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## IMPACT OF UMTRI RESEARCH

In addition to UMTRI's scholarly contributions in pushing the boundaries of scientific knowledge of the interaction of drivers, vehicles, and infrastructure, UMTRI's research has also significantly impacted highway transportation practice, in the United States and internationally.

While maintaining a fundamentally scholarly and scientific stance, UMTRI has consistently applied knowledge to advance transportation practice, particularly in relation to improving safety. UMTRI has been involved with stakeholders and peers in the long-term development and evolution of research programs, as well as in the conduct of specific studies within those programs. UMTRI has also developed research tools and databases that attract research collaboration and provide research facility as well as competitive advantage.

As UMTRI enters its fortieth year, its six research divisions are highly engaged in their respective domains, and their expertise is sought by highway transportation stakeholders in both government and industry. The accumulated achievements of UMTRI's research are best understood in the context of the UMTRI divisional structure, although an increasing amount of UMTRI's research is multidivisional and involves collaboration with University of Michigan faculty from a wide range of schools and colleges. UMTRI has forged an effective interdisciplinary working method over its forty year history.

### Biosciences Division

UMTRI's Biosciences Division has been a national and international leader in the field of impact/injury biomechanics and occupant protection research for nearly four decades. In addition to generating much of the basic knowledge on injury causation and human tolerance to injury, Biosciences researchers have been instrumental in the application of this knowledge to the design and development of injury assessment tools such as anthropomorphic test devices (crash dummies), computer models, and associate injury criteria and injury reference values. The scope of biomechanics research in UMTRI's Biosciences Division is unique among its peers and competitors in that it includes the conduct of in-depth crash investigations as well as biomechanical testing in the laboratory. Moreover, Biosciences research has historically sought to study and document the biomechanics of occupant positioning and posture within the motor vehicle for the range of occupant sizes from infants to large adults, and to understand the relationship between vehicle interior package and seat design features to seated automotive anthropometry and positioning. This has provided Biosciences researchers with a unique appreciation and understanding of occupant positioning as it relates to safety issues, such as seat-belt fit and optimal positioning of restraint components such as airbags and knee restraints.

**1. *Reduction of Airbag-Induced Injuries***

- a. Innovative test methods and computer models developed by Biosciences researchers based on biomechanical testing are used by the auto industry and airbag suppliers to assess the potential for deploying airbags to cause skin abrasions, skin burns, and forearm fractures.
- b. A set of surrogate infant/child safety seats was developed by Biosciences' researchers, in collaboration with First Technology Safety Systems, Inc.(FTSS), to assess the effectiveness of airbag suppression systems.
- c. Anthropometric specifications and seat/subject pressure patterns were developed for use in by FTSS in designing the Occupant Classification Anthropomorphic Test Devices (OCATDs) used to evaluate airbag suppression systems that utilize seat pressure patterns to determine the presence of an adult occupant in right-front passenger seat.

**2. *Assessment and Analysis of Injury-Causation and Restraint-System Performance through In-Depth Crash Investigations***

- a. For nearly forty years, Biosciences' in-depth crash-investigation program has provided timely feedback to the automobile industry on the real-world crashworthiness of late-model vehicles and the effectiveness of the latest restraint technologies in reducing injuries and fatalities. This feedback is provided in the form of detailed case reports as well as results from statistical analyses of the UMTRI crash/injury database with regard to current safety issues.
- b. Statistical and anecdotal analyses performed by Biosciences' researchers using the UMTRI crash/injury database have provided critical and timely feedback to the safety community regarding changes in frontal crash protection offered by airbag equipped vehicles due to changes in FMVSS 208 test requirements.

