

Technologies to Reduce Commercial Motor Vehicle Crashes in Work Zones

National Transportation Research Center
November 13, 2014
2360 Cherahala Boulevard
Knoxville, Tennessee 37932

FEDERAL MOTOR CARRIER SAFETY ADMINISTRATION



*Disclaimer: Some workshop presentation material described herein was marked "proprietary and confidential."
Distribution of this report is intended for workshop attendees and FMCSA staff.*

MEETING DETAILS

The meeting was held from 8:30 am to 12:30 pm on November 13, 2014. Oak Ridge National Laboratory (ORNL) provided logistical support to FMCSA in arranging and hosting the event, and the meeting was conducted at the National Transportation Research Center (Knoxville, TN). Chris Flanigan, Federal Motor Carrier Safety Administration (FMCSA) Program Manager for the Commercial Motor Vehicle Roadside Technology Consortium (CMVRTC) led the overall meeting, which included representatives from several State Departments of Transportation and Safety including, Georgia, Kentucky, Louisiana, North Carolina, and Tennessee. Federal officials present included Jack Van Steenburg (FMCSA Chief Safety Officer and Assistant Administrator), Dr. Kelly Regal (FMCSA Associate Administrator for Research and Technology), Dr. Steven Smith (Director of Analysis, Research, and Technology), as well as State-based FMCSA and Federal Highway Administration (FHWA) staff.

PURPOSE OF MEETING

The purpose of the meeting was to convene an overview of current State efforts to address this issue; to understand solutions that could be provided through existing commercial mobile radio services (CMRS) systems in commercial motor vehicles (CMVs); and to identify specific research areas that will need to be addressed to deploy such a solution.

AGENDA

The agenda was constructed to offer participants perspectives on implementation of commercial vehicle safety in work zones from Federal, State and private sector/industry stakeholders.

*8:30 AM: Welcome and Introductions: **Chris Flanigan**, Program Manager, FMCSA.*

*8:45 AM: Technology Applications to Prevent Work Zone CMV Crashes: **Jack Van Steenburg**, Assistant Administrator and Chief Safety Officer, FMCSA.*

9:15 AM: Current State Activities:

- *Colonel **Tracy Trott**, Tennessee Highway Patrol (THP).*
- *Lieutenant **Anthony Back**, North Carolina Department of Public Safety.*
- ***Barry Lacy**, Claims/Work Zone/Audit Engineer, Louisiana Department of Transportation.*

*10:00 AM: Federal Highway Administration Activities: **Todd Peterson**, Transportation Specialist, Work Zone Management, Federal Highway Administration.*

10:30 AM: Break.

10:45 AM: Available Solutions Using Commercial Mobile Radio Services:

- **Hass Machlab**, President, Innovative Software Engineering.
- **Rick Ochsendorf**, Senior Vice President, Operations and Product Management, PeopleNet.
- **Tom Cuthbertson**, Vice President, Regulatory Compliance, XRS Corporation.
- **Brian Heath**, President, Intelligent Imaging Systems.

11:45 AM: Discussion and Next Steps, Moderator—**Gary Capps**, Technical Director, CMVRTC, ORNL.

12:30 PM: Adjourn.

DISCUSSION BY TOPICAL AREAS

- Chris Flanigan gave the Welcome and Introductions of key representatives from government, industry, and academia. The attendees self-introduced around the room before the meeting sessions commenced.
- Jack Van Steenburg, Assistant Administrator and Chief Safety Officer, FMCSA, gave the charge to the attendees to prevent work zone CMV crashes with technology applications. He cited 609 fatalities occurred in work zones in 2013, with 25 percent involving commercial vehicles. While a nominally small statistic in comparison to total motor vehicle accidents, Jack Van Steenburg recognized the importance of each one in human terms. He disclosed the availability of \$25M in Commercial Vehicle Information System Networks (CVISN) grants to States commencing in December 2014, including provisions for work zone safety improvement.

