

CONNECTED VEHICLE

Designing a better transportation system through Connected Vehicles

Update

Prosperity Amid Uncertainty Automotive and Transportation Industries Benefit from Partnerships and Connected Vehicle Research

By Kirk T. Steudle, P.E., Director,
Michigan Department of Transportation

The transportation and automotive industries have enjoyed a successful and long-standing partnership. In good times, we both have much to gain. In tough times, we have much to lose. These are uncertain times.

Michigan once put the world on wheels, but today is faced with aging infrastructure it cannot afford to expand or improve. Fuel-tax revenues reliant on gas-hungry vehicles and vehicle-registration fees have decreased with declining travel and more fuel-efficient vehicles. The downturn in the state and national economies has hurt the revenue stream that state, county, and local road agencies depend on at a time when the costs of energy and materials are continually on the rise, making it difficult to plan for, and pay for, keeping roads in good condition.

The auto industry, prompted by falling revenues, has managed to survive amid uncertainty through restructuring, focusing investment on its most profitable lines, eliminating redundancy by closing dealerships, and reducing legacy costs with union negotiations. After making several tough decisions, this industry, so important to Michigan, has begun to see profits.

The transportation industry faces a similar need to restructure. The Michigan Department of Transportation has changed the way it does business. We are working better, faster, cheaper, safer, and smarter to focus investment, eliminate redundancy, and reduce staff costs. Our partners at the county and local levels are also reinventing and reorganizing. Everyone is doing more with less.

Michigan's economy relies on a safe and efficient transportation network for just-in-time delivery of critical manufacturing components and to get goods to market as cost-effectively as possible. Congestion is expensive in terms of wasted time and fuel costs; access to markets and avoiding traffic delays are critical to a company's bottom line.

Elsewhere in this newsletter you will read about a \$14.9 million research contract awarded by the U.S. Department of Transportation to the University of Michigan Transportation Research Institute. Data from this one-year pilot in Ann Arbor in 2012, which will involve roughly 2,850 vehicles, will support the USDOT's activities and decisions regarding equipping cars and trucks with connected-vehicle technology.

MDOT and UMTRI are working to deliver the promise of



Courtesy of the Michigan Department of Transportation

connected-vehicle technology. These technologies will improve safety, reduce congestion, lower transportation costs, and increase efficiencies for businesses, road agencies, and motorists. Embedding wireless technology in vehicles and roadways will help monitor traffic conditions for real-time traffic control and traveler information systems. We foresee new ways to pay for road use by efficiently pricing roads and parking and to dramatically lower costs associated with crashes by helping drivers avoid them.

An exciting future awaits us if we are willing to embrace change and if government can keep up with private industry. We must adapt, preserve useful assets while making the right new investments, fight rising costs with innovation, and take full advantage of technology. The long-standing partnership of the transportation and automotive industries will drive our future, a future that is bright indeed if we are up to the challenge.

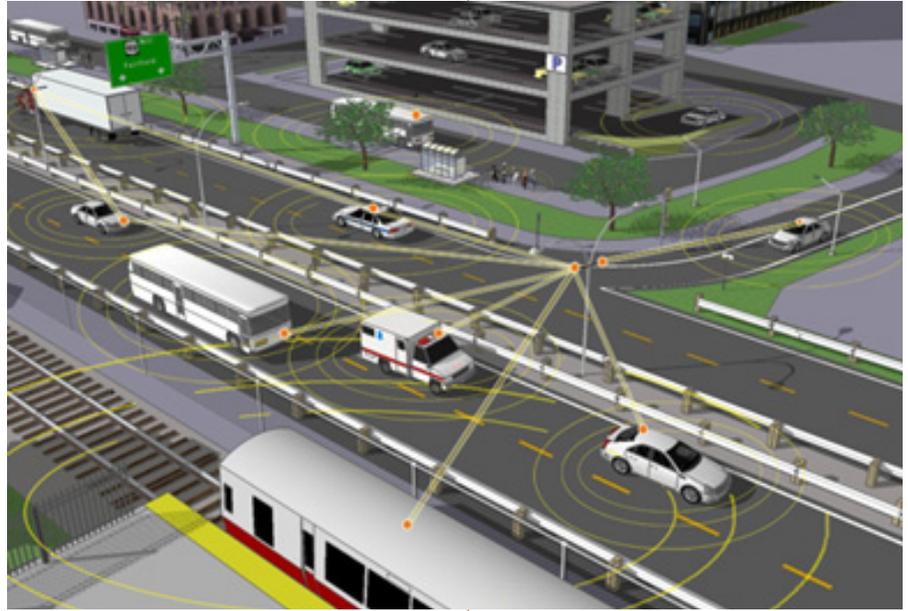
Connected-Vehicle Technology to be Tested in Safety Pilot Model Deployment

