

UMTRI

# RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • JANUARY–MARCH 2004 • VOLUME 35, NUMBER 1 •



**ROAD SAFETY  
IS NO ACCIDENT**



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## Transportation Tidbits

- On January 3, 1899, the word *automobile* was used for the first time in an editorial in *The New York Times*.
- On March 2, 1925, the first nationwide highway numbering system was instituted by a joint board of state and federal highway officials. The board, appointed by the secretary of agriculture, created shield-shaped highway number markers. Later, interstate highway numbering would be improved by colored signs and the odd-even numbering system that distinguishes between north-south and east-west routes.
- On March 5, 1929, fire destroyed the Los Angeles Automobile Show. Over 320 new cars, including the Auburn Motor Company's only Auburn Cabin Speedster, were destroyed.
- On January 1, 1937, safety glass became mandatory in windshields in Great Britain. Safety glass was first produced in 1909 by French chemist Edouard Benedictus, who used a sheet of clear celluloid between glass layers. The plastic used in 1937 was polyvinyl butyral (PVB).
- On March 2, 1949, the first automatic streetlight system was installed in New Milford, Connecticut. An electronic device, which contained a photoelectric cell capable of measuring outside light, turned the streetlights on automatically when it got dark. By November 1949, seven miles of New Milford roads were automatically lit at dusk by a total of 190 photoelectric streetlights.
- On February 5, 1952, the first "Don't Walk" sign was installed in New York City. The city erected the signs in response to the growing awareness of pedestrian fatalities in the increasingly crowded Manhattan streets.

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**Source**

**This Day in Automotive History,**  
[www.historychannel.comhour](http://www.historychannel.comhour)

# Integration and Collaboration in the Automotive Value Chain

Automotive suppliers face major challenges in supporting their customers: organizing their resources to support them on a global basis; delivering innovation, quality, and value with increasing speed; and operating profitably in the face of continuous competitive pressures to reduce costs. To survive and prosper, suppliers must integrate their internal processes and effectively collaborate with both their customers and their suppliers. This encompasses combining or unifying internal business processes across functions, activities,

and units, as well as coordinating business processes with external customers and suppliers.

A recent UMTRI study examined this integration process. *Destroying Boundaries: Integration and Collaboration in the Automotive Value Chain* was authored by Bruce Belzowski, Mike Flynn, and Maitreya Sims of the Office of the Study for Automotive Transportation (OSAT) and Paul Hebler and John P. McGlynn of Oracle Corporation. OSAT and Oracle, with the cooperation of the Original Equipment Suppliers Association, collaborated on the study to identify:

- current barriers and facilitators to successfully implementing these efforts
- a vision of the future, more fully integrated and collaborative value chain

Information was gathered from a set of eight preliminary interviews, a survey of over 100 high-ranking supplier executives, and 12 interviews with executives from major suppliers. The major findings of the study are discussed below under five main areas: industry evolution, integration and collaboration, executive decision making, product design and development, and supply chain management.

## Industry Evolution: Significant Disconnects Looming

Suppliers feel that over the next five years there will be a continuing shift in responsibility and power from the OEMs to the supply base, especially system integrators, for major activities such as PDD and SCM, as well as lifecycle and warranty costs. Suppliers expected major changes in the structure of the supply base over the next five years, accentuating changes that have occurred since the mid-1990s.

Fifty percent of Tier 1 suppliers reported they will remain Tier 1 suppliers, while 30 percent expected to become system integrators and 20 percent expected to become Tier N suppliers. The authors found important differences between current and emerging system integrators (ESIs) as well as between current and enhanced Tier N suppliers (ETNs). ESIs tend to lag current system integrators in a number of key performance indicators (KPIs) and in their progress in integration and collaboration. ETNs generally

*continued...*



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focused more on cost reduction and PDD than did current Tier N suppliers. They also consider their customer collaboration efforts as more of a combination of value added activity and cost reduction rather than as a purely value added activity.

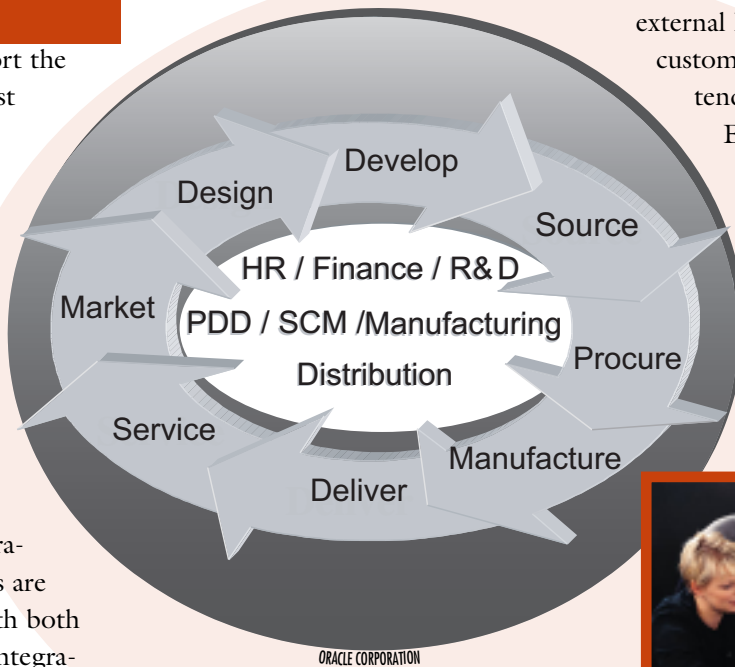
**Integration and Collaboration: A Holistic Approach**