STATE PRACTICES

- Colonel Tracy Trott, THP, briefed the group on Tennessee's implementation plan for National Traffic Incident Management (TIM) Responder Training and announced the State's newest facility for providing this training. Citing national statistics that suggest one law enforcement officer is struck and killed each month while in an incident response setting, and secondary work zone crashes are some of the "worst they've ever seen." In the field, THP endeavors to minimize their exposure and clear disabled vehicles within 30 minutes (statistics reveal that each minute increases the chance of a secondary crash incident by 2.8 percent). The TIM primarily focuses on the safety of their staff, but collateral protection is provided to other affected parties like emergency medical technicians, fire, tow truck, highway workers that have greater risk of death (~200 sum/year nationwide) via timely coordination. He related that the Tennessee Highway Patrol incorporates a 4-hour course into their academy curriculum using multi-

disciplinary instructors. Using FHWA grant funds, Tennessee's new TIM responder training site was opened in 2014 and is available to agencies that would like to use it. It includes over 1,800 feet of dedicated pavement for simulation of traffic incidents (crashes, felony stops, work zones) in mock actual traffic settings (Figure 1). It can also be utilized for controlled field evaluation of work zone safety warning devices and equipment.



Fig. 1. State of TN Traffic Incident Management training site features.

- Lieutenant Anthony Back from the North Carolina State Highway Patrol (NCSHP) gave an overview of the work zone practices being conducted within his State by the North Carolina Department of Public Safety. The effectiveness of these hinges foremost on planning and communication. Planning phases include standardized work zone design augmented with traffic count estimations and accommodation of the work zone practices. Communications mechanisms include public means (news outlets), variable message signs and digital real time information systems. Execution of work zone safety involves highly visible NCSHP presence and incident management patrol trucks for quick response in accident handling and removal. Lt. Back described results of a study which probed aspects of emerging Vehicle to Vehicle (V2V) and Vehicle to Infrastructures (V2I) technologies and their potential to warn motorists of work zone activities. Even existing CMRS could have a quickly implemented impact. He cited a need for portable roadside

equipment to supplement satellite communications to alert motorists in real time of altered traffic conditions or maintenance activities.

- Barry Lacy, Claims/Work Zone/Audit Engineer, for Louisiana Department of Transportation & Development presented his State's road contractor policies which are used to mitigate work zone crashes. These include mandatory flaggers, traffic control technicians, and traffic control supervisors. Stiff penalties and consequences can be enforced if these policies are not followed or contractor training lapses, etc.

FEDERAL HIGHWAY ADMINISTRATION (FHWA) ACTIVITIES

- Todd Peterson, Transportation Specialist, Work Zone Management for FHWA, presented the Agency's initiatives for addressing large truck safety in work zones. Peterson noted the emerging appearance of a plateau effect (Figure 2) in an otherwise steady decline of truck work zone crashes for much of the post-2005 period. He addressed viable causes for the observations including changes in driver behavior, increased truck exposure, and underlying data issues. It was noted that 80 percent of Caltran and Maryland work zone "closures" are phantom due to over-reporting duration of work zones for having an active work zone up—but not "filed with the system" beforehand. Some trouble spots are constantly moving—such as pavement marking.

