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A SMART Vision for Urban Transportation

Multi-amenity hub

UMTRI
RESEARCH REVIEW

UMTRI's Strategic Intent
To be the leader in transportation systems research integrating vehicles, people, and infrastructure to achieve a highway transportation system where:

- Fatalities and injuries are eliminated
- People and goods flow efficiently
- Reliance on nonrenewable energy is reduced

A SMART Vision for Urban Transportation

Traffic congestion in and around the world's largest cities governs daily routines for many urban residents, some of whom spend hours on the road traveling to and from jobs.

To complicate matters, demographics experts predict that by the year 2025, two-thirds of the world's population will live in cities. This rapid urbanization is already occurring. In 2007, for the first time in history, 3.3 billion people, the majority of the world's population, lived in cities.

A growing urban population intensifies already complex challenges related to maintaining a healthy environment, economic stability, and social equity. If these issues have common threads, says Susan Zielinski, director of U-M's SMART initiative, one of them is transportation—a critical element of a healthy urban landscape.

"How we move—and don't move—people into and around urban regions affects everything from climate change to quality of life to the shape of our economy," says Zielinski. "We've reached a turning point in transportation, which has brought urban transportation policy, innovation, and economy to the forefront of public and legislative debate."

SMART (Sustainable Mobility and Accessibility Research and Transformation) has helped shape that debate. SMART takes a unique systems approach to advancing sustainable, socially equitable transportation. Since it began, SMART has become

A mobility hub can be as simple as a bus stop at an outlying parking lot, or it can be a multiamenity station connecting many modes, services, and retail.

a recognized leader in identifying and accelerating new business and employment opportunities related to the emerging new-mobility industry, an industry that combines sectors and innovative approaches to supply sustainable transportation in cities.

Making Connections

SMART took shape at the University of Michigan around the year 2000, evolving from collaborative, multidisciplinary discussions among faculty and leadership at U-M's Center for the Study of Complex Systems, The Erb Institute, Taubman College of Architecture and Urban Planning (TCAUP), and the School of Natural Resources and Environment (SNRE), as well as UMTRI and Ford Motor Company. SMART's interdisciplinary program is jointly affiliated with UMTRI and TCAUP.

SMART pilot projects and related research are now underway or in development with dedicated local partners in Cape Town, South Africa; Chennai, Bangalore, and Cochin in India; and selected U.S. cities including Los Angeles, Washington D.C., Ann Arbor, Seattle, Portland, and the Detroit region.

While locations are widespread, says Zielinski, each pilot project begins in a similar way—by taking stock of existing transportation infrastructure, and mapping connectivity points.

In the Washington, D.C. pilot, for instance, Zielinski first met with a group of business and city leaders, entrepreneurs, and nongovernmental organizations to map locations where two or more transportation modes or services connected, such as a bus line, train station, or a zip car station. In many cases, she recalls, the infra-

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structure was already there, but "they needed signage, a way to let people know about the integrated multimodal system that is already available."

Where infrastructure is absent, Zielinski works with local partners to bring varied, multimodal transportation services together. The result is a robust, multifaceted grid called a new-mobility-hub network.

New-Mobility-Hub Networks

New mobility hub networks connect a grid of places by physically and technologically bringing together a range of transport services and modes including buses, trains, parking, streetcars, clean-fuel taxis, and car-share or bike-share vehicles— even ferries and auto rickshaws. They can also include amenities like satellite offices, day care, and retail.

New-mobility-hub networks allow commuters to transfer seamlessly from one mode of transportation to another. Throughout their travel, users can also access transport options and real-time arrival and departure schedules via public kiosks, signage, cell phones, or PDA devices.

"This approach favors the best mode of transportation for the purpose," explains Zielinski. "For example, users might access a car-share vehicle at one hub and drop it off at another to pick up a waiting bus, train, or bike. It provides a seamless, sustainable, door-to-door trip that, as we urbanize and get more congested, begins to become a much more appealing, convenient, and even hipper option."

