RR**

NAMMIES & FACIES

UM Transportation Initiatives

UM Strives to Make Its Vehicles More Energy Efficient

Pat Cunningham, director of UM Parking and Transportation Services, and staff of UM's Environmental Stewardship Task Force contributed to this article.

The University of Michigan has the largest active, alternative-fuel vehicle fleet in the state and one of the largest in the country, with more than 400 vehicles operating on bio-diesel fuel, ethanol, or electricity. There are also programs in place for the reuse and recycling of used coolants, engine oils, solvents, oil filters, and tires.

UM is committed to experimenting with alternative fuel vehicles and has been a leader in electric vehicle technology through its solar car and hybrid vehicle teams in the College of Engineering.

Biodiesel Fuel

All of UM's diesel-powered equipment, including more than 55 buses, are powered by the biodiesel fuel B20. It's a mix of 20 percent biodiesel fuel with 80 percent low sulfur diesel fuel. The bio-diesel fuel is a soy-based product that produces fewer emissions when burned. It is also a renewable energy source and reduces our reliance on foreign oil. UM is one of the first fleets in Michigan or elsewhere to utilize biodiesel.

Ethanol-Powered Vehicles

The University of Michigan Parking and Transportation Services (PTS) department has more than 300 vehicles operating on E-85 ethanol. It's the largest fleet of ethanol vehicles in Michigan and one of the largest in the country.

E-85 ethanol is a blend of 85 percent ethanol—generally made from corn—and 15 percent unleaded gasoline. Ethanol is a cleaner fuel than gasoline and is a renewable energy source. Its use reduces harmful emissions, and the growing of corn also reduces carbon dioxide in our environment. Furthermore, ethanol is a sustainable product, domestically produced. E-85 ethanol is more expensive than regular unleaded gasoline, but because an ethanol plant is being built in the state, the fuel should become easier for UM to obtain and less expensive. PTS installed a 10,000 gallon underground ethanol storage tank in 2000, which enables fueling all of these vehicles on-site.

As ethanol is not readily available outside the University, UM's vehicles are "flex-fuel," and can be operated on unleaded gasoline when necessary. This is handy when vehicles are away from the premises. The ethanol-fueled vehicles cost the same to purchase as the

identical gasoline vehicles, and all of UM's new sedans, station wagons, minivans, and small pickup trucks are E-85 compatible. Ford, General Motors, and Chrysler all produce E-85 ethanol-compatible vehicles, and more models are being offered each year.

Electric Ford Rangers

UM has recently purchased several electric Ford Ranger pickup trucks to be used in its fleet of more than 900 vehicles. The Rangers are among the first built on a new assembly line in Troy, Michigan, and are totally electric powered. They operate on 39 eight volt batteries stored in a special battery pack under the vehicle. This pack produces 312 volts of power and gives the electric Ford Ranger generally the



Ethanol fuels—generally made from corn—burn cleaner than gasoline and are a renewable energy source.

same performance characteristics of its gasoline equivalent, without any tailpipe emissions. The Rangers are used as working vehicles by the Grounds Department, the Facilities Maintenance Department, and the UM Department of Occupational Safety and Environmental Health. One vehicle is used in the daily rental pool.



GRAC BEHNERT / UM PARKING AND TRANSPORTATION SERVICES

The University of Michigan uses electric Ford Ranger pickup trucks in the Grounds Department, the Facilities and Maintenance Department, and the UM Department of Occupational Safety and Environmental Health.

The range of the electric Ranger is 50 miles between charges and it takes about six hours to fully recharge the vehicle. However, most university vehicles travel less than 50 miles a day, so the limited range is not a major deterrent in their use on campus.

Engine Fuel and Solvent Recycling

UM Parking and Transportation Services also recycles used engine oil and engine coolant fluid generated during vehicle and equipment maintenance and repair activities. UM strives to recycle as much used engine oil as possible. This reduces the total amount of both hazardous and non-hazardous waste generated. Reusing engine coolant saves on the costs of replacing

the coolant and reduces the total amount of waste generated. For both oil and coolant, there is also a substantial savings on labor, compliance, and paperwork costs associated with typical waste disposal procedures.

Other Transportation Options

UM offers free campus transportation services to students, faculty, and staff. Buses operate 363 days a year, 17 to 21 hours each day. More than 4.3 million passengers ride the buses each year, eliminating thousands of single-passenger automobile trips each day, and contributing to the quality of the campus environment. Additionally, more than 2,000 faculty and staff members use a free bus pass (provided by the local bus company) rather

than purchasing a University parking permit, which further reduces the number of vehicles on campus.