The results strongly support the hypothesis that companies must develop and execute internal integration and external collaboration strategies to meet the critical survival challenges they face over the next five years. Asked to rank ten items critical to their future survival, suppliers saw only cost reduction as more important than internal integration and external collaboration. However, integration efforts across the activities are well ahead of collaboration with both customers and suppliers, and integration is seen as more important to recent specific performance improvements than is either form of collaboration.

The authors found it important to distinguish between primary and secondary links for various industry activities. Primary links strongly bind adjacent tiers in an activity, while secondary links characterize less intensely involved tiers. Suppliers tend to focus their collaborative efforts on the primary links at the expense of appro-

priate and competitively beneficial attention to the secondary links.

- In PDD, suppliers report collaboration with customers (the primary link) is further advanced and *more* important than is collaboration with suppliers (the secondary link).



- In SCM, suppliers think their external collaboration with customers (the secondary link) is *less* important than collaboration with suppliers (the primary link).
- In EDM, suppliers report external collaboration with customers (the primary link) is *more* important than is collaboration with suppliers (the secondary link).

Suppliers report barriers and facilitators to integration and collaboration across four different categories: organizational patterns, human resource or personnel practices, business processes, and information technology. Balancing change efforts across these categories

increases the likelihood of implementing change successfully.

**Executive Decision-Making: Job 1 for Survival**

Suppliers reported they are about half way to their goal in internally integrating their EDM business processes, but only about a quarter of the way in external EDM collaboration with their customers and suppliers. They also tended to believe their internal EDM integration efforts play a more important role in their companies' performance improvement than do their external EDM collaboration efforts. They did report that collaboration with customers plays a

MICROSOFT DIGITAL GALLERY LIVE / MICROSOFT CORPORATION



**The automotive enterprise design, production, and sales cycle offers numerous opportunities for integration and collaboration activities.**

more important role than does supplier collaboration.

The industry's information challenges of the past few decades represent three waves of challenges. The first wave was and is simply collecting or acquiring information. The second wave involves organizing the information so that it can be stored and retrieved, and the third wave involves deploying and using the information.

In terms of wave one, suppliers rated business-information acquisition as the least critical survival challenge.

In terms of wave two, suppliers generally considered their information to be timely, accurate, analyzable, relevant, and electronically available. However, they also reported that information is fragmented across the organization, which significantly hampers an executive's ability to make major decisions based on good, current information. Companies that spend more on information technology tended to have more accessible and less fragmented information. In terms of wave three, supplier executives emphasized traditional financial metrics (such as gross margin and revenue growth) over operational metrics (such as reductions in engineering change notices or RFQ success rate) in evaluating internal program efforts.

### *Product Design and Development: New Roles, New Partners*

Suppliers estimated they are about halfway to their goals for internally integrating and externally collaborating with their customers in PDD. But external collaboration with suppliers is developing substantially more slowly; suppliers feel they are about one-quarter of the way to this goal.

This progress is reflected in suppliers' reporting that internal integration efforts have been "very" important as sources for their improved PDD performance over the past two years, while customer collaboration is "moderately" to "very" important, and supplier collaboration is of just "moderate" importance to PDD improvement. This reinforces that suppliers need to consider more activity with the secondary link of supplier collaboration in PDD for future success.

Suppliers "often" electronically communicated drawings, engineering change notices, and quality specifica-

tions, but only "sometimes" communicated product data, project plans, target costs, and financial information.

### *Supply Chain Management: Great Risks, Great Opportunities*

SCM is currently the least developed internal integration effort. Suppliers reported only being about one quarter of the way to achieving this goal, and only about a quarter of the way to achieving their goals for external collaboration with customers and suppliers. Suppliers recognized this lack of progress and are currently focusing many of their integration and collaboration efforts on SCM.

Suppliers reported that internal integration efforts have been "very important" in improving their SCM performance over the past two years. They reported that collaboration with customers is "moderately important" to their improvement, and that collaboration with suppliers is "very important." As is the case with PDD, these results also reinforce that suppliers need to tap into the secondary link (in this instance, customer collaboration) in SCM to succeed.