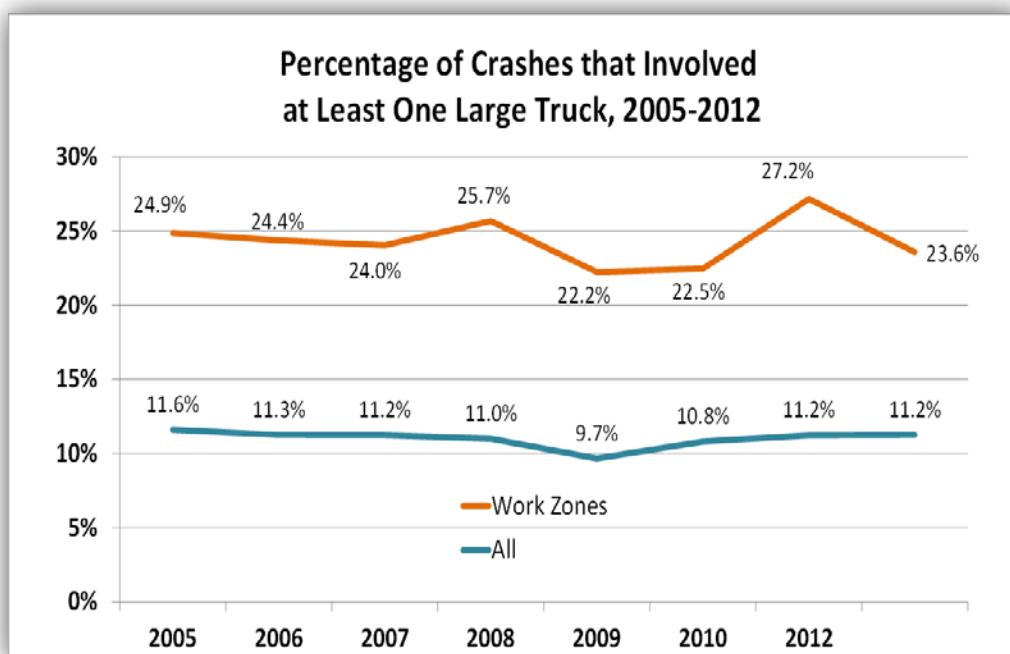


Fig. 2. FARS data considered in a closer look at truck crash statistics in work zones. One of the observations arising from ongoing Texas Transportation Institute study of national truck crash statistics effort is that trucks appear to be overrepresented in work zone crashes.

As most work zone fatal crashes involving trucks are typically rear-end crashes, he described applicability for work zone Intelligent Transportation System (ITS) tools, such as queue-warning systems (QWS) (see Figure 3) and Freight Advanced Traveler Information System (FRATIS)¹ (see Figure 4). FRATIS is designed to enhance traveler information systems to address specific freight needs for long- and short-haul goods movement. The application will provide traveler information to freight operators and drivers, such as real-time travel estimates with route guidance to freight facilities, and basic incident alert, road closure, and work zone information. Enhanced freight-specific information could include oversize/overweight route restrictions with associated time periods, tailored weather information, intermodal connection information, container disposition, and shipment schedule updates. This information will support more efficient freight operations resulting in reduced traffic congestion and increased air quality in metropolitan areas.

¹ *Developing ITS Mobility Applications for Freight Operations* – [Source: http://www.camsys.com/kb_experts_ITS_mobility.htm#sthash.HJEGrmxk.dpuf]

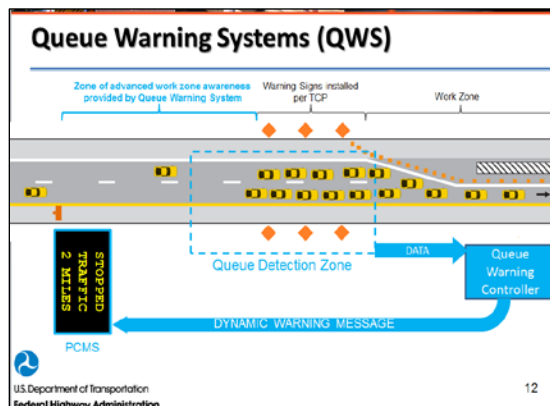


Fig. 3. ITS work zone tool Queue Warning Systems (QWS).

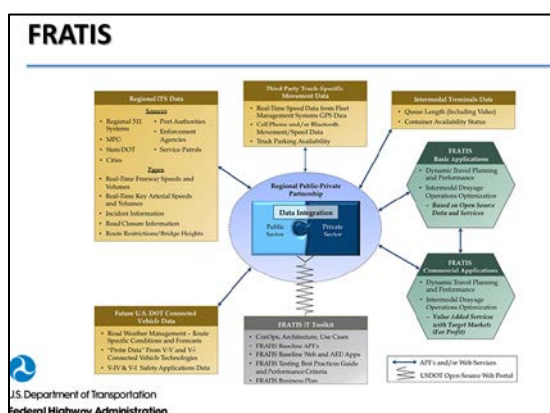


Fig. 4. ITS work zone tool Freight Advanced Traveler Information System (FRATIS).

