MDOT Connected Vehicle Work Zone Applications
• The first stage of connected vehicles
  • Video 1

• Can we give up control
  • Video 2

• The Future ....
Presentation Overview

• CV Infrastructure Deployment Plan
• V2I Application Development
• Work Zone Applications
  • Work Zone Data Input
  • Connected Vehicle WZ Applications
    • Wide Area Distribution (API)
    • Work Zone Traveler Information Messages (TIM)
CV Infrastructure Deployment Plan

350+

Miles of equipped freeway and major arterial by 2019
MDOT V2I Applications

- Red Light Violation Warning
- Work Zone Warning/Management
- Road Weather Management
- Pavement Condition
Work Zone Warning/Management

Vehicle is approaching work zone too fast

Approaching vehicle receives message from RSU with work zone information

Driver Vehicle Interface (DVI) provides warning of lane closure

Portable RSU sends work zone info to vehicle
Data Entry Portal for Construction Personnel

Data Elements Including:
- Speed Limit
- Lane and Ramp Closures
- Workers Present
- Truck Restrictions
- MAP

Data Collection/Processing

Message Development

DSRC

DVI

Mobile Device

Internet (API)

Cellular Satellite

Data Elements Including:
- Speed Limit
- Lane and Ramp Closures
- Workers Present
- Truck Restrictions
- MAP

Work Zone Data Input
Work Zone Data Elements

- Timestamp
- Road
- Start/End Points
- County
- Direction of Travel
- Start/End Time
- Detour Routes
- Speed Limit
- Workers Present
- Work Type
- Ramp Closure(s)
- Truck Restrictions
- MAP (Geometry)
- Elements as Identified
Work Zone API

- Application Programming Interface (API)
- Data Format: Extensible Mark-up Language (XML)
- Data Feed Includes:
  - Work Zone Data
  - Incident Data
- Established Data Spec
  - XML Structure
  - Data Formats
  - Data Elements

```xml
<?xml version="1.0"?>
    <fileVersion>1.0.0</version>
    <fileTimestamp>YYYY-MM-DDTHH:MM:SS.000Z</fileTimestamp>
    <author>Mixon Hill</author>
    <fileContents>Transportation Flow Restrictions (TFR) feed</fileContents>
    <laneClosures>
        <laneClosure>
            ...
        </laneClosure>
        <laneClosure>
            ...
        </laneClosure>
    </laneClosures>
</document>
```
Work Zone TIM

• SAE J2735 Standard
  • Traveler Information Message (TIM)
  • Advisories, etc. (Text Content)

• Work Zone Info
  • “Lane Closed Ahead”
  • “Workers Present”
  • “Speed Limit 45 MPH”

• I-69 Corridor Test
  • US Army TARDEC
  • V2V and V2I Testing
  • Portable RSUs
Collin Castle, P.E.
Connected Vehicle Specialist
517.636.0715
castlec@michigan.gov

PLANET M Website
www.planetm.com
Integrate Active Work Zone Notifications into Traveler Information Dissemination Systems (Phase 1)
ENTERPRISE Program

Evaluating New Technologies for Road Program Initiatives in Safety and Efficiency
ENTERPRISE Program

Goals

• Facilitate rapid progress in the development and deployment of ITS technologies
• Accelerate systematic advancement of selected ITS projects

Collaboration of transportation agencies: Members carry out ITS projects including fundamental research, technology development, demonstration, standardization and deployment.

enterprise.prog.org
ENTERPRISE Program

Members

- Georgia DOT
- Illinois DOT
- Iowa DOT
- Kansas DOT
- Michigan DOT
- Minnesota DOT
- Oklahoma DOT
- Pennsylvania DOT
- Texas DOT
- Ontario Ministry of Transportation
- Transport Canada
- FHWA
Background:
- Construction information is often manually entered into Road Condition Reporting Systems and ATMS Systems, for display on 511 websites, DMS, etc.
- Arrow boards designating lane closures in the field display the most current information to approaching motorists

Objective:
- Develop an ITS solution that integrates active work zone notifications (lane closures from arrow boards) into agency traveler information dissemination systems
  - Phase 1: Systems Engineering - underway
  - Phase 2: Demonstration and Evaluation – to be completed in a future phase
Portable Arrow Board indicates lane closure.

Location & message:

"Event" created.

Road condition reporting system:

"LEFT LANE CLOSED ON HWY “ABC” AT MP ##”

Connected vehicles:

511 Phone & Web

Mobile Apps

Social Media

Connected Vehicles
Portable Arrow Board
Indicates Lane Closure

Location & Message
"Event" created

Road Condition Reporting System

"LEFT LANE CLOSED ON HWY "ABC" AT MP #" 

Advanced Traffic Management System

DMS

511 Phone & Web
Mobile Apps
Social Media
Connected Vehicles
Portable Arrow Board
Indicates Lane Closure

Road Condition Reporting System

"Event" created

Location & Message

Advanced Traffic Management System

Database

DMS

"LEFT LANE CLOSED ON HWY "ABC" AT MP ##"

511 Phone & Web