Suppliers all too often fail to implement the lessons they learn as suppliers when acting as customers. Thus they reported that their integration and customer collaboration efforts are driven by the need to add value and reduce cost. However, their own external supplier collaboration efforts are driven more by the need to reduce cost. As OEMs' cost and value strategies undercut suppliers' long-term competitiveness, so will similar suppliers' strategies undercut their own suppliers.

Advanced shipping notices and shipping schedules are electronically communicated "very often," forecasts

"often," inventory information and part bill of materials "sometimes," and process data and supplier capacity constraints "once in a while."

The study suggests that warranty information is one of the least often electronically communicated types of information between suppliers and customers. Warranty responsibility faces other challenges as well. For example, suppliers reported the current systems for analyzing the source of parts' failures are inaccurate and unclear. They also expressed concern about the quality of dealer data and commented that the current system lacks visibility and standard dealer coding.

### *Final Thoughts*

This study provides suppliers the opportunity to benchmark their progress in internal integration and external collaboration. As the supplier industry continues to evolve, suppliers' competitive success will depend on their ability to function smoothly and effectively within all parts of the value chain. Integrating processes internally and concurrently collaborating with both customers and suppliers in the value chain is not an easy task, but one that suppliers must confront and master. Managing the increased responsibility for PDD and SCM throughout the supply chain demands that suppliers have these processes in place. Without these processes, supported by effective EDM, suppliers will find their companies gradually replaced by suppliers that can manage the internal and external relationships demanded of today's—and tomorrow's—automotive value chain. **RR**

## Divisional Name Changes

UMTRI's Truck and Bus Safety Analysis Division has changed its name to the **Transportation Safety Analysis Division**. "The name change more accurately reflects our division's role and incorporates our broad research focus," says John Woodrooffe, head of the Transportation Safety Analysis Division. As an interdisciplinary team, the division will continue to advance motor vehicle safety through its data collection and analysis activities, plus its fundamental understanding of traffic safety.

In addition, the Center for National Truck Statistics, an operational unit within the Transportation Safety Analysis Division, is now known as the **Center for National Truck and Bus Statistics**. The unit was established in 1988 to develop a national program to collect and analyze truck accident data, the Trucks Involved in Fatal Accidents (TIFA) survey. A national bus survey, patterned after TIFA, began for the 1999 data year and has continued on an annual basis. The name change reflects this added scope.

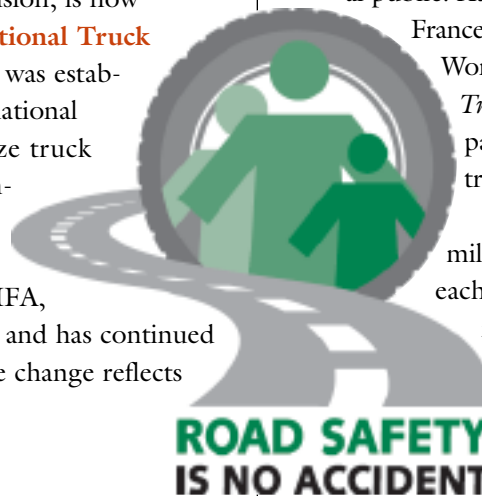
## World Health Day on Transportation Safety

The theme of this year's World Health Day, which took place April 7, is road safety. With partners from around the world, the World Health Organization (WHO) and its regional and country offices hosted events involving political leaders, public figures, road safety experts, and the general public. At a global level event in Paris,

France, WHO launched the WHO/World Bank *World Report on Road Traffic Injury Prevention* and will pay tribute to victims of road traffic injuries.

Road traffic injuries kill 1.2 million people around the world each year. Hundreds of thousands more are injured on our roads, some of whom become permanently disabled. The vast majority of these occur in developing countries, among pedestrians, cyclists, motorcyclists, and public transport users, many of whom would never be able to afford a private motor vehicle. World Health Day aims to make this knowledge more widely known throughout the world.

For more information, visit [www.who.int/world-health-day/2004/en](http://www.who.int/world-health-day/2004/en). The site features facts on traffic safety and WHO's five-year strategy for road traffic injury prevention.