Access is Key

A connected, systems-based approach to transportation goes beyond simply moving people from point a to point b. Transportation policy that focuses on mobility alone can have the effect of spreading development over wide areas, according to SMART member Jonathan Levine, professor and chair of TCAUP.

Levine is developing accessibility measures to be compared across thirty of the largest metropolitan regions in the United States. He promotes the idea that needs can be met in several ways. While one way is through mobility, another way is via proximity, or bringing destinations closer to one another. A third strategy employs technology that enables remote connectivity, which allows people to telecommute or obtain services such as shopping, banking, or locating restaurants and entertainment. An accessible system, explains Levine, incorporates all three approaches—mobility, proximity, and connectivity.

"The purpose of transportation is not movement but access," says Levine. "It makes most sense for transportation planning to focus on the best way to provide access to needs, not on getting people farther faster."

JOYCE DANIELS/UMTRI

The Bottom Line

Not surprisingly, meeting the growing need for urban mobility and accessibility can be profitable. The new mobility industry has already fostered a host of impressive business, employment, and entrepreneurial ventures—from new vehicles and new energy sources, to technology appli-

cations, and operations that support fractional-use services including both cars and bicycles.

Some of the world's biggest companies are playing a role in the new mobility industry. Among them are Ford Motor Company, which now includes "mobility" in its company descriptions, Cisco systems, which focuses a major aspect of its IT infrastructure business on connected urban development, and IBM, which enhances efficiency through strategic use of data and technology.

Small or large, many private enterprises in the new-mobility industry share some common principles. In addition to the need to be economically viable, there's a growing awareness of social equity issues and ecological health, particularly as urban populations grow.

Together, the three principles—environment, equity, and economy—not only form the foundation of many successful businesses, says Zielinski, they also form the building blocks of sustainable transportation. RR

Keeping Teen Drivers Safe

When teenagers get behind the wheel of a car, there are several things they can do to improve their own safety. One of the most important, according to UMTRI research professor Ray Bingham, is to limit passengers—specifically teenage passengers.

"All the evidence we have is that teenage passengers increase crash risk—not just incrementally but geometrically with every additional passenger in the vehicle," said Bingham. The reasons are unclear, he added, but parents of teenage drivers need to be aware of this and other risk factors.

To help get the message out, Bingham coordinated a teen driver symposium at the University of Michigan in late August. The symposium, sponsored by the Michigan Center for Advancing Safe Transportation throughout the Lifespan (M-CASTL), brought together a distinguished group of teen-driver safety experts from several universities in the United States as well as The Netherlands, Israel, and Australia, to evaluate current knowledge of teen driver safety.

COURTESY OF M-CASTL

Ann M. Dellinger of the Centers for Disease Control and Prevention gave the opening address. She noted that unintentional injury resulting from motor-vehicle crashes is the leading cause of death among teens, ages 15 to 19. In addition to driving with teenage passengers, other risk factors include nighttime driving, risky driving style (which frequently involves alcohol), and not wearing seat belts. However, said Dellinger, the most important factor is the combination of inexperience and immaturity.

"Because they are inexperienced drivers, teens are slower to recognize situations that may lead to a crash," said Dellinger, who added that when they do react, teen drivers have a tendency to overreact.

One way that states are working to improve the safety of young drivers is through graduated driver licensing. UMTRI associate director Jean Shope described graduated driver licensing (GDL) as having three stages. The three stages are learner (driving with supervision), intermediate (driving alone with restrictions), and full (no restrictions).

According to Shope, GDL has been shown to reduce teen crashes 20 to 40 percent. However, she noted, the quality of GDL programs varies by state. In 2009, using a standardized GDL rating system, 34 states were categorized as "good," while nine were rated "fair" (including Michigan), and seven were rated "marginal." To maximize teen driver safety, Shope said, a comprehensive, coordinated GDL approach is needed.

Following the symposium, presenters gathered to discuss ways of directing key safety messages to target audiences, including practitioners, law enforcement, driver educators, secretaries of state, and anyone involved in traffic safety.