Connected-vehicle technology will be put to the test next year in an extensive road-safety field trial on the streets and highways of Ann Arbor, Michigan. The University of Michigan Transportation Research Institute (UMTRI) will conduct the Safety Pilot Model Deployment, with \$14.9 million in support from the U.S. Department of Transportation (USDOT) and an additional \$3.7 million in cost-share commitments, to evaluate the effectiveness of connected-vehicle technology in preventing crashes.

The Model Deployment will include the installation of wireless devices in up to 2,850 vehicles, enabling communication with other instrumented vehicles and roadside equipment. It will take place from August 2012 to August 2013. Drivers using cars, trucks, and transit vehicles will be recruited from Ann Arbor and the surrounding communities, according to UMTRI associate research scientist Jim Sayer, who will manage the program.

“The model deployment is being designed such that the number of interactions between equipped vehicles is maximized, thereby providing an ideal opportunity to test the robustness of vehicle-to-vehicle and vehicle-to-infrastructure connectivity as well as drivers’ responses to these systems in a real-world environment,” said Sayer.

During the model deployment, drivers of a subset of the instrumented vehicles will be alerted to impending dangers in real-time so they can take action to avoid crashes. Data will be collected from vehicles and roadside equipment in order to understand how motorists respond to safety messages in the



Courtesy of the U.S. Department of Transportation

real world and how effectively the roadside equipment operates.

Data generated and archived as part of the model deployment will be used by the USDOT in future decisions regarding the larger-scale deployment of such systems. The data, as well as the test site itself, will be used by the broader transportation industry in developing additional safety, mobility, and environmental applications utilizing wireless technologies.

“Safety is our number one priority, and this research could save lives and prevent injuries across America,” said U.S. Transportation Secretary Ray LaHood. “With more than 30,000 people a year killed on our nation’s roads, we need to keep looking for new ways to improve safety and reduce fatalities.”

“This test will be an important step towards the U.S. Department of Transportation’s top priority—a safer transportation system,” said Peter Appel, administrator of the

Research and Innovative Technology Administration. “Technology is an investment in the future and this pilot deployment of vehicles that ‘see’ and ‘talk’ with one another with the help of wireless communication will allow us to learn how drivers use electronic alerts to avoid crashes in a real-world environment.”

Partners supporting UMTRI on the program include the Michigan Department of Transportation, the City of Ann Arbor, Parsons Brinkerhoff, Mixon Hill, HNTB, SAIC, Texas Transportation Institute, AAA of Michigan, and ESCRYPT. Additional support is being provided by the Office of the Vice President of Research at the University of Michigan and the Michigan Economic Development Corporation.

“We feel honored to be hosting the national test environment for vehicles that don’t crash,” said UMTRI director Peter Sweatman. “We look forward to helping many private and public-sector organizations

advance connected-vehicle technologies, to save lives and promote efficient movement of cars, trucks, and transit buses.”

Connected-vehicle technology is envisioned as a platform to save many lives on America’s roads and to foster innovations, said National Highway Traffic Safety Administration (NHTSA) Administrator David Strickland. “When completed, the pilot will demonstrate first-hand how connected vehicles communicate in the real world, bringing us a step closer to what could be the next major safety breakthrough,” he said.