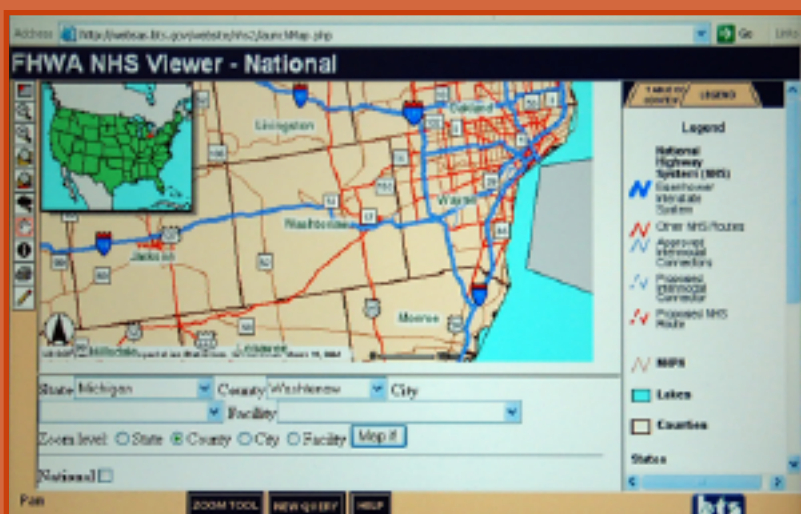
# GIS in Transportation

The Federal Highway Administration (FHWA) has launched a website—[www.gis.fhwa.dot.gov](http://www.gis.fhwa.dot.gov)—that provides resources for using geographic information systems (GIS) in transportation. The site presents noteworthy practices and innovative uses of GIS for transportation, lists GIS-related events and training opportunities, and provides links to GIS data, software, and reports. GIS was used in the early 1990s in the development of the National Highway Planning Network, a database of the nation's major highway systems that is

being used to maintain the National Highway System and the Strategic Highway Network. More recently, in the Transportation Equity Act for the 21st Century (TEA-21, Section 5113), the U.S. Department of Transportation called for agencies to use spatial information and technologies in applications related to national transportation. FHWA's website is one way to encourage the increased use of GIS.

Watch for an article about UMTRI's use of GIS in a future edition of the *UMTRI Research Review*. **RR**

**FHWA uses GIS data to produce online, interactive National Highway System (NHS) maps. Users can select from various regions and transportation settings to make their own maps. The top screen shows intermodal transportation facilities in and around Michigan, while the bottom screen focuses on major highways in southeastern Michigan.**



GRAPHICS: FEDERAL HIGHWAY ADMINISTRATION / NHS VIEWER

# UMTRI Presentations at TRB's Annual Meeting

*UMTRI was well represented at the 83rd annual Transportation Research Board (TRB) meeting, which took place January 11-14 in Washington, D.C. Many UMTRI researchers attended committee meetings and several also gave presentations, which are highlighted below.*

## Truck and Bus Data Assessment

Dan Blower, assistant research scientist in the Transportation Safety Analysis Division, serves on the Truck and Bus Safety Committee and is coordinating the writing of a chapter for a circular on the domain of truck and bus safety research. He presented "Truck and Bus Safety—Problem Assessment and Data." The talk discussed the gaps of knowledge in current crash-file and exposure data and highlighted new initiatives for in-depth data analysis. Most crash files for trucks and buses contain general purpose data—information on *what* crashes happened *when* and *where*, but not *why*. Furthermore, crash data for fatal and nonfatal crashes does not come from the same source and gaps exist in the nonfatal data. Finally, exposure and population data comes from administrative files, which are not well matched to the crash data.

Data on fatal crashes generally come from FARS and TIFA/BIFA files. The FARS file contains a standard set of data elements and general descriptions of trucks and buses. The TIFA/BIFA files supplement the FARS data with improved vehicle identification and information on the motor carrier operator, driver hours of service, and accident type. Data for nonfatal crashes, on the other hand, come from GES and MCMIS files. The former is a nationally representative sample with common truck configurations. It is well matched to



FARS but contains few bus configurations and large sampling errors on small subsets. MCMIS is a state-reported census file with limited data

elements and both over- and under-reported data.

This data is matched to exposure and population data from yet other sources. FHWA *Highway Statistics* provides annual data on two truck types and five road types, and shows long-term trends. Vehicle Inventory and Use Survey (VIUS) data is published every five years from a sample of truck owners and provides information on the truck (configuration, cargo, cargo body, weight, mileage, etc.). Population data on truck carriers and drivers provide additional information but also leave intrastate gaps and uncertain totals.

Researchers hope that new initiatives can bridge these gaps. For example, the Large Truck Crash Causation Study (LTCCS) provides a nationally representative sample of 1,000 cases and 1,000 variables for fatal and serious crashes. This FMCSA/NHTSA program, to be released late this year, contains an unprecedented, comprehensive level of detail and focuses on pre-crash events and conditions. In addition, instrumented vehicles are a promising new source for exposure and incident data on the driver, vehicle environment, and road surface during normal driving and critical incidents.