**3. *Crash Dummy Development and Testing***

- a. Biosciences' researchers developed more humanlike thorax, spine, and shoulders with multipoint chest-deflection instrumentation for NHTSA's future frontal anthropomorphic test device (ATD) known as THOR.
- b. A second-generation pregnant dummy has been developed by Biosciences' researchers to provide more accurate assessment of fetal loss in motor-vehicle crashes based on researched mechanisms of adverse fetal outcomes due to placental abruption, and to assist safety engineers with the design and evaluation of improved restraint technologies for pregnant occupants.
- c. In the 1980s, Biosciences' researchers conducted biomechanical side impact testing and used the results to develop NHTSA's first side-impact dummy (SID) for use in FMVSS 214, *Side Impact Protection*.
- d. Biomechanical testing conducted at by Biosciences in the 1970s and 1980s led to the development of injury criteria for the knee, thigh, and hip that are still used in frontal crash dummies today.
- e. An improved method for positioning the small-female, midsize-male, and large-male ATDs at more representative and consistent (across vehicles) fore/aft seat locations was developed by Biosciences' researchers. This method is being used in crash testing performed at the Insurance Institute for Highway Safety and is being considered by NHTSA for use in their the New Car Assessment Program (NCAP).

**4. *Anthropometry of Motor Vehicle Occupants***

- a. Biosciences' extensive database of infant and child standard and functional anthropometry, developed for application to consumer product safety, is based on more than 90 anthropometric measurements taken on over 8,000 infants, children, and youths. This database remains the most comprehensive and widely used child anthropometry resource for the U.S. population and is widely referenced in the design of child safety seats.

- b. Data collected and analyzed by Biosciences' researchers provide the anthropometric basis for all adult crash dummies developed in North America since the mid-1980s, and are also widely used to design vehicle interiors, seats, and restraint systems to accommodate the needs of the adult population. These data define in-vehicle seated anthropometry of small-female, midsize-male, and large-male drivers, and have been incorporated into 3-D reference forms and computer models

**5. *Crash-Victim Simulation Modeling***

Biosciences' researchers developed the MVMA-2D crash-victim simulation model, which served as the world standard computer simulation tool in the 1960s and 1970s for studying the biomechanics of injury and restraint-system performance. The methods pioneered in the computer code were used in the development of the rigid-body crash-simulation models that are used today.

**6. *Human Modeling for Occupant Accommodation***

- a. Biosciences' researchers developed a new statistical model to predict driver-selected seat position (i.e., a new seating-accommodation model), based on driver stature, vehicle-seat height, wheel-to-pedal distance, seat-cushion angle, and transmission type, for use in designing vehicle interiors to accommodate the needs of the driver population. Versions of this model have been in use at Ford and General Motors for designing vehicle interiors and seating since the mid-1990s. This model is now incorporated in SAE Recommended Practice J4003, *H-Point Machine (HPM-II)—Procedure for H-Point Determination—Benchmarking Vehicle Seats*.
- b. Biosciences' statistical models are used to predict driver and passenger posture as a function of vehicle-interior package geometry and occupant anthropometry. These tools are incorporated in the Jack human-figure model software that is used in many companies around the world for laying out passenger-car, light-truck, and heavy-truck interiors.

**7. *Measurement of Vehicle Seats and Interior Package Geometry***

An improved H-point manikin with articulated spine was developed by Biosciences' researchers based on extensive measurements of occupant anthropometry and changes in posture and position with changes in vehicle-interior-package geometry. The new manikin and associated tests procedures are used to measure vehicle seats and interior-package space and are the basis for SAE J4002, *H-Point Machine (HPM-II)—Specifications and Procedure for H-point Determination*, and a new ISO standard.

**8. *New Driver-Eye-Position Model***

A new statistical model of driver eye locations has been developed by Biosciences' researchers for use in interior and exterior vision analysis of late-model vehicles. This model is the basis for an updated version of SAE Recommended Practice J941, *Driver Eyellipses*.

**9. *Improved Crash Protection for Disabled Travelers Seated in Wheelchairs***

Biosciences' researchers have led the development of voluntary national and international standards to evaluate the crashworthiness of wheelchairs used as seats in motor vehicles, including test methods and performance criteria. All major wheelchair manufacturers are now designing, testing, and marketing products in compliance with these new standards.

## Engineering Research Division

UMTRI's Engineering Research Division (ERD) has been at the forefront of international efforts to develop vehicle dynamics and driving theory since the late 1960s. Historically, ERD has been the primary source of such information for heavy commercial vehicles in the United States, and continues to position UMTRI as the national leader in that field. ERD also remains at the forefront of international research on driver support systems and, related to this, has conducted the most comprehensive ever scientifically based experiments on real-world driving.

