MDOT
Connected Vehicle Activities

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Presentation Overview

- Towards Zero Deaths Initiative
- MDOT Connected Vehicle Program
- MDOT Connected Vehicle Projects
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  - Weather Responsive Traveler Information (Wx-TINFO)
  - I-94 Truck Parking Info and Management System (TPIMS)
- 2014 ITS World Congress – Detroit, MI
Towards Zero Deaths

What's Your Goal?
Michigan has made impressive strides over the past decade in reducing the number of traffic fatalities on our roads. However, over the past couple of years, the trend of sharp declines in fatalities has “leveled out”.

In order to resume the deep downward trend experienced in the last decade, we need to apply new advances and technological approaches to our comprehensive campaign of traffic safety engineering, enforcement, and education...advances such as connected vehicle technologies.

Connected and automated vehicles have the chance to revolutionize automobile travel. The crashes that claim that kill 30 – 40,000 people killed every year across the country can be traced back to driver error and miscalculation in a large majority (some estimates are over 80%) of these crashes.

Connected vehicles and other advanced safety features can be effective in reducing, and maybe eliminating, these fatalities.
What are we doing now?
MDOT has been engaged in a variety of activities contributing to the development and deployment of Connected Vehicles over the past several years. The above slide highlights the number of activities we have going on right now.

These initiatives are focused on Connected Vehicle data collection, use, dissemination or research to either directly or indirectly improve safety. I am going to present on a few of the projects on this slide in more detail later in the presentation.
MDOT, working with a number of CV industry partners, have been able to establish and operate a number of test beds here in Michigan; probably more so here than in any other state. A lot of these have been in operation for a period of several years, and a lot of the “lessons learned” in connected vehicle technology development has occurred on one of these test beds.

We are coordinating with the USDOT in upgrading some of the legacy equipment located on some of these “older” test bed locations such as Oakland County, to keep them up to speed with advances in DSRC technology.

USDOT is also in the process of establishing the 2014 SE Michigan Test Bed Architecture Implementation to Support Data Exchanges. The initiative is to provide interoperability between vendors, operators and solution providers by developing Vehicle to Infrastructure (V2I) data exchanges. The purpose is to support development and testing activities in the Southeast Michigan Deployment in preparation for ITS 2014 World Congress

Another test bed location in the City of Detroit, is under deployment right now, in preparation for the ITS America 2014 World Congress in Detroit.
Southeast Michigan also has a unique opportunity in having such a high concentration of automotive research, testing and engineering facilities, along with research institutions such as U of M. A number of which are focusing on Connected Vehicle Research.

Couple this with a number of Connected Vehicle Test Beds and an extensive MDOT ITS Communications network, Michigan is primed for developing the first real, large scale Connected Vehicle deployment in the world, and MDOT is ready to support moving Michigan toward a connected future.

This slide shows the location of a number of these facilities in proximity to Southeast Michigan.
Connected Vehicle systems......generate data......lots of data. A single “connected vehicle” has the potential to generate literally thousands of data points for every minute it’s running, creating a potential deep well of useable information for road agencies.

Being able to harness this data, and more importantly being prepared to know how to use it, may take many months or even years of planning. Going through this process now can allow road agencies to immediately benefit from this wealth of data once “connected vehicles” are on our roads.

The MDOT Data Use Analysis and Processing project, is focused on utilizing Connected Vehicle data and other mobile observations, in conjunction with other traditional MDOT data sets, to populate a series of applications for our use.
It is expected that this data will be able to benefit MDOT and other road agencies in an almost countless number of ways. As a road agency, MDOT sees a lot of value in the data and applications that can be enabled through Connected vehicles.

This slide shows a number of the data use applications that are expected to benefit organizational areas such as planning, design, construction, maintenance, operations, etc.
One of the data sources that MDOT has been able to investigate for agency applications is the USDOT Safety Pilot Model Deployment data here in Ann Arbor, MI. Above is a screenshot from the DUAP system, showing a plot of vehicle communications with the deployed Roadside units.

The Safety Pilot Model Deployment in Ann Arbor has been hugely successful. A huge congratulations to the UMTRI team in putting together and executing a superb model deployment.

With the NHTSA rulemaking decision, MDOT hopes that the Safety Pilot Model Deployment area can serve to further prove out and test Connected Vehicle technology and applications, including utilization of the data for critical MDOT Safety applications.
The next project is the Integrated Mobile Observations. This project is funded by the FHWA Road Weather Management Program and is being designed with UMTRI’s assistance.

At a high level, the project is tasked with designing a mobile data collection system, focused on collecting weather observations, for applications such as MDOT operations and maintenance.

Focusing on the left side of the slide, the data collection platform is an Android Smartphone running the DataProbe application. The phone logs accelerometry data directly from the phone. It also accesses vehicle data from the CanBus as well as atmospheric data from external sensor such as air temperature, and road surface condition information.

The DataProbe application is set-up to automatically take photos when certain vehicle parameters are met such as ABS or traction control actuation. This allows MDOT to log a unique events which could have a negative impact on MDOT operations or maintenance.

This data is then transmitted via a cell connection UMTRI’s servers, where it is then supplied to a number of data users including the NCAR, MDOT, and others. MDOT is currently investigating how to use this data for applications such weather responsive traveler information and winter maintenance activities, which will improve motorists safety by providing safer driving conditions.
This slide shows the IMO 2.0 data sets that are currently being collected.

On the left you have the data signal or element that is being collected, and on the top you have the data collection mechanism.

The X in the cells represents which data elements are being collected by what form of instrumentation on the vehicle. At the bottom, you can see the number of MDOT fleet vehicles instrumented with each type of data collection.