PHOTOS: UMTRI / SHEKHAR ENGINION



## Older Driver Self-Awareness

David Eby, research associate professor in the Social and Behavioral Analysis Division, presented a paper entitled “Improving Older Driver Self-Awareness and Knowledge” at the human factors workshop Educational Programs for Older Drivers: Do They Work? His presentation highlighted various abilities that decline with age and the value of older driver self assessment. He then discussed the *Driving Decisions Workbook*, an older driver self-assessment tool developed by Eby, Lisa Molnar, and Jean Shope.

For those willing and able to assess their own driving abilities, the workbook provides feedback for making good driving decisions by increasing self-awareness and general knowledge, and by suggesting appropriate driving compensation and clinical evaluations. It also increases general awareness of age-related declines in driving abilities for generating discussion within families.

Questions and feedback in the workbook were written based on literature review and expert knowledge. The authors used an eighth-grade reading level for more universal understanding. A question and feedback section gives appropriate feedback based upon the respondent’s answers.

Several pilot tests were conducted at various critical points during the workbook’s development to ensure its effectiveness. The workbook was also validated with 99 licensed drivers above the age of 65. Nearly all participants would recommend the workbook to a friend or family member and thought it would be useful for older adults in discussions with their family.

In addition:

- 75 percent stated that the workbook made them more aware of changes that affect driving.
- 15 percent discovered a change of which they had been previously unaware.
- 24 percent indicated that they were planning to make a change in they way drove.
- 41 percent reported that they were more likely to take a driving refresher course.
- 36 percent said they were more likely to have a doctor evaluate their abilities.

In conclusion, the *Driving Decisions Workbook* has the potential to be an effective first-tier assessment and educational tool for maintaining safe and effective mobility for the elderly.

## Road Roughness

Steve Karamihas, senior research associate in the Engineering Research Division, served on the committee for surface properties-vehicle interaction. He presented three papers. The first, “Development of LTPP Pavement Smoothness Specification for Weigh-in-Motion Sites,” was authored by Karamihas; Gonzalo R. Rada, Barbara K. Ostrom, and Amy L. Simpson of MACTEC Engineering & Consulting, Inc.; and Larry J. Wisner of the Federal Highway Administration. To minimize dynamic motions and therefore improve the accuracy of traffic loading data at weigh in motion (WIM) scales, the study developed pavement smoothness specifications to screen sites for excessive truck dynamic loading that exacerbates scale error beyond ASTM recommended tolerances. WIM scale error was related to pavement profile

characteristics using a large simulation study of the response of virtual trucks over measured profiles. A distribution error was compiled over the truck population for steer axle, tandem axle, and total vehicle weight at each site. The error distributions were summarized by their 95th percentile absolute error levels. The error levels assigned to each site were then used as a correlation standard for the proposed roughness indices and for the selection of corresponding threshold values. Instead of a single index, two versions of the Butterworth filter were selected for use in the specifications – one each for short- and long-range roughness. The short- and long-range WIM error indices were then statistically related to WIM scale error to set the threshold values.

The second paper, “Assessment of Profiler Performance for Construction Quality Control,” was written by Karamihas and Thomas Gillespie, research professor in UMTRI’s Engineering Research Division. The study tested inertial profilers on four pavement sections to determine the repeatability and reproducibility of the profile and the International Roughness Index for construction quality control. Results showed that repeatability was compromised on the new concrete site with transverse tining and was inadequate on the new concrete site with longitudinal tining. Further, inertial profilers could not sufficiently reproduce profiles when the position and severity of localized rough features were of interest. Poor performance on the concrete sites with coarse texture is attributed to the fact that the depth of tining and joints on new concrete are of the same scale as the height of longer wavelength features that are relevant to vehicle response. These problems can be solved in two ways. First, the sensor footprint of profilers could be altered to better represent the behavior of

*continued...*

vehicle tires. Second, a “tire bridging filter,” customized to ignore narrow downward features that do not affect vehicle ride vibrations, could be applied to measured profiles.

The third paper, “Assessment of Profiler Performance for Construction Quality Control with Simulated Profilograph Index,” is authored by Karamihas and presents the results of further analysis for the profiler experiment above. The further analysis was aimed at judging the repeatability and reproducibility of a simulated profilograph index from profilers. The study examined the repeatability and reproducibility of the simulated California Profilograph Index (PI) values produced by repeat measurements from eleven profiling devices on four pavement sections.

The paper also reviewed automated profilograph trace-reduction procedures that have been adopted in profilograph simulations. Results of profilograph simulations showed that the low-pass filter and minimum scallop width are important aspects of trace

reduction and should be retained as standard components of simulated profilograph trace reduction. However, criteria are needed that help remove narrow, downward spikes such as those found in profiles of jointed concrete. Also, existing profilers did not agree on PI values sufficiently when a zero blanking band was used.