1. ***Driver Modeling.***

- a. UMTRI pioneered the development of lateral driver-preview models; publications from the late 1970s and early 1980s are still extensively referenced in the literature
- b. Using extensive naturalistic databases, models of longitudinal control – for vehicle speed, range and range-rate – have been developed. These models have been used to develop design criteria for driver assistance systems such as Adaptive Cruise Control and Forward Collision Warning.

2. ***Education.***

- a. ERD has continuing educational impact via the University of Michigan College of Engineering and direct to industry, via its highly recognized courses in vehicle dynamics and heavy-truck mechanics.
- b. Two national centers of excellence were established by the division – the Great Lakes Center for Truck and Transit, and the Intelligent Transportation Systems Research Center of Excellence. As well as their research relevance, both delivered educational goals in terms of their substantial undergraduate and graduate student involvement.

3. ***Vehicle Dynamics.***

- a. The Engineering Research Division established the underlying principles of heavy truck rollover, principles which are the basis of truck design and rollover warning and prevention systems.
- b. ERD initiated one of the major international multibody simulation codes for vehicle dynamics, in the form of the Autosim-Carsim-Trucksim family. Now a commercial product of Mechanical Simulation Corporation, the code is a world leader for real-time applications such as driving simulators and hardware in the loop simulation.
- c. The Division’s researchers have provided leadership to the Society of Automotive Engineers in the area of vehicle dynamics for more than twenty years, and contributed to the development of international standards in the areas of tire testing and vehicle stability testing.
- d. The Division’s facilities for truck and tire parameter measurement have provided the majority of public domain data on the inertial and suspension properties of trucks and the performance of truck tires.

4. ***Driver Assistance Systems***

ERD has applied its modeling, analysis and design expertise to the design and development of Advanced Driver Assistance Systems. These include Intelligent Cruise Control, Rollover Stability Advisor, Automotive Collision Avoidance System and Road Departure Crash Warning (all developed in close cooperation with industry and DOT sponsors).

5. ***Field Operational Testing (FOT)***

Working closely with Human Factors, the Engineering Research Division has established a leading role in the field of Field Operational Testing of systems such as those mentioned in (4). A unique system for data acquisition and management has been developed over a number of FOT projects:

- a. Intelligent Cruise Control FOT [1997, 114,000 miles of driving]
- b. SAVME – observing traffic and building digital track-files [1998, 35,000 vehicles]
- c. Rollover Stability Advisor [2000-01, 479,000 miles]
- d. Automotive Collision Avoidance System [2003-04, 130,000 miles]
- e. Road Departure Crash Warning [2004-05, 135,000 miles]

6. ***Databases of Naturalistic Driving.***

In concert with the FOT experiments, large searchable databases of naturalistic (and assisted) driving have been created. Tools for analysis, mining and visualizing that data have been

created, giving UMTRI what is probably the most comprehensive driving databases anywhere in the world.

7. ***Vehicle-Road Interaction.***

- a. An international standard for road roughness was defined by UMTRI researchers, in the form of the International Roughness Index. Further standards continue to be developed, in areas such as smoothness requirements for weigh-in-motion sites.
- b. Research has provided a fundamental reference for the road community to measure profiles, in a way that accurately characterizes the effects on the vehicle-road interaction.

## Human Factors Division

The Human Factors Division studies the interactions of the driver, the vehicle, and the environment. The underlying rationale for research in this division is that well-designed vehicles and driving environments make the driving task safer, easier, more efficient, and more enjoyable. However, to achieve this end, we need to understand driver capabilities and limitations. Consequently, the Human Factors Division performs both basic and applied research. On the basic side, the research is designed to develop models of driver capabilities in vision, perception, decision making, and psychomotor performance incorporating the effects of factors such as age, sex, fatigue, and alcohol. On the applied side, knowledge concerning these capabilities is being used to develop guidelines for well-designed vehicle components and driving environments.