ILLUSTRATIVE DISCUSSION OF I-35 TRAVELER INFORMATION MANAGEMENT SYSTEM

Todd Peterson called upon attendee Gerald Ullman, Ph.D., Senior Research Engineer, from Texas A&M Transportation Institute (TTI) to help describe a pilot testbed for FRATIS that functions in a work zone safety notification capacity. The 96-mile I-35 freight corridor between Austin and Dallas, TX services about 25,000-30,000 heavy trucks daily, and is in the midst of a lane-widening upgrade. During the construction period, the Texas DOT (TxDOT) is utilizing data collection and dissemination to:

- Provide advance notification of planned lane closures and their anticipated impacts.
- Provide travelers with predicted delays for construction closures.
- Provide real-time traveler information (travel time, delays, queues).

The system integrates information obtained from Bluetooth-sensed monitoring of traffic movement (every 2–3 miles), 17 spot speed and volume sensors, and 7 digital cameras to analyze travel time and delays. Information is provided back to road users via 21 portable dynamic message signs. A Web-based travel pre-planning and current information tool is also accessible (See Figure 4).

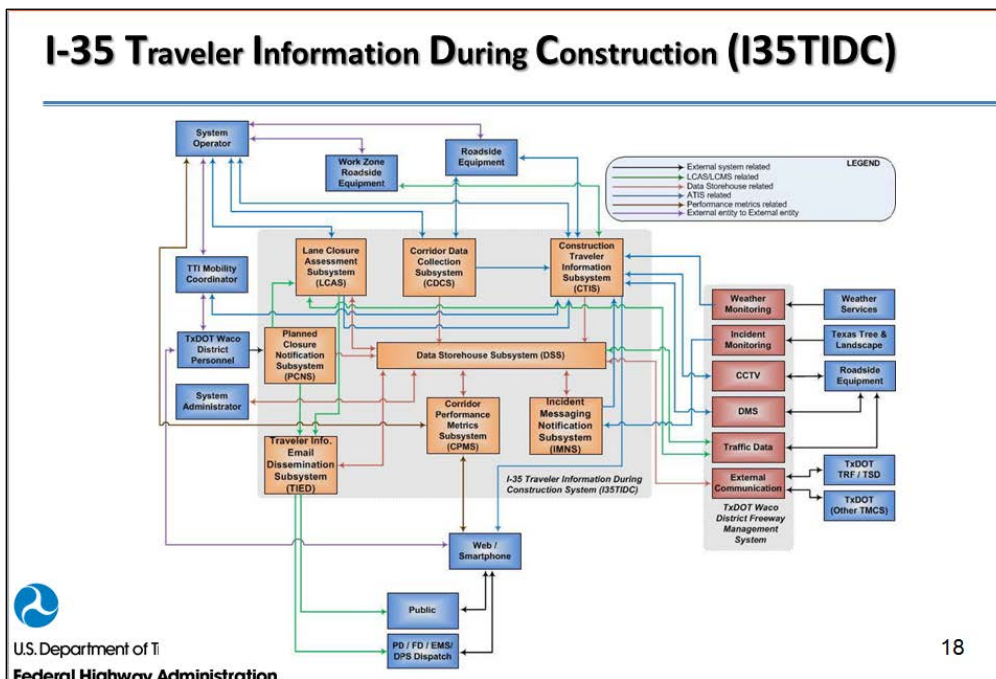


Fig. 5. Texas Department of Transportation's design during I-35 Traveler Information During Construction

The sophisticated architecture of the system was discussed at length, and Jeff Loftus remarked on the need for implementing a National ITS Reference Architecture for truck and motorcoach safety standards.