As an option for faculty and staff who live in outlying areas, UM sponsors vanpooling. The 16 vanpools serve communities within a 75-mile range of Ann Arbor. Up to six passengers and a driver meet each day in their community, ride in together, and are dropped off near work. The van is parked in a reserved parking place on campus.

Bicycling to and around campus is also a viable option, and there are bike racks available around all University buildings, accommodating over 5,700 bicycles in all. Bicyclists don't need to purchase parking permits, and their vehicles require less parking space—twelve bicycles can fit in the space required for one car. Biking contributes no pollution to the environment, provides healthy exercise, and is a time-efficient method of traveling between classes and meetings. **RR**

UMTRI's Office for the Study of Automotive Transportation (OSAT) is involved in analyzing consumer acceptance of new transportation initiatives. Its website, www.osat.umich.edu/fuelcell.html, features articles on emerging fuel technologies, including the U.S. Department of Energy's FreedomCAR and Fuel Initiative. In addition, OSAT staff members Michael Flynn, Maitreya Sims, and Kara Alkire published an article on alternative fuels in *Natural Gas Fuels* (www.osat.umich.edu/alternative_fuels.pdf).

National Rural ITS Conference
August 10–13, Palm Harbor, Florida
itsflorida.org

18th IAVSD Symposium
August 25–29, Atsugi, Japan
iavsd.sd.kanagawa-it.ac.jp

Asia Auto Parts & Repair Expo 2003
September 4–6, Bangkok, Thailand
www.aapre.com/showinfo.htm

National Highway Utility Conference
September 17–19, Orlando, Florida
www.natlconference.com

ITS Forum 2003
September 23, Milwaukee, Wisconsin
www.its-forum.info

Global Powertrain Conference
September 23–25, Ann Arbor, Michigan
www.gpc-icpem.org/html/home.shtml

IEEE International Conference
October 5–8, Washington, D.C.
https://becat.engr.uconn.edu/IEEE_CSMC_2003

International Body Engineering Conference
October 27–29, Chiba, Japan
www.sae.org/calendar/ibe

Weather and Highways
November 4–5, Washington, D.C.
www.ametsoc.org/atmospolicy

International Truck & Bus Meeting
November 10–12, Fort Worth, Texas
www.sae.org/calendar/itb

ITS 10th World Congress
November 16–20, Madrid, Spain
www.madrid2003.itscongress.org

**Fifth Annual Workshop on Highway—
Rail Grade Crossing Research**
November 24–25, Montreal, Canada
www.tc.gc.ca/tdc/events/fifth.htm

**E-CAR International Conference
on Telematics**
December 2–4, Stuttgart, Germany
www.iir.de/app/?navi=310&pid=74

Asphalt Rubber 2003
December 2–4, Brasilia, Brazil
www.consulpav.com/ar2003

Midwest Work Zone Safety Conference
December 2–4, Springfield, Illinois
www.lhsfna.org

Transportation Engineering and Safety
December 10–12, State College, Pennsylvania
app.outreach.psu.edu/PTI

Work Zone Traffic Control Seminar
December 11–12, Atlanta, Georgia
www.asce.org/conted/seminars/transportation.cfm#Work


TRB 2004 Annual Meeting
January 11–15, Washington, D.C.
www.nationalacademies.org/trb

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www.atssa.com/meetevents/expo/Default.htm

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www.ictpaweb.org/templates/hq_conference_index.dwt

World of Concrete
February 17–20, Orlando, Florida
www.worldofconcrete.com

Virtual and Remote Weigh Stations
February 16–18, Lake Buena Vista, Florida
www.ce.ucf.edu/asp/catss 

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Technical Reports

Automotive collision avoidance system field operational test: ACAS/FOT third annual report. General Motors Corporation, Warren, Mich./ Delphi Delco Electronics Systems, Kokomo, Ind./ Delphi Chassis Systems, Dayton, Ohio/ Hughes Research Laboratories, Malibu, Calif./ HE Microwave, Tucson, Ariz./ Michigan University, Ann Arbor, Transportation Research Institute. 112 p. Sponsor: National Highway Traffic Safety Administration, Washington, D.C. Report No. DOT HS 809 600. UMTRI-97019.

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