1. ***Effects of light on crash risk.*** The Division has performed a series of analyses of crash data to characterize the effects of ambient light on the risk of various types of crashes. The most significant contribution of this work has been the identification and quantification of a major problem with pedestrian visibility at night. This has led to efforts by the Society of Automotive Engineers and others to develop designs for low-beam headlamps that would better address the problem of pedestrian visibility at night.
2. ***Industry Affiliation Program for driver vision.*** The Division has established an international consortium of vehicle manufacturers and suppliers to support and guide research to advance the design of equipment that is important for driver vision. One of the main activities of the program has been research to support effective and consistent international standards for vehicle lighting.
3. ***Headlighting.*** Research in the Division has led to the establishment and or development of the following:
  - a. Core photometric requirements for low-beam headlamps in the U.S. (incorporated in FMVSS 108 and SAE J1735). These requirements have also been adopted in Japan and are being considered by the ECE for worldwide use.
  - b. A headlighting rating system for NHTSA for potential use in the U.S. New Car Assessment Program (NCAP).
  - c. A database to document the light output of U.S. and European high- and low-beam headlamps. The database has been used for a variety of purposes, including quantifying the levels of glare that drivers experience from headlamps at different mounting heights and the levels of light incident on retroreflective signs and other highway materials.
  - d. New light sources for vehicle lighting. Division researchers have quantified the visual effects of new, nonincandescent light sources for vehicle lamps, including high-intensity discharge (HID, or "xenon") sources for headlamps. UMTRI research from the 1980s and 1990s on HID headlamps provided the major scientific input to a current effort by NHTSA to understand the effects of these lamps on drivers' perceptions of glare in night driving.

Current UMTRI research on the visual effects of possible future lamps using light-emitting diodes (LEDs) is currently being considered by the companies developing these lamps.

4. **Signal lamps.**
  - e. Human Factors researchers developed the method for applying photometric standards to automotive signal lamps that use new light sources, such as LEDs (SAE J1889), and draft versions of SAE J585, J586, and J588.
  - f. Human Factors' research has enabled the quantification of the benefits of the center high-mounted stop lamps that were introduced on U.S. vehicles in the 1980s.
5. **Rear vision.**
  - g. Human Factors researchers have evaluated the possible benefits of alternative rearview mirrors for passenger cars, including convex and complex-surface mirrors. This work has contributed to a review of the federal requirements for passenger car mirrors that is currently underway.
  - h. The Division has also performed research on how drivers use video rear vision systems that is helping to guide the development of these systems.
6. **Retroreflective materials.** Division researchers have contributed to the development of European and U.S. standards for retroreflective safety-garment requirements (EN471 and ANSI/ISEA 107-2004).
7. **In-vehicle information systems.** These systems are advancing, in part, because of the Division's development of
  - i. A method to predict the times required to perform in-vehicle tasks (SAE J2365).
  - j. A standard for the usability and safety of navigation systems (SAE J2364).
8. **Adaptive cruise control.** The Human Factors Division led the development of an SAE standard on the minimum requirements for adaptive cruise control systems (SAE J2399).
9. **Safety of different modes of transportation.** Results of research that evaluates the relative risks of different modes of transportation can be used by travelers to assist them in their modal-choice selection.

## Automotive Analysis Division

Since its establishment in the late 1970s, UMTRI's Automotive Analysis Division (formerly OSAT) has been a leader in the forecast and analysis of developing trends and challenges facing the worldwide automotive industry. AAD's multidisciplinary work has covered a broad range of topics and issues, and is hallmarked by its leading-edge and independent analysis, providing the industry early warnings and information on developing challenges. These have included technical and material innovation forecasts, import competition, the rise of the transplants, manufacturing and organizational advantages of Japanese assemblers and suppliers, attainable and sustainable product quality, changing supplier roles and structural relationships, the surge in IT/e-business implementations, and the challenges facing the U.S. industry as it again globalizes its operations.