The Model Deployment is the second part of a two-part Connected Vehicle research initiative. The first part is the Safety Pilot Driver Acceptance Clinics, which began on August 8, 2011. The driver clinics are the first step in identifying how motorists respond to innovative wireless devices for safety. Participants in the six driver acceptance clinics will test cars equipped with connected-vehicle devices in a controlled environment where researchers can observe the drivers’ responses to the technology. The connected-vehicle technology uses dedicated spectrum at 5.9GHz known as Dedicated Short-Range Communication (DSRC).

The Connected Vehicle Safety Pilot research program was created to collect data in order to assist NHTSA in making decisions about the use of connected-vehicle technology based on reliable, scientific information.

For more information, visit http://www.its.dot.gov/connected_vehicle/connected_vehicle.htm

Connectivity Highlighted at CAR Management Briefing Seminars

National automotive-industry and policy leaders explored the state of connected-vehicle technology in August at the Center for Automotive Research (CAR) Management Briefing Seminars (MBS), held annually in Traverse City, Michigan

CAR’s Richard Wallace chaired and moderated a session entitled “Connected Vehicles: Are They Already Here?” on the first day of MBS 2011. Session speakers were drawn from the automotive industry, the information technology industry, telematics providers, and the public sector.

Many of the speakers presented connected-vehicle options available today. Among these are advanced telematics options available from both OnStar (including a new after-market version that allows many non-GM vehicles to be equipped), presented by GM OnStar president Linda Marshall, and ATX, presented by ATX Group development director Scott Nelson. Also presented were new approaches for reducing

driver distraction through different vehicle interfaces, including so-called terminal mode, which allows handheld devices to link with the vehicle to enable operation of the device through the vehicle itself. This allows for larger displays and takes advantage of built-in voice-activated features.

Bluetooth Special Interest Group executive director Michael Foley continued the theme by extolling the virtues of wireless connectivity within the vehicle for a wide range of uses, including hands-free calling. Dave Miller, chief security officer for Covisint (which is part of Compuware) rounded out the safety and security focus by assuring the audience of about 200 people that concerns for data privacy and security should not be an obstacle to widespread adoption of connected vehicle technology. He said that the primary technical challenges related to security have been solved

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Photo courtesy of Joe Willessen

Rick Warner, president and CEO of ParkingCarma, explains the basic concepts and benefits of smart parking at MBS 2011.

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and implemented in other domains, notably electronic medical records.

While safety, including hands-free operation of mobile devices, and security received significant attention from the speakers at MBS, mobility and environmental applications of connected-vehicle technology were also emphasized. Rick Warner, chief executive officer of ParkingCarma, explained how smart parking helps reduce vehicle miles traveled and reduce emissions. He cited research conducted by UCLA professor Donald Shoup that documented the excess mileage and emissions associated with searching for parking.

Furthermore, region engineer Roger Safford of the Michigan Department of Transportation (MDOT) explained how MDOT is using connected-vehicle technology and the resulting data for many purposes, including those related to asset management, such as measuring pavement quality and monitoring bridge health, and freeway operations, including monitoring traffic conditions and detecting slippery road surfaces. Safford also addressed the complicated funding challenges facing state DOTs, including MDOT, in the current economy. Other speakers also discussed the economy, with Rick Warner stressing the economic development potential of growing high-tech start-ups in the connected vehicle industry, such as ParkingCarma, right here in Michigan.

The focus on connected-vehicle technology continued on the second day of MBS in a panel entitled “Designing for Technology” cochaired by Brett Smith and Richard Wallace of CAR. This session, which



Photo courtesy of Joe Wissens

Jeff DeBest, Electronics Group vice president, JCI, discusses the many distractions that drivers experience.

began with vehicle-design-oriented presentations from Jim Farley of Ford, Paul Williamsen of Toyota, and Imre Molnar of the College for Creative Studies, concluded with presentations from Chris Weber of Nokia and Doug Frisbie of Facebook. Weber spoke about Nokia's new partnership with Microsoft and new product offerings that would result from this partnership, including Nokia phones running the Windows Mobile operating system. Frisbie stressed the many opportunities for social networking in the automotive sector, including reviews of vehicles and marketing—a theme that Farley also stressed in explaining how marketing for the new Ford Fiesta was driven by customer-generated concepts, thereby saving Ford millions of dollars.