Todd Peterson closed by further enumerating FHWA's targeted conventional outreach efforts to stakeholder groups through dedicated webinars and topical events such as this workshop.

COMMERCIAL SOLUTIONS USING CMRS:

- Hass Machlab, President of Innovative Software Engineering (ISE) presented ISE's technical approach to mitigate work zone crashes which relies upon in-cab notification of CMV drivers prior to encountering congestion and/or work zones. Hass Machlab noted that work zones are generally fixed and known in advance, while congestion is dynamic in nature and not always predictable. Hass Machlab mapped data flow from information sources, through accessible pathways to drivers (and their manifestation as audio/visual alerts, live navigation updates, etc.). A telematics-based road information

consolidation service could effectively integrate and manage the various data handling modes. Machlab argued the Government (in collaboration with industry) can help by providing a path forward to road data consolidation and dissemination via host-based services, geo-fence based services, etc.

- Rick Ochsendorf, Senior Vice President, Operations and Product Management-discussed PeopleNet solutions. Their architecture is cloud-based with a variety of mobile gateway feeds. Their foundational product is focused on hours-of-service compliance and efficient use of driver time. Rick Ochsendorf articulated that global positioning system (GPS) geo-fences, while a common feature of many fleet management service offerings, offer a unique set of challenges for dynamic incident alert and response situations. The most problematic challenges are establishing meaningful (i.e., not self-defeating) geo-fenced area configurations and getting the notification information into the cabin of affected vehicles. Rick Ochsendorf also revealed some CMV-mounted video camera technology, enhancing driver ability to distinguish proximate threats. PeopleNet also claimed to have an approach for auto-subdividing geo-fence into a few stages of warnings.
- Tom Cuthbertson, Vice President, Regulatory Compliance, XRS Corporation discussed proactive notification mechanisms for work zones. Tom Cuthbertson drew upon an anecdotal example illustrating the range of highway incidents, which were encountered (multiple road work zones and a post- high speed chase arrest (traffic stop) in a relatively short 4-hour period. While law enforcement officer (LEO) presence was noted, in no case did Tom Cuthbertson observe any of the information finding its way (uploaded) onto the popular app Google Maps. He noted the elasticity of time delays which can be experienced by other users under such congestion-inducing variables as location, time-of-day, and severity of the incident. Tom Cuthbertson offered several key criteria for considering notification management, which suggested a Federally-overseen central database/clearinghouse. Additional features and desirable attributes of a notification mechanism were also listed, and he noted that all were available (though mostly unintegrated) in the marketplace today. Some GPS latency issues are identifiable for certain modes of tracking incidents and nearby CMVs.
- Brian Heath, President, Intelligent Imaging Systems, highlighted Drivewyze work zone notification solutions. Drivewyze is a “smart mobility services” provider for the transportation industry (and a subsidiary of Intelligent Imaging Systems Inc.). With a foundational product utilizing CMRS smart transponders (coupled with electronic logging devices) to enable at weigh station bypass convenience for trucks, Drivewyze advocated a CMRS-based approach to work zone safety warnings. Heath cited cost effectiveness, functionality, and market penetration of CMRS services and in-cab equipment as enablers. In addition, he noted the need for designing in component/system interoperability through hardware and software neutrality. Heath further addressed the market implementation barriers which have to be surmounted:

value proposition for the owner/operator, market readiness, regulatory/law enforcement (LE) agency readiness, and an attractive service provider business model.

WORKSHOP WRAP-UP

Chris Flanigan wrapped up the half-day meeting with some input from the audience. Discussion points included:

- Technology is available, but will take effort to adapt for work zone applications.
- Need to include CMV drivers as a stakeholder voice when developing these systems.
- Will need research funds to help address this matter.
- Need to address privacy and security issues for these services.