The data elements being collected include GPS (speed, location, heading), accelerometry (all 3 axis), vehicle data (ABS, Traction control, etc.) and weather observations (atmospheric and pavement surface condition information) and photos for verification.
This slide shows the cumulative number of vehicle miles traveled and photos taken by the MDOT IMO instrumented vehicles since January, 2014 in the MDOT University Region.

These reports have been great tool for MDOT maintenance staff to understand how much data is being collected based upon given conditions, etc.
This slide represents the IMO data that was collected from December 1st to January 18th.

As you can see, a majority of the data points are focused in lower Michigan, with the highest density along the I-94 corridor.

The current plan is to prove out the technology on the 60 MDOT vehicles, but the potential for data collection statewide is endless with a number of Connected Vehicle data collection initiatives underway or in the near future.
One other component of the system that has been very valuable is ability to take photos of the roadways conditions using web portal.

It allows supervisors, etc. to take snap shots of the roadway remotely to determine current roadway conditions, as well as for verification of the data that is being collection for different agency data use applications such as maintenance decision support, as well as weather responsive traveler information. Which I will present later in the presentation.
The next few slides are a couple of sample photos taken from recent weather events in Michigan from the IMO fleet.

As you can see from the pictures, they are high resolution and can give MDOT a very clear understanding of roadway conditions and the ability to validate data that is being collected.
Integrating Mobile Observations (IMO) 2.0

Taken 12/16/13 by WMT at 10:30am
Integrating Mobile Observations (IMO) 2.0

Taken 12/11/13 by WMT at 11:05am
Integrating Mobile Observations (IMO) 2.0

Taken 12/14/13 by WMT at 8pm
Integrating Mobile Observations (IMO) 2.0

Taken 12/12/13 by Ford Truck at 7pm
Another application of the IMO data is the development of a Weather Responsive traveler information system. The development of this project is also funded by the FHWA Road Weather Management Program. At a high level, the system will use mobile and fixed weather observations, to determine where a weather advisory message is warranted based on real time conditions, and disseminate that information to motorists via multiple methods.

So if you follow the slides, from left to right columns, you have data collection, Data Analysis and Processing, and finally information dissemination on the right.

The first column, data collection shows not only IMO vehicles, but other MDOT mobile and fixed weather observations that are being used for weather data collection. This data is transmitted to the middle column, and ultimately to the MDOT DUAP servers for processing.

Here data is processed and logic is applied to determine where a weather advisory is warranted. This information is then sent to MDOT statewide Advanced Traffic Management System or ATMS, where it is posted to roadside Dynamic Message Signs or MDOT Mi Drive traveler information website for motorists use.
From the Wx-TINFO system, MDOT will develop real-time Motorist Advisory warning messages based upon pinpoint weather observations.

This slide shows a sample of some of the potential messages that could be produced by the Wx-TINFO system.
The I-94 Truck Parking project is possible through a grant from the FHWA.

This project is deploying a real-time truck driver information system that can relay the availability of truck parking spaces at private and public facilities along I-94 between I-69 and the Indiana border. This will allow truck drivers to plan their rest stops well in advance of reaching the parking areas, resulting in fewer trucks parking illegally and dangerously along the side and shoulders of the freeway.

The program is using a combination of detection technologies, to gage the availability of truck parking spaces at individual lots, and to provide this information to truck drivers.

The information is disseminated via multiple methods in including dynamic roadside signs, the Mi Drive traveler information website, a smart phone applications, and 5.9 GHz DSRC technology on board equipment in a number of pilot trucks. The on-board Smart Phone and DSRC applications have been designed to minimize / eliminate driver distractions, including text-to-speech capabilities.

This project has resulted in successful partnerships between FHWA, MDOT, private truck stop owners, and private trucking / freight companies.

The project is finalizing installation and integration of field devices, and will go live in March of this year.
Currently, the project extends along I-94 from the Indiana State line to just east of the I-69 interchange, near Marshall, MI, and includes several private truck stop operators, public rest areas and welcome centers.

With the successful operation of this first section of the Truck Parking System, we are anticipating an expansion of the system to other sections of I-94 further east, and will explore application to other freight corridors.

There is a total of 5 DSRC roadside locations, at critical decisions points along the corridor (freeway to freeway interchanges, etc.) to provide timely truck parking info to allow drivers to make smart truck parking decisions to increase safety and minimize unsafe truck parking decisions using Connected Vehicle technology.
TPIMS Connected Vehicle System

- Solicited Technical Proposals & Costs from 5 Companies
- Kapsch TrafficCom selected
  - 5.9GHz DSRC RSU & OBU
  - Android Tablet with Application
- Current Status:
  - RSU – Deployed
  - OBU – Fit Up, Deploy in Mar 2014
A few months from now, efforts will be in overdrive for the 2014 ITS World Congress. This event, hosted every three years in the United States, will bring thousands of ITS and technology professional from across the world to showcase and learn about the latest developments in transportation technology. It is fitting to have this event here in Detroit....the “hub” and home of transportation technology!

The ITS World Congress will be one of the first events in the newly completed/expanded Cobo Hall. In addition to showcasing everything that Detroit and Southeast Michigan has to offer, this event is also the opportunity to showcase the development of connected and automated vehicle technology.
As part of the technology demonstrations for the 2014 ITS World Congress, DSRC equipment will be deployed on the streets of Downtown Detroit, as well as Belle Isle.

Belle Isle will be instrumented with DSRC technology to provide an opportunity to demonstrate and showcase live connected vehicle applications in real time.
Thanks for the opportunity to speak, and I can answer questions during the Q&A session.