Finally, Karamihas presented an update on the WIM effort, entitled “LTPP Weigh-in-Motion Pavement Smoothness Specifications.” This talk described the WIM smoothness index, and how it should be used to screen existing and potential WIM systems for excessive roughness. The presentation showed how the content of the smoothness index could be displayed as a continuous profile along a segment of pavement. With this display



UMTRI / SHEKHAR KARAMIHAS

method, potential WIM sites can be searched for the optimal location of a new WIM scale. For existing WIM sites, the method helps isolate localized roughness that may be corrected to improve the performance of the scale. The presentation demonstrated the use of this method for both purposes.

## Standard Enforcement of Safety Belts

Lidia Kostyniuk, research scientist, and David Eby, associate research professor, in the Social and Behavioral Analysis Division presented a poster based on their paper “Effects of Standard Enforcement on Safety Belt Citations in Michigan.” The paper is coauthored by UMTRI staff members Lisa Molnar and Linda Miller.

The study, sponsored by the Michigan Department of State, investigated the effects on safety belt citations as a result of the change in police enforcement of Michigan’s mandatory safety belt law (enacted in March 2000).

Researchers obtained safety belt citation records from Michigan courts

for one year before and one year after standard enforcement. Analysis of the records indicated an overall increase of 9 percent in safety belt citations and an 8 percent increase in the number of individuals cited. No effects were found for the distributions of safety belt citations by sex, age, and race, both overall and for day and night. The proportion of persons with more than one citation per year was unchanged. Individuals who continued to receive citations after standard enforcement were

more likely to be males, between the ages of 16 and 22. No effect was found on child restraint citations. In the court system, changes in disposition of cases included an increase in the proportion of guilty outcomes and a decrease in the proportion of cases dismissed.

## Incentives for Alternative Fuel Vehicles

Lidia Kostyniuk also presented the poster of the paper “Experimental Assessment of Incentives for Alternate Fuel Vehicles,” which is authored by Tom Adler of Resource Systems Group, Laurie Wargelin of MORPACE International, Kostyniuk, and Chris Kavalec and Gary Occhiuzzo of the California Energy Commission (CEC).

This study explored conditions and incentives that might encourage California residents to buy or lease alternate fuel vehicles. It also statistically estimated a set of vehicle choice models for use in California’s vehicle fleet forecasting models. Researchers designed and conducted a stated-preferences experiment with choice alternatives consisting of different size and body style classes of conventional gasoline vehicles, hybrid electric vehicles, and diesel vehicles. Attributes of alternative fuel vehicles that were tested included purchase, fuel, and maintenance costs; acceleration; ability to sustain speed on grades; and alternative-fuel incentives.

Researchers gathered data from 2,200 households, tested main and interaction effects among the variables, and explored the effects of socioeconomic variables on utility values. Once they had developed a reasonable set of utility specifications, they developed nested logit models of vehicle choice.

AMERICAN HONDA MOTOR CO., INC. / hondacars.com



TOYOTA MOTOR SALES U.S.A. / toyota.com

**Top: The Honda Insight is an example of a fuel-efficient, gas-electric hybrid vehicle.**

**Above: The Toyota Prius sedan is a mid-size, gas-electric hybrid vehicle.**

**On cover: Smart™ cars, produced by DaimlerChrysler, are small, highly fuel-efficient vehicles. They are a popular way to get around in European cities and will be introduced in the U.S. in 2006.**

The model results indicate that fuel cost savings, reductions in vehicle purchase taxes, and the availability of free parking for alternative-fueled vehicles provide significant purchase incentives for those vehicles. However, the abilities of the vehicles to accelerate and to sustain speeds on grades are also significant factors in purchasers’ evaluation of hybrid vehicles. **RR**

## Engineering Research Division Testing Devices

*UMTRI's Engineering Research Division has developed many testing devices to aid researchers in their work. Such equipment includes a fifth-wheel load transducer, a flat-bed tire dynamometer, heavy-vehicle inertial measurement facilities, heavy- and light-vehicle tilt tables, a mobile truck-tire dynamometer, a smart cruise platform, and a suspension properties tester. Two of these items, which are commonly used for testing by the manufacturing community, are described below.*