Carl Anderson (FHWA Connected Vehicle Program Manager) announced a Call for Proposals that will go out early calendar year (CY) 2015 and will be seeking establishment of deployment test-beds for the purpose of demonstrating how to build, operate, and maintain connected vehicle environments at city-scale. Carl Anderson noted that some of the anticipated solicitation awards would be looking for niche applications such as work zone safety for CMVs. ITS Joint Program Office support contractor Noblis had elucidated five scenarios for Connected Vehicles (available via podcasts): freight, corridor, rural, urban, etc., are keywords.

Chris Flanigan invited the audience to ruminate on the great discussions and come prepared to discuss in greater detail at the Commercial Vehicle Safety Alliance (CVSA) meeting next year: National Symposium on Work Zones and Large Trucks 2015 CVSA Workshop (April 13, 2015, in Jacksonville, FL). The objective of the workshop is to provide a forum to convene the CMV industry, DOTs, law enforcement agencies, traffic safety advocates, partners, and stakeholders to share experiences and ideas, and to identify prospective solutions to improve work zone effectiveness and efficiency of the core system components: driver, vehicle, and highway. The workshop's invited attendance is being managed by FHWA.

PERCEPTIONS / INTERPRETATIONS:

ORNL offers the following perceptions and interpretations from the workshop to augment FMCSA program planning:

- There is a need for a survey of available data sources and integrators, to wit: GPS w/traffic, Google Maps, Bing Maps, TDOT Web site, Waze, Zipdash, TomTom, Yahoo, MapQuest, INRIZ, NAVTEQ. Most companies get traffic data from cell phone GPS. A spot

survey of two commonly-used systems: (1) MapQuest (see Figure 6) and (2) Bing (see Figure 7) show the presumed disparity in information.

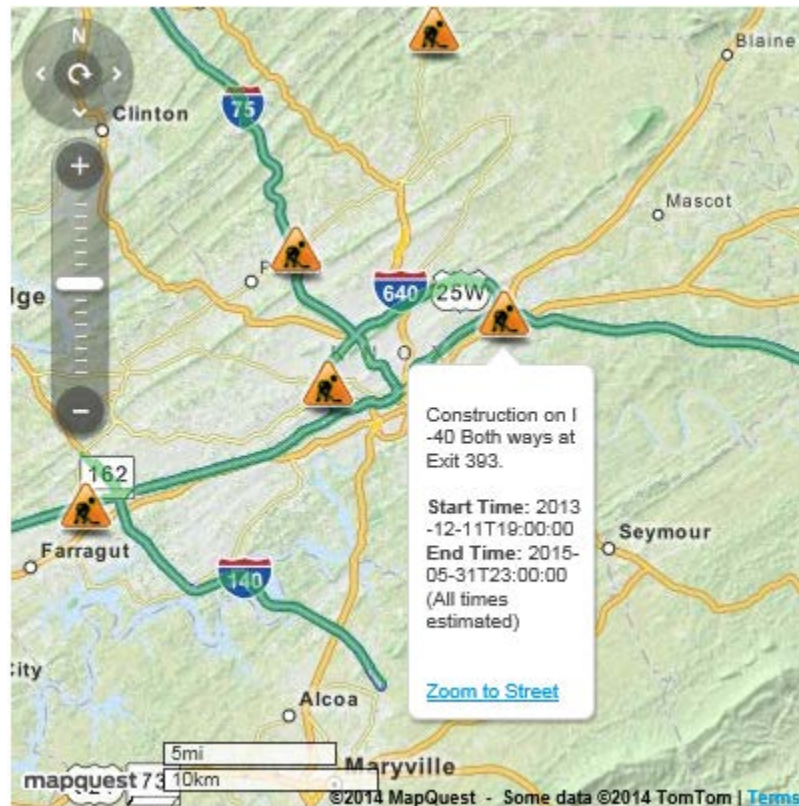


Fig. 6. MapQuest map displaying traffic information for Knoxville, TN (<http://www.mapquestapi.com/traffic/>). [Note the Start/End times are estimated and cover a large range.]