On the last day of MBS 2011, connected-vehicle technology was

again highlighted when MDOT Director Kirk Steudle delivered the final presentation of the conference during a session chaired by Dave Cole, CAR's chairman emeritus. Steudle reiterated some of the points made by Roger Safford on Monday, but probably more importantly addressed the timely topic of reinventing the management and operation of a state DOT in times of economic hardship and budget cuts. Connected-vehicle technology has the potential to dramatically reduce data-collection and operating costs, contributing to this reinvention. (See page 1 for details from Director Steudle.)

All told, MBS 2011 may well have marked the coming-out party for connected-vehicle technology, from a sidelight of the automotive industry to a central component

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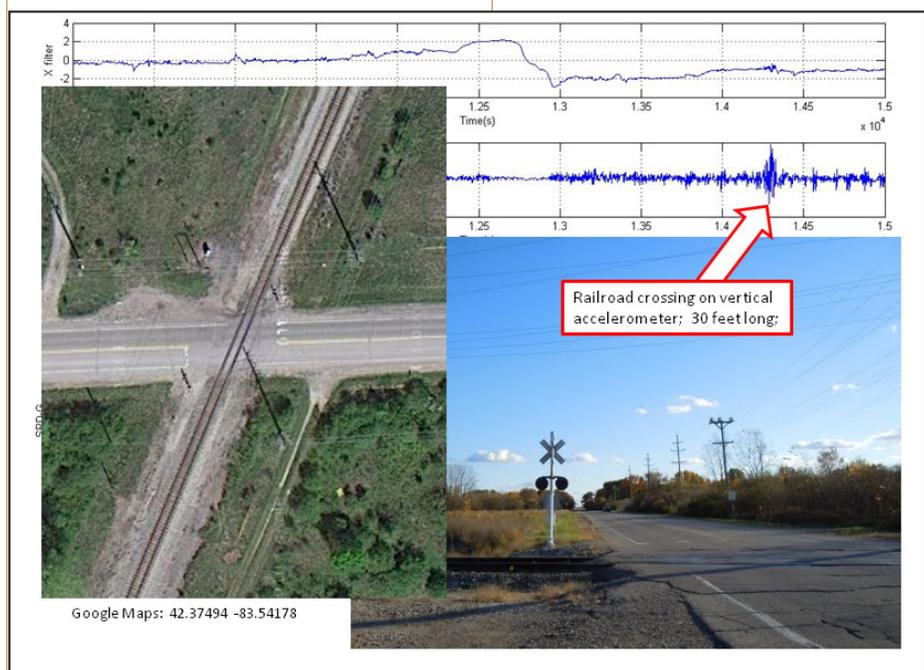
MDOT Vehicle Data Collection Project Supports Road Planning and Maintenance

In a typical year, only a small fraction of Michigan's roadways are manually rated by road engineers for surface quality and condition. To improve this monitoring process, researchers at the University of Michigan Transportation Research Institute (UMTRI) in partnership with the Michigan Department of Transportation (MDOT) are using specially equipped vehicles to collect real-time data on road roughness and condition.

The project team will evaluate how collecting road data automatically can be used to improve the way MDOT operates and maintains the road network system. Project goals are to determine how in-vehicle data-collection systems can be leveraged to support and enhance systems for collecting roadway and weather data, reduce data-collection costs, increase travel information effectiveness, and improve the efficiency of asset management processes.

Two particular areas of investigation are currently underway. The first involves monitoring on-board accelerometer data to measure road roughness. The second involves accessing on-board vehicle-systems status to determine if hard braking, wheel slipping, or an out-of-control condition has occurred and where it has occurred. This data, correlated with current weather data, can be used to identify the earliest possible moment when slippery road conditions might occur.