"These are the professionals who can help influence the parents of teen drivers," said Bingham, adding that many parents don't fully appreciate the risk. "The issue of teen driver safety hasn't been very visible. We're hoping to change that."

To see presentations from the symposium, visit the M-CASTL website: *http://m-castl.org/node/57* RR

UMTRI BRIEFS

The Business of IT: Transforming the Organization and the Vehicle

As part of its second annual Focus on the Future conference series, UMTRI's Automotive Analysis Division hosted "The Business of IT: Transforming the Organization and the Vehicle" on September 22 at the University of Michigan.

Assistant research scientist Bruce Belzowski moderated the daylong conference, which offered the opportunity to assess the current state of information technology within the automotive industry, predict where it's heading in the near future, and identify challenges and opportunities.

The conference's first theme, "Transforming and Globalizing the Organization," featured speakers Servio Araujo of Ford Motor Co., Paul Skornia of Lear Corp., Ram Prabhakar of EDS/HP Corp., Gahl Berkooz of Ford Motor Co., Suneel Sekhri of HCL Technologies, and Ed Allen of Oracle Corp.

The second theme, "Transforming the Vehicle," included speakers Susan Zielinski of UMTRI's Sustainable Mobility and Accessibility Research and Transformation project, UMTRI assistant research scientist Dave LeBlanc, and David Berdish of Ford Motor Co.

The conference's corporate sponsors were Hewlett-Packard Corp. and HCL Technologies.

The next event in the series, "Understanding the New Role of Government in the U.S. Automotive Industry," is scheduled for Wednesday, February 17, 2010. For more information, see: *http://www.umtri.umich.edu/divisionPage.php?pageID=47* RR

Preventing Injuries Among Youth

A keynote address on motor-vehicle-injury prevention helped mark the official launch of the U-M Center for Injury Prevention Among Youth (CIPY) on September 16. CIPY is a joint effort of the U-M School of Public Health and UMTRI, sponsored by UMTRI and the U-M Office of the Vice President for Research.

The goal of CIPY is to build on existing strengths at U-M to conduct research and to train researchers and practitioners to reduce injuries and fatalities among youth. A concurrent goal is to reduce the economic cost associated with those injuries. UMTRI associate director Jean Shope serves as director of CIPY.

"We have U-M faculty across several academic units who are engaged in research related to youth injury prevention," said Shope. "CIPY encourages interdisciplinary collaboration among these researchers and helps build capacity for training and education."

Research projects by CIPY faculty members address a number of topics related to understanding and preventing substance abuse among youth and promoting teen driver safety.

CIPY addresses a variety of injury-prevention topics in its monthly seminar series during the 2009-2010 academic year.

For upcoming events, see *http://cipy.umtri.umich.edu* RR

ARUSH BALUJA

David Sleet (right) of the Centers for Disease Control and Prevention, shown here with UMTRI associate director Jean Shope, gave the keynote address at the CIPY launch.

Human Factors Engineering Short Course Celebrates 50 Years

The Michigan Human Factors Engineering Short Course celebrated its 50th year in 2009. The course began in 1961 at the University of Michigan after getting its start at Ohio State University in 1959. Since it began, more than 3,000 students have taken the popular course, which is held annually at the University of Michigan.

The course is geared toward professionals who design systems, products, and services to make them easier, safer, and more effective for human use. The flagship course has trained more practicing human factors professionals than any other course in the world, according to UMTRI research professor Paul A. Green, who serves as course program coleader with Christopher Wickens of Alion Science and Technology, formerly of the University of Illinois.

What makes the program noteworthy is the wide variety of application environments that people bring to the course—from aircraft cockpits, to nuclear power plants, medical environments, motor vehicles, and military settings, to name just a few.

The course typically attracts engineers, psychologists, medical professionals, managers, and others interested in human factors, ergonomics, usability, and human-computer interaction.

"The hallmark of the class is that it represents the breadth of the human factors profession," says Green. "There's a tremendous cross-section of people who attend. That's what makes it interesting."

This year's course, held in early August, featured thirty lectures, sixteen seminars, six workshops, and numerous field trips and social activities, complemented by small-group and hands-on design experience. Primary topics included cognitive-task analysis, advanced displays, motor skills and manual controls, perception, memory and cognition, and human-computer interaction.

The Human Factors Engineering Short Course is offered through the Center for Professional Development, U-M College of Engineering.

For more information, see *http://cpd.engin. umich.edu/proed.htm?id=57* RR

UMTRI/HUMAN FACTORS DIVISION

Students work on presentations during the Human Factors Engineering Short Course.

UMTRI BRIEFS

Technology and Distracted Driving

Text messaging while driving and manually dialing a cell phone are among the riskiest forms of driver distraction. These behaviors have been related to increased crash risk, according to UMTRI research scientist David W. Eby, but they're not the only culprits.

When it comes to technology, using an iPod, manipulating a DVD player, or programming a navigational device while driving can also cause problems. "Any technology that engages a driver's attention can be distracting," said Eby, who spoke at a recent distracted driving summit, sponsored by the U.S. Department of Transportation.

The summit brought together experts from around the nation to discuss ways to combat distracted driving and its consequences. During a panel session focusing on technology, Eby noted that distracted driving is becoming an increasingly important societal issue because of four primary factors.

ALEX WONG/GETTY IMAGES

First, the use of technology in vehicles is increasing. According to Eby, cell phone use by drivers has doubled between the years of 2000 and 2005. He noted that while research on the distracting effects of some technologies is still unclear, there is good evidence that use of cell phones of any type increase crash risk by a factor of four to nine.

Second, roadways are becoming more congested, making the task of driving more difficult.

The third factor, Eby said, is that young drivers, who often have fewer years of driving experience, are the biggest users of "nomadic devices" or technologies that are brought into a vehicle, such as cell phones and iPods.

Finally, the U.S. population is aging, with age-related medical conditions potentially exacerbating the distracting effects of technology.

But while some technologies can cause distraction, other technologies can mitigate distraction.

Eby highlighted several technological advancements currently in development. These include vehicle systems that can help manage distractions by monitoring "driver workload" and blocking incoming cellular calls at critical moments.

Eby cited development of crash-warning systems that can help mitigate the outcomes of distraction. He noted current efforts to integrate these systems via the ongoing Integrated Vehicle Based Safety System (IVBSS) project led by UMTRI and partners, sponsored by the US DOT.

To read Eby's presentation, visit the M-CASTL website at *http://m-castl.org/.*

To see video of the summit presentations, visit *http://www.rita.dot.gov/distracted_driving_summit/* RR

Reed Elected as Fellow of SAE International

Matthew Reed, research associate professor in UMTRI's Biosciences Division, has been elected as a Fellow of the Society of Automotive Engineers (SAE) International. The distinction recognizes Reed for his outstanding accomplishments and his contributions to industry practices in automotive ergonomics and safety.

Reed holds a joint appointment in U-M's Industrial and Operations Engineering Department, where he serves as the director of the Human Motion Simulation Laboratory in the Center for Ergonomics.

His research interests focus on occupant protection and physical ergonomics for road vehicles. Reed has conducted research on restraint systems, emphasizing investigation of airbag-induced injuries, crash-dummy positioning procedures, and child-passenger safety. He has developed tools for the ergonomic design of vehicle interiors, including posture-prediction and motion-simulation algorithms for use with digital human-figure models.

Reed is a member of the SAE Human Accommodation and Design Devices Committee, the SAE Driver Vision Standards Committee, and the SAE G13: Digital Human Modeling Committee.

SAE Fellowship status is the highest grade of membership bestowed by SAE International. Reed will be honored along with twenty-three newly elected SAE Fellows during the SAE 2010 World Congress to be held in Detroit in April. **RR**

Chang Wins First Place in Stapp Student Paper Competition

Chia-Yuan "Mark" Chang, a doctoral student in UMTRI's Biosciences Division, received first place in the student paper competition at the 53rd Stapp Car Crash Conference, held in Savannah, Georgia, November 2-4, 2009.