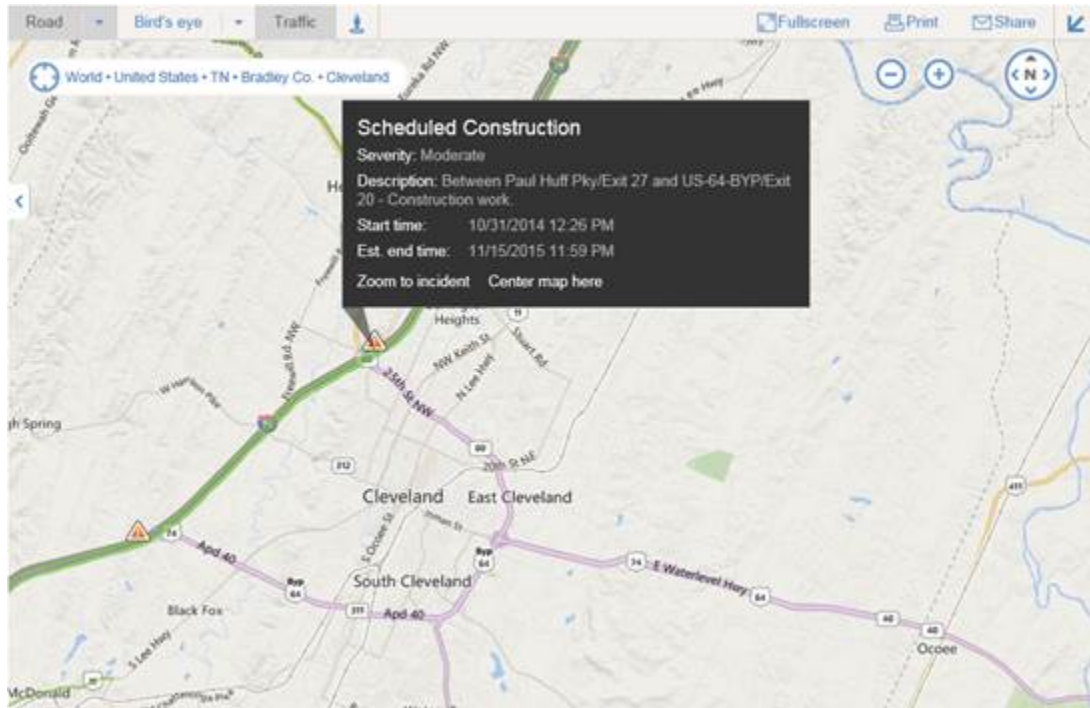


Fig. 7. Bing map displaying traffic information for Knoxville, TN
<http://msdn.microsoft.com/en-us/library/hh441726>.

This data call returns nothing for Knoxville, so there are definitely gaps in coverage depending on source.

- Institute a hardware-based mechanism so that when law enforcement or other emergency workers activate their vehicle emergency lighting, trucks within a 2-, 5-, or even 10-mile radius out are warned about it in-cab.
- Need to standardize XML file format for all States' work zones.
- System solutions should archive historical data—like precise timing of crash from reports compared to timing that was shown (if at all) on Google, Bing, TDOT, etc.
 - Cursorsory—manually spot check some.
 - Advanced—automate.
- (Alan internal) make an “aggregator” system like Visualizing Energy Resources Dynamically on Earth (VERDE)/Energy Awareness and Resiliency Streaming Service (EARSS) that scrapes Web sites (Google, Bing, MapQuest), State DOTs, even Twitter. This is used by first responders in preparation for things like hurricanes.