### Fifth-Wheel Load Transducer

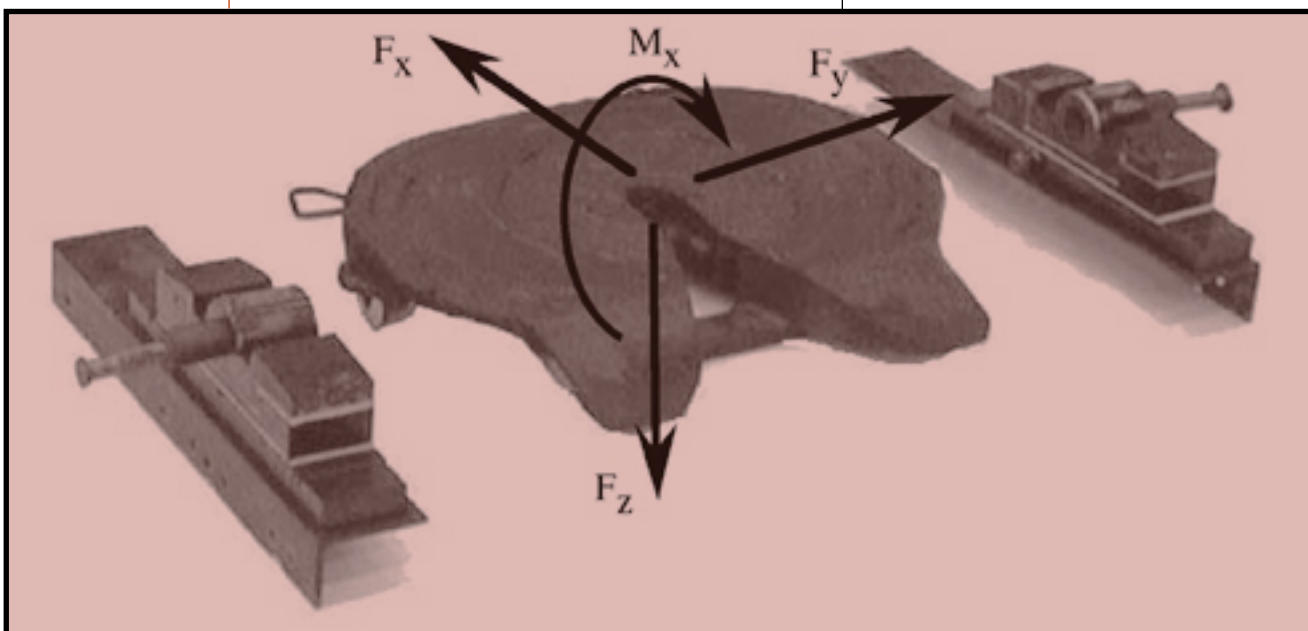
UMTRI staff developed a fifth-wheel load transducer in 1997 for the National Highway Traffic Safety Association (NHTSA). The device is used in place of a highway tractor's standard fifth wheel (i.e., "trailer-hitch"), which connects the tractor to the semitrailer. The device was initially constructed to aid researchers in their development of a real-time rollover warning system for trucks, the Roll Stability Advisor.

The fifth-wheel load transducer remains the property of NHTSA, with UMTRI serving as its agent in making the device available to the motor

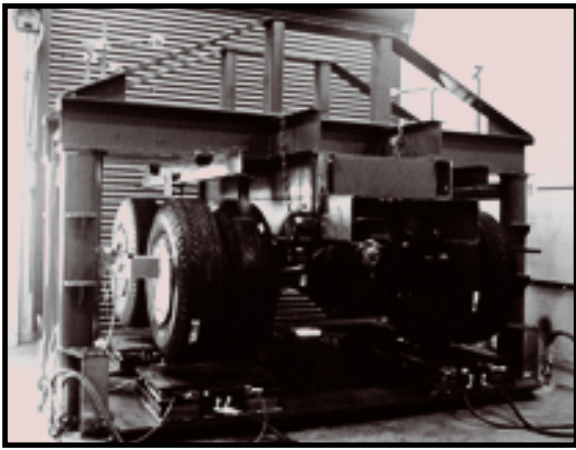
vehicle industry for appropriate testing purposes. For example, the transducer helps designers of trailers, tractors, and fifth wheels know how strong to make various areas of their product. Also, manufacturers can use the transducer for interactive testing of prototype parts.

The transducer measures, to a high level of fidelity, all four primary loads that are transmitted between the tractor and the semitrailer by the fifth-wheel coupling: longitudinal force,  $F_x$ , lateral force,  $F_y$ , vertical force,  $F_z$ , and roll moment,  $M_x$ . The transducer system measures these loads by replacing the standard fifth-wheel chairs (the outer two components shown in the photo) with specially-made chairs, each of which is in itself a four-component load transducer. The four signals from the individual chairs are combined appropriately by a data-reduction matrix calculation to yield the three forces and one moment acting on that chair. In turn, the values from the left and right chairs are combined to determine the total loads on the fifth wheel.

The transducer system is nominally designed for use with trailers applying static fifth-wheel loads of up to 30,000 lbs. Calibrations show the system to provide less than 1 percent error in  $F_x$  and  $F_y$  and no more than about 2 percent error in  $F_z$  and  $M_x$ . Other tests show that the load cells are quite insensitive to twisting and flexing of the frame rails to which they are mounted.