1. **Global Competitiveness.** The Structural Group has played a key role in "honest-brokering" relationships between the US and other automotive industries and relevant government units.
  - a. A series of four key reports covering the implications of comparative competitiveness for trade policies contributed to accelerating the establishment of Japanese automotive production in the United States;
  - b. A report to the Select Panel of the FTA on the comparative competitiveness of the industries helped shape relevant trade regimes with Canada and Mexico.

- c. The Structural Group was a major participant in a State Department project that set the basic issues and parameters for the development of a US-Sino relationship in the automotive sphere. AAD's work also became an important basis for the Chinese government's automotive development strategy.
2. **Technology Transfer.** The Manufacturing Group has played a major and key role in the transfer of Japanese manufacturing techniques and disciplines to U.S. industry, especially the auto industry, through its early development and dissemination of critical information.
  - a. This is especially true in the areas of functional build, dimensional validation strategies, and body development, disciplines and techniques that contributed to the Japanese lead in automotive quality in the 1980s and 1990s.
  - b. The Group's research was used to guide the US industry's efforts to introduce fundamental change in its approach to the design and use of stamping dies and weld tools.
3. **Supplier Relations.** The Structural Group played a key role in transferring knowledge to the US industry on how supplier relations work in the Japanese industry.
  - a. The Group identified how they play a key role in Japanese time, quality, and cost advantages;
  - b. The Group's research clarified the demands of Japanese OEMs on their suppliers, positioning US suppliers to compete more effectively for Japanese business;
  - c. This led to AAD's early identification of the changing structure of the U.S. industry, especially the role of System Integrator, which had elements of a self-fulfilling prophecy, as major auto suppliers and at least one manufacturer began to use AAD's work as key elements in their strategic planning and decisions.
4. **Education.** AAD's Manufacturing Group created the College of Engineering's first online course (with COE's Gary Herrin), and this course and its complement have been major training sources for Six Sigma, a competitively important quality discipline. It is difficult to estimate the exact importance of this, but the numbers of enrollees speak to its critical role.
  - a. Six Sigma green-belt has been offered to over 3,000 students;
  - b. The more advanced black-belt courses have been offered to more than 500 students. The black-belt course is offered for credit as part of the master's program, as well as for professional certification.
  - c. Both courses have drawn large enrolments from two key manufacturing industries, auto and electronics, as well as from service industries.
5. **Information Technology.** The Structural Group has issued a series of five reports that alerted the industry to the critical nontechnology challenges and requirements of successful information technology implementation, both internally and across the supply chain.
6. **Manufacturing.** The Manufacturing Group's work has been continuously funded by GM for a number of years, and has saved the supply chain millions of dollars.
7. **Knowledge Transfer.** AAD's reports are used quite widely throughout the global automotive industry, sometimes reaching five-digit circulation.

## Social and Behavioral Analysis Division

The Social and Behavioral Analysis Division (SBA) conducts research that enhances the safety and efficiency of transportation by advancing expert and public understanding of the social and behavioral issues important to transportation. Through its research projects involving drink/driving, older drivers, young drivers, occupant protection, policy and program evaluation, intelligent transportation systems, and crash-data analysis, SBA aims to prevent traffic injuries and fatalities. Using a variety of behavioral

science and public-health research methods, the division has contributed significantly to expanded knowledge in the field of traffic safety and the psychosocial issues involved in travel by motor vehicle.