Appendix A: Attendees

First Name	Last Name	Organization
Carl	Andersen	FHWA, Connected Vehicle Program Manager
Anthony	Back	Lieutenant, North Carolina Department of Public Safety
Tony	Barham	Captain, TN Highway Patrol
Alan	Barker	Oak Ridge National Laboratory
Joe	Barry	Innovative Software Engineering
Randy	Boyles	PeopleNet
Gary	Capps	Oak Ridge National Laboratory
Tom	Cuthbertson	XRS Corp.
Brandon	Douglas	Lieutenant, TN Highway Patrol
Mark	Dunlap	FMCSA -- Mississippi Division
Fred	Fakkema	Zonar Systems
Chris	Flanigan	FMCSA, Office of Analysis, Research, and Technology
Oscar	Franzese	Oak Ridge National Laboratory
Don	Gedge	TDOT
Linda	Goodman	FMCSA -- Kentucky Division
John	Hall	TDOT
Robert	Hancock	Mississippi Department of Public Safety
Earl	Hardy	FMCSA, Sr. Policy Advisor, Office of the Assistant Administrator and Chief Safety Office
Brian	Heath	Drivewyze
Shawn	Hines	Captain, Kentucky State Police
Richard	Holt	Law Enforcement Administrator, Governors Highway Safety Association
Willie	Huff	Director, Mississippi Department of Transportation
Harmon	Hunsicker	Captain, Metro Nashville Police
David	Jackson	Intelligent Imaging Systems
Samuel	Johnson	Officer, Metro Nashville Police
Keith	Kahl	Oak Ridge National Laboratory
Tom	Kelly	FMCSA, National CVISN Program Manager
Barry	Lacy	Louisiana Department of Transportation
Taylor	Lochrane	FHWA, Office of Operations Research and Development
Beth	Loflin	Mississippi Department of Public Safety
Jeff	Loftus	FMCSA, Technology Division Chief
Hass	Machlab	Innovative Software Engineering
Brian	Mofford	Drivewyze

First Name	Last Name	Organization
Sheila	Moore	Oak Ridge National Laboratory
Rick	Ochsendorf	PeopleNet
Todd	Peterson	FHWA, Office of Transportation Operations
Kendall	Poole	Chairman, Governors Highway Safety Association
Kelly	Regal	FMCSA, Assistant Administrator for Research and Information Technology & Chief Information Officer
Terry	Robinson	First Sergeant, North Carolina Department of Public Safety
Adam	Siekmann	Oak Ridge National Laboratory
David	Smith	Oak Ridge National Laboratory
Steve	Smith	FMCSA, Director for the Office of Analysis, Research, and Technology
Dereck	Stewart	Lieutenant Colonel, TN Highway Patrol
Shirley	Thomas	Director, Mississippi Department of Highway Safety
Tracy	Trott	Colonel, TN Highway Patrol
Jerry	Ullman	Texas A&M Transportation Institute
Jack	Van Steenburg	FMCSA, Assistant Administrator & Chief Safety Officer
Ron	Whittaker	Louisiana Department of Transportation
Dan	Williams	American Traffic Safety Services Association
Sterlin	Williams	FMCSA -- Mississippi Division

Appendix B: Post-workshop Follow-up Letter from Chris Flanigan (FMCSA)

Work Zone Stakeholder Meeting Attendees:

Thank you for your participation in the Technologies to Reduce Commercial Motor Vehicle Crashes in Work Zones meeting. We look forward to our discussion regarding technologies designed to address work zone crashes involving commercial motor vehicles (CMVs). Our goal at the meeting is to gain: an overview of current State efforts to address this issue; an understanding of solutions that could be provided through existing commercial mobile radio services (CMRS) systems in CMVs; and identify specific research areas that will need to be addressed to deploy such a solution.

These research areas include:

- 1. How will work zone location data be provided to CMRS vendors to maximize effectiveness of the solution?*
- 2. Should there be a centralized clearinghouse for these data?*
- 3. What is the most effective distance from the start of congestion to deliver the alert message to the driver?*
- 4. How will the variability of congestion be taken into account to provide effective warning to drivers?*
- 5. What type of alert message should be given to drivers: audio, visual, or both?*
- 6. Can and should these solutions apply to all types of congestion, not just at work zones?*
- 7. How can we best achieve national deployment and inclusion of all interested CMRS vendors?*

If you have any questions, please contact me at (202)385-2384 or chris.flanigan@dot.gov.

Thanks, Chris Flanigan