Collecting vehicle data directly and automatically can dramatically increase the amount of road data available to MDOT planners as well as to federal (interstate), county,



Courtesy of the U-M Transportation Research Institute

and township road agencies. In the Michigan project, almost four billion bytes of data have been collected from thirteen vehicles driven over 11,000 miles during the summer of 2011. The bulk of these data are accelerometer samples taken at 100 times per second. This is an adequate sample rate to detect potholes, surface cracks, bumps, and a wide variety of other surface imperfections in a road segment.

The technical challenge for researchers is correlating the road-smoothness rating levels as determined by the subjective evaluations to the measured roughness levels as determined by the data acquisition system. The detailed roughness profiles captured by the automated equipment must be carefully matched and filtered to correlate with the criteria used for the manual ratings generation methodology. This is the minimal requirement to be useful. Additional benefits of automatic monitoring come from the identification and tracking of specific

problem spots and deterioration of the surface conditions over time.

To be potentially useful on a large scale, the design of the data-gathering equipment needs to be low cost, accurate, and nonintrusive in the vehicle installation. UMTRI chose a Droid smartphone platform that contains a three-axis accelerometer, global positioning system (GPS) receiver, cellular and Bluetooth receivers. A DataProbe application was developed to read basic data once per second and accelerometer data 100 times per second. This data is captured in discrete data files and transferred every five minutes to a server at UMTRI via cellular data service. Once received by the server, the files are scanned and summarized for pertinent information with results placed in a log file. The log file is then monitored for statistics on device use, number of samples collected, time in use, and so forth.

The focus of the effort now is the reduction of the data to match the manual rating-data methodology provided by the MDOT engineers.

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AASHTO Update

Connected Vehicles

The National Highway Traffic Safety Administration (NHTSA) will make an agency decision in 2013 to follow either a regulatory path toward requiring Dedicated Short-Range Communication (DSRC) radios in all new vehicles or to conduct additional research and consumer outreach. With 2013 only two years away, the American Association of State Highway and Transportation Officials (AASHTO) has begun working in several areas to prepare for a potential connected-vehicle roadway world. AASHTO activities are addressing issues related to application development, benefit assessment, DSRC communication needs, infrastructure rollout approaches, and agency education. Support for the AASHTO initiatives came from the Joint Program Office and the National Cooperative Highway Research Program (NCHRP).

The safety pilot model deployment underway in Ann Arbor, Michigan will be a great step forward in answering many of the remaining questions on how the connected-vehicle concept will work. Future regional model deployments will generate additional information on deployment, national acceptance, and ideally, a funding strategy. AASHTO continues to be a strong supporter of the safety pilot program and works closely with the USDOT, the automobile industry, as well as suppliers.

National Cooperative Highway Research Program

Under the National Cooperative Highway Research Program (NCHRP), a cost-benefit assessment and a DSRC evaluation are underway. The cost-benefit assessment is a \$500,000 study that will use the recently completed AASHTO Deployment Analysis to determine costs to deploy and operate the infrastructure as well as the societal and agency benefits of a deployed system. The purpose of this effort is to assist NCHRP in making the necessary investment decisions. Expected completion is the end of 2012.

A smaller study of \$50,000 under the NCHRP 20-07 program is addressing issues around the DSRC infrastructure such as licensing, installation, and operational experiences and guidelines to assist states that have not yet deployed DSRC infrastructure. Proposed completion is early 2012.

AASHTO Infrastructure Deployment Analysis

In June, AASHTO completed an analysis of infrastructure deployment approaches. The report examined applications, market trends in vehicle technology rollouts, and magnitude of effort to upgrade or replace 300,000 traffic signal controllers with controllers that can communicate on DSRC. It also examined the future of wireless communications in the area of 4G and LTE to understand what will be available in the future, reviewed

what leading states are testing in the connected vehicle space, (such as in-vehicle signing, commercial-vehicle transactions, and emergency vehicle preemption), and finally laid out a set of deployment scenarios and strategies for the 2011-to-2013 time frame.