Mark's paper, titled "Predicting the Effects of Muscle Activation on Knee, Thigh, and Hip Injuries in Frontal Crashes Using a Finite-Element Model with Muscle Forces from Subject Testing and Musculoskeletal Modeling," is based on Mark's doctoral dissertation research, which he completed earlier this year.

Mark began working on his dissertation research at UMTRI in September 2005 and received his PhD in Mechanical Engineering from the University of Michigan in May 2009. His research was supported by the UMTRI/OVPR Doctoral Studies Program and by the National Highway Traffic Safety Administration (NHTSA) Cooperative Agreement for Biomechanical Research Support.

Coauthors of the winning paper are UMTRI's Jonathan Rupp, Matthew Reed, and Lawrence Schneider, and Associate Professor Richard Hughes of the U-M Department of Biomedical Engineering and the Department of Orthopedic Surgery.

The Stapp Car Crash Conference is the premier forum for presentation of research in impact biomechanics, human injury tolerance, and related fields that advance knowledge of vehicle crash injury protection. **RR**

Stephen Rouhana of Ford Motor Company presents the award to Mark Chang on behalf of the Ford Motor Company Fund's Driving Skills for Life Program, which sponsored this year's Stapp student awards.

UMTRI NAMES & FACES

Recent UMTRI Publications

*Most UMTRI reports are available in full text online. See the website address at the end of the citation. Please contact the UMTRI Library at 734-764-2171 or **umtridocs@umich.edu** to inquire about the availability of other publications listed here.*

Books and Book Chapters

Belzowski,B. 2009. "Can Chrysler Survive Its Re-invention?" In *The Automobile Industry in the 21st Century: New Perspectives for a Changing Market.* New York: Palgrave.

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Senter, R. Jr.; McManus, W.S. 2009. "General Motors in an Age of Rapid Change." In *The Automobile Industry in the 21st Century: New Perspectives for a Changing Market.* New York: Palgrave.

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Sivak, M. 2009. "Energy-Demand Consequences of the Recent Geographical Shift in the Metropolitan Population of the US." *Cities,* vol. 26, pp. 359-362, DOI:10.1016/j.cities.2009.08.001.

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http://hdl.handle.net/2027.42/64025

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Transportation Engineering & Safety Conference
December 9-11, State College, Pennsylvania
www.outreach.psu.edu/programs/Transportation

Transportation Policy and Finance Summit
December 13-15, Washington, D.C.
www.ibtta.org/Events/eventdetail.cfm?ItemNumber=3855

International Conference on Travel Behavior Research
December 13-18, Jaipur, Rajasthan, India
http://iatbr2009.asu.edu

TRB 89th Annual Meeting
January 10-14, Washington, D.C.
www.trb.org/AnnualMeeting2010/Public/AnnualMeeting2010.aspx

North American International Auto Show
January 11-24, Detroit, Michigan
www.naias.com

NAPA Annual Meeting
January 17-20, Maui, Hawaii
www.hotmix.org

MITA Annual Conference
January 20-22, Mt. Pleasant, Michigan
www.mi-ita.com

Crash Data Retrieval User's Summit
January 25-27, Houston, Texas
www.crashconferences.com

National Biodiesel Conference and Expo
February 7-10, Grapevine, Texas
www.biodieselconference.org

American Trucking Associations Meeting
February 9-12, Tampa, Florida
www.truckline.com

Hybrid Vehicle Technologies Symposium
February 10-11, San Diego, California
www.sae.org/events/training/symposia/hybrid

Understanding the New Role of Government in the U.S. Automotive Industry
February 17, Ann Arbor, Michigan
www.umtri.umich.edu/divisionPage.php?pageID=47

ATSSA Convention and Traffic Expo
February 14-18, San Antonio, Texas
www.atssa.com/cs/american-traffic-safety-services-association-events

2010 National Conference of Regions
February 21-23, Washington, D.C.
www.narc.org

Washington Legislative Briefing (AASHTO)
February 28-March 4, Arlington, Virginia
www.transportation.org

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