UMTRI / ENGINEERING RESEARCH DIVISION



## Suspension Properties Tester

UMTRI's suspension measurement facility is a permanently installed laboratory device that measures various parameters of heavy-vehicle suspensions. Specifically, it measures all of the compliance, kinematic, and coulomb friction properties of commercial vehicle suspensions that are pertinent to vehicle simulation. The system can be used to measure single or tandem axle, steering or nonsteering, and front or rear suspensions. Suspensions can be tested as installed on the actual vehicle or on a frame "buck," as shown in the photo.

The facility consists of the following:

- ◆ an overhead static structure to which the vehicle chassis is rigidly fixed
- ◆ a movable table that serves as the "ground" and whose vertical and roll motion exercises the suspension
- ◆ four wheel pads, one for each wheel set of a tandem axle suspension, on which the tires of the suspension rest

Each wheel pad can either act as a frictionless surface or apply controlled shear force and moment to the tires in the ground plane. Each pad contains a load cell system for measuring the forces and moments applied to the suspension. Potentiometric transducers measure the resulting motions of each wheel and axle. The facility uses up to 48 individual transducers. Signals are gathered by a digital data acquisition system with software that allows flexible calculation and real-time display for test monitoring or later data reduction.

The following parameters can be determined: wheel rate, coulomb friction, roll rates (total and auxiliary), roll-center height, roll steer, lateral compliance, lateral force, and aligning moment compliance steer. For tandem suspensions, load leveling and the interaxle load transfer due to braking can be determined. For steering axles, jounce steer, wrap-up (caster) rate, and wrap-up steer may also be measured. **RR**

## Journal Articles

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# CONFERENCES & EVENTS

## World Health Day on Road Safety

April 7, Worldwide

[www.who.int/world-health-day/2004/en](http://www.who.int/world-health-day/2004/en)

## Design-Build Transportation Conference

April 21–23, Baltimore, Maryland

[www.dbia.org/cc/tran01.html](http://www.dbia.org/cc/tran01.html)

## CODATU 11th World Congress

April 22–24, Bucharest, Romania

[www.codatu.org](http://www.codatu.org)

## Ninth Michigan Traffic Safety Summit

April 27–28, Lansing, Michigan

[www.michigan.gov/msp/1,1607,7-123-1593\\_3504\\_8271--,00.html](http://www.michigan.gov/msp/1,1607,7-123-1593_3504_8271--,00.html)

## Making Work Zones Better

April 29, Pomona, California

May 25–26, Dickson, Tennessee

[ops.fhwa.dot.gov/wz/workshops/workshops.htm](http://ops.fhwa.dot.gov/wz/workshops/workshops.htm)

## Tenth National Clean Cities Conference

May 2–5, Fort Lauderdale, Florida

[www.cities.doe.gov/conference/lauderdale/](http://www.cities.doe.gov/conference/lauderdale/)

## Bus Rapid Transit Conference

May 5–6, Denver, Colorado

[apta.com/conferences\\_calendar/bus/](http://apta.com/conferences_calendar/bus/)

## Automotive Dynamics & Stability Conference

May 4–6, Detroit, Michigan

[www.sae.org/calendar/ads](http://www.sae.org/calendar/ads)

## Second International Traffic

and Road Safety Congress

May 5–7, Ankara, Turkey

[www.trodsa.com](http://www.trodsa.com)

## Fifth International RILEM Conference

May 5–8, Limoges, France

[www.congres-scientifiques.com/RILEM](http://www.congres-scientifiques.com/RILEM)

## Canadian Transportation Research Forum Annual Conference

May 9–12, Calgary, Alberta, Canada

[www.ctrf.ca/2004.htm](http://www.ctrf.ca/2004.htm)

## Community Transportation Expo

May 18–23, Seattle, Washington

[www.ctaa.org/expo](http://www.ctaa.org/expo)

## TRANSED 2004

May 23–26, Hamamatsu, Japan

[transed.jp](http://transed.jp)

## FISITA World Automotive Congress

May 23–27, Barcelona, Spain

[www.fisita2004.com](http://www.fisita2004.com)

## ITS in Europe Congress and Expo

May 24–26, Budapest, Hungary

[www.itsineurope.com/its\\_pres.cfm](http://www.itsineurope.com/its_pres.cfm)

## Testing Expo 2004 Europe

May 25–27, Stuttgart, Germany

[www.testing-expo.com/txeintro.html](http://www.testing-expo.com/txeintro.html)

## Women's Transportation Seminar

May 26–28, Detroit, Michigan

[www.wtsnational.org/conferences.asp](http://www.wtsnational.org/conferences.asp)

## Applications of Advanced Technologies in Transport

May 26–28, Beijing, China

[www.jtzx.net.cn/aatt8.htm](http://www.jtzx.net.cn/aatt8.htm)

## Safety 2004

June 6–9, Vienna, Austria

[www.safety2004.info](http://www.safety2004.info) 

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