Because connected-vehicle technology is not expected to enter the market on new cars until the 2020 model year, the report looked at applications and infrastructure where agencies could get benefits in the commercial vehicle area, emergency vehicle area, transit, and agency fleets in the early years 2011 to 2014. After 2014, the emphasis would move to preparing for the DSRC-equipped vehicles entering the fleet and preparing intersections and safety hot spots with the corresponding DSRC infrastructure.

For more information, visit the USDOT Connected Vehicle web site at http://www.its.dot.gov/connected_vehicle/connected_vehicle.htm

Pooled Fund Study

The state Connected Vehicle Pooled Fund Study has ten members including Virginia, Florida, New York, Michigan, Minnesota, Texas, Wisconsin, Washington State, California, and the Federal Highway Administration (FHWA). In addition, there are associate members from Maricopa County, Arizona, Palm Beach County, Florida, the Metropolitan Transportation Commission (California), and Transport Canada. The purpose of the pooled fund is to conduct research that is deployment oriented

and which states deem important in preparation for the Connected Vehicle Program.

Studies have been completed on the following: 1) vehicle probe data for traffic control, 2) vehicle probes for monitoring pavement conditions, and 3) signal phase and timing (SPaT). Results of these studies can be found at http://cts.virginia.edu/CTSPFS_2.html.

Studies underway include the following: 1) certification for hardware and software, 2) ways to accelerate aftermarket on-board units for communication with the roadside infrastructure, and 3) system engineering for a field trial of vehicle probes for signal control.

Future efforts are now being considered. More details of the Pooled Fund Program and ways to join can be found at http://cts.virginia.edu/CTSPFS_1.html.

Miscellaneous Activities

- On September 15, AASHTO and USDOT held discussions on AASHTO's deployment scenarios, critical issues, and security.

- On October 16, the AASHTO annual meeting will feature a keynote speaker from GM and a session on the vehicle of the future with speakers from Ford and GM.

- At this year's ITS World Congress, AASHTO is hosting the 8th AASHTO International Day with speakers from around the globe, as well as a Connected Vehicle Policy meeting with USDOT, AASHTO, and the automobile industry to discuss roadside infrastructure.

Some remaining issues include the following:

- Dedicated Short Range Communication spectrum. There is still some discussion of how essential the DSRC spectrum is with the rapid evolution in cellular systems. DSRC is a valuable spectrum, and it is important that we become clear on this before there is competition from others to use this asset.

- Autonomous vehicle. All vehicles are beginning to introduce technology that will deliver substantial safety benefits such as adaptive cruise control to prevent collisions and lane departure systems to prevent run-off collisions. Some of the manufacturer websites indicate that these two technologies can prevent 80 percent of the accidents. So the future vehicle may have a combination of this technology and connected vehicle technology.

- Public applications. What should be done to ensure that the public applications are developed, are nationally interoperable across all states and utilized?

For more information, contact Jim Wright at jwright@aaashto.org

CAR Seminars

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thereof. Indeed, both Linda Marshall of OnStar and Scott Nelson of ATX Group cited data indicating the importance of connectivity in consumers' vehicle purchase decisions. From the infrastructure side, MDOT Director Steudle, as well as Roger Safford, stressed how this technology already is being used and how it will contribute to the transportation agency of the 21st century.

A complete list of speakers, along with links to audio files and presentations for some of the speakers, can be found at http://mbs.cargroup.org/2011/component?option=com_eventlist/Itemid,75func,details/did,12/

For more information, contact Richard Wallace at rwallace@CARGROUP.ORG.

MDOT Vehicle Data

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The data will also be used to support a broader project called the Data Use Analysis and Processing (DUAP) project that collects probe data and determines how this data can change the way a transportation department does business. As this correlation is verified against the actual data coming in and the methods accepted by MDOT, a process will be identified to distribute the results and methods to other road agencies for their use. As winter weather arrives, attention will turn to monitoring vehicle events that warn of slippery road conditions. This project is scheduled to run through 2013.