1. **Occupant Protection Use.** SBA's research has helped to improve programs and policy in the United States.
  - a. Safety belt use rates in Michigan under secondary enforcement demonstrated the need for a primary enforcement law.
  - b. Evaluation of Michigan's 2000 primary enforcement law demonstrated its effectiveness in increasing belt use.
  - c. A state-mandated study of whether Michigan primary enforcement contributed to police harassment showed that it did not, allowing other states to use that information in their policy decisions.
  - d. Statewide survey results demonstrated lower safety belt use among Michigan commercial drivers than noncommercial drivers, leading to the Insurance Institute for Highway Safety's citing the study in their request to the National Institute of Occupational Safety and Health to require safety belt use on the job.
  - e. SBA's methodology for surveying safety belt, child safety seat, and booster seat use through direct observation that has been adopted by researchers across the United States, Australia, and Europe.
2. **Child-Safety-Seat Use.** SBA's survey of Michigan's statewide child safety seat use and misuse helped to draw nationwide attention to the high use/high misuse rates that have led to the more convenient LATCH system for installing child safety.
3. **Young Drivers.** SBA's large longitudinal study of young drivers has helped extend Problem Behavior Theory to include high-risk driving. Using this theoretical model, the study has:
  - a. Shown that psychosocial characteristics of drivers are predictive of driving behavior, including police-reported offenses and crashes, as well as self-reported risky driving;
  - b. Demonstrated the lasting association between psychosocial characteristics and driver behavior by establishing a predictive association between psychosocial characteristics of teenage drivers and their driving behavior as young adults.
  - c. Informed injury prevention, driver training, and public policy.
4. **Graduated Driver Licensing.** SBA's evaluation of Michigan's graduated licensing program for teen drivers has been in the forefront of policy adoption by other states.
  - a. Parents were supportive of and able to provide extensive supervised driving practice.
  - b. A large crash reduction among sixteen-year-olds was found in the first year following implementation.
  - c. The reduction in crashes has been maintained throughout the first four years of the program.
5. **Drunk Driving.** Michigan's drunk driving laws were twice evaluated by SBA and the results led to important policy changes:
  - a. In 1994, SBA determined that the existing laws were effective for first-time offenders, but not for recidivists. The laws were subsequently changed.
  - b. In 2002, SBA determined that the new laws directed at recidivists were working, but could be even more effective if all the sanctions were fully utilized.
6. **Older Drivers.** SBA's research on older drivers has been instrumental in improving senior safety and mobility in the United States and abroad.
  - a. A statewide Michigan survey found that the majority of older drivers had little experience with public transportation, is not aware of alternative transportation, and prefers options as

- similar to the private automobile as possible. These findings have implications for policy and the design of alternative transportation systems for the aging population.
- b. SBA developed, validated, and evaluated a self-assessment instrument for older drivers called the *Driving Decisions Workbook*. This instrument resides on several gerontological web sites in the United States and has been translated into Japanese and revised for an Australian audience.
  - c. An older-driver resource guide developed by SBA is considered one of most comprehensive guides in the world. This guide served as the background for the first *North American Conference on Elderly Mobility: Best Practices from Around the World*.
7. **Motorcycle Crashes.** SBA's analysis of Michigan motorcycle crash trends showed an aging motorcyclist population and revealed that 45 percent of crash-involved motorcyclists were not legally licensed to drive a motorcycle. These findings led the state to examine its policies on motorcycle licensing and enforcement.

## Transportation Safety Analysis Division

The Transportation Safety Analysis Division (TSA) has established itself as an authoritative resource on vehicle safety and crash data. TSA's Transportation Data Center (TDC) has carved out a web-based data supplier niche of federal crash databases (mostly passenger car data). The expertise within the group in the use and analysis of these data sets is unmatched and has become a critical resource for the auto manufacturing industry.

TSA's heavy-truck safety and crash data is by far the most comprehensive and accurate data available. The data is used for a variety of needs from assessing the probable impact on new technology to supporting the regulatory process by providing targeted analysis for regulators. TSA's data and targeted analyses were used to develop truck size-and-weight policy, cab crashworthiness standards, evaluation of rear underride standards, and hours of service. Because of TSA's reputation, they are involved in most major research efforts involving large-truck safety. TSA researchers regularly serve on committees that review crash-data collection efforts, crash-causation analysis, and safety strategy and planning sessions.

1. **Collision Avoidance.** TSA's project to develop collision-avoidance strategies based on accident data has produced collision typologies that are used to better identify situations where collision avoidance technology can be beneficial. Results have been used to identify specific situations in which advanced technology could be useful, as well as identify the potential savings in terms of reduced deaths and injuries possible in specific crash types.
2. **Crashworthiness.**
  - a. A cab safety study evaluated the crashworthiness of truck cabs in which truck drivers were fatally injured. The project was part of a review of standards for testing the integrity of cab structures and supported an SAE standard for testing cab strength.
  - b. TSA researchers determined how certain characteristics of cars, sport utility vehicles, vans, and pickup trucks influence the fatality risk for occupants of cars with which they collide—the aggressivity of the striking vehicle. The research resulted in an influential paper on the safety and compatibility of light truck vehicles.
3. **Data Analysis.** TDC has assisted in numerous projects of other divisions and non-UMTRI researchers by providing consulting support and data analysis. The TDC system is used by Alliance of Automobile Manufacturers member companies, nonmember automobile

manufacturers, the National Safety Council, state governments and private engineering firms. Measuring the direct influence of this service in terms of major contributions is difficult because the information is used to support the process. The long-term continued funding and independent references from Alliance members and other users is likely the most relevant and reliable measure of worth.

#### 4. **Data Collection.**

- a. TSA has developed an in-depth crash investigation program for the Michigan State Police. Data was collected by Fatal Accident Complaint Team officers over five years. Results were used by MSP to target enforcement. The program and data collection protocol was a major influence on the Federal Motor Carrier Safety Administration's Large Truck Crash Causation Study.
- b. TDC develops and publishes *Michigan Traffic Crash Facts* for the Michigan State Police Office of Highway Safety. This publication is the basis for safety planning in Michigan. TDC has helped move this from a small booklet to a web-published, 600-page research document used by researchers and the public as the definitive source of crash information in Michigan for safety planning purposes at the state and local level.
- c. TSA's Trucks Involved in Fatal Accidents (TIFA) data collection is ongoing. TIFA provides the most accurate and comprehensive accounting of trucks involved in fatal accidents. It is used by FMCSA as a benchmark for other programs and to evaluate heavy truck safety.

5. **Truck Drivers.** TSA has provided analytical support for the evaluation of hours-of-service regulations. The project assessed the safety and economic impact of the proposed hours-of-service options. The safety analysis developed baseline estimates of the risk of fatigue crashes by the driver/operation subsets under consideration. Baseline numbers of vehicles, vehicle miles, and fatigue crashes were refined to characterize the populations affected by hours-of-service regulations. This produced a paper supporting the Federal Motor Carrier Safety Administration's recent change to hours-of-service regulations.

## Research Information and Publications Center

The Research Information and Publications Center (RIPC) is the primary conduit for the flow of knowledge out of and into UMTRI. The RIPC disseminates UMTRI's research results to the world via the *UMTRI Research Review*, the UMTRI website, and UMTRI's digital collection of research reports. Library staff members funnel vital information into UMTRI by thoroughly and continually scanning the relevant literature to build and maintain the world's most thorough collection of literature in the field of highway safety and related disciplines.

Researchers and decision makers in government and industry alike are guaranteed ready access to the information that best represents UMTRI.

1. **Information Retrieval.** Librarians provide value-added service to researchers based on the notion that any information anywhere is within reach. They are proactive, pushing information, before it is requested.
2. **Knowledge Access.**
  - a. The RIPC has improved the world's access to knowledge that has grown out of UMTRI research and that of other, similar institutes, by making the library catalog accessible on the worldwide web.

- b. Librarians are working to bring UMTRI researchers greater access to the vast electronic resources of the University of Michigan Library system.
- c. RIPC staff members have built and continually improve the UMTRI intranet.
- 3. **Leadership.** UMTRI librarians are influencing information policies at state and federal levels through leadership positions with the Transportation Division of the Special Libraries Association, the Midwest Transportation Knowledge Network, and the American Society of Information Science and Technology.
- 4. **Publishing.**
  - a. RIPC staff members provide editorial assistance to help ensure the highest quality in all UMTRI publications.
  - b. RIPC staff members keep all UMTRI staff member aware of each other's research and activities via the monthly staff newsletter.
  - c. UMTRI's quarterly journal, the *UMTRI Research Review*, published by the RIPC brings UMTRI news to a worldwide subscriber base.
  - d. Librarians provide instant access to nearly all UMTRI reports via the worldwide web, through collaborative projects with the University of Michigan Library system and its Digital Library Production Service.
  - e. RIPC staff members maintain and update the content of the UMTRI website.