For more information, contact Steve Cook, MDOT, 517-636-4094, or Ralph Robinson, UMTRI, 734-764-2181.

Detroit to Host 2014 ITS World Congress

Detroit will welcome more than 10,000 international members of the transportation technology industry in October 2014 for the Intelligent Transportation Systems (ITS) World Congress.

The five-day event will take place at Cobo Conference and Exhibition Center and will be hosted by the Intelligent Transportation Society of America (ITS America) in partnership with ITS Michigan, the state chapter for the national group.

“We’re extremely pleased that the Motor City was selected to host this international industry gathering,” said Scott Belcher, ITS America president and CEO. “Intelligent Transportation Systems are intimately tied to the automobile, and Michigan’s automotive heritage makes it the perfect choice.”

James Barbaresso, vice president for Intelligent Transportation Systems for engineering firm HNTB and former president of ITS Michigan, has been selected as Organizing Committee chairman for the event.

“We can’t think of a better place to hold the ITS World Congress,” Barbaresso said. “We have the world’s highest concentration of engineering talent, auto companies, and automotive suppliers. We are also home to some of the largest test beds and auto-related research facilities of any place in the world. These resources offer an unsurpassed environment for showcasing connected-vehicle technologies and other emerging transportation concepts.”

“We have a few surprises in store for attendees,” Barbaresso

added. “This will be an opportunity to demonstrate—on the streets of Detroit and surrounding areas—Michigan’s technological prowess to the rest of the world.”

The annual ITS World Congress is held in the Americas once every three years. This year’s event takes place in Orlando, Florida, from October 16-20, 2011. The event is held in Asia and Europe in the intervening years.

For information on the 2011 World Congress, see www.itsworldcongress.org. For information on the 2014 ITS World Congress, visit www.itsmichigan.org.

Third International Summit on State of the Connected Vehicle

The Connected Vehicle Trade Association in conjunction with the Michigan Department of Transportation is hosting the third International Summit on the State of the Connected Vehicle on January 18-19, 2012, in Troy, Michigan. The primary focus of the summit will be on policy and strategy for deployment.

The first half day of the summit will emphasize policy, funding, issues, and strategies to accelerate deployments regionally and internationally. Speakers representing the United States, European Union, Japan, China, Korea, Michigan DOT, and AASHTO will present. The second full day will address near-term business opportunities, interoperability, and insurance telematics. Major corporate business leaders from automotive companies, the technology supplier community, and communication companies will discuss the business and partnering opportunities in this rapidly evolving environment.

The summit brings together senior executives and policy officials from government and industry with responsibility for the deployment

and operation of connected-vehicle programs.

For conference details and registration, visit www.connectedvehicle.org or contact Scott J. McCormick at sjm@connectedvehicle.org.

A Note of Thanks...

As we close this series of newsletters, we find ourselves ending as we began, with a welcome article from Kirk Steudle. It seems as though we have come full circle. We began in 2007 with the *Michigan VII Update* and now, under the title *Connected Vehicle Update*, we come back with a concluding MDOT perspective.

Through our various title changes, a number of participants have had a hand in making this newsletter possible. I would like to thank, in particular, Jim Schultz, Steve Cook, and Barbara Hicks at the Michigan Department of Transportation, Greg Larson at the California Department of Transportation, and Jim Wright at AASHTO. At U-M I would like to thank UMTRI’s Joyce Daniels and Bob Sweet along with Ruth Gretzinger and Kathy Krick at Michigan Marketing and Design.

Safe driving!!
Todd Anuskiewicz
University of Michigan Transportation
Research Institute

Connected Vehicle Update is produced by the University of Michigan Transportation Research Institute with funding from the Michigan Department of Transportation.

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Title history: *Michigan VII Update* (2007), *VII Update* (2008), *IntellidriveSM Update* (2009), *Connected Vehicle Update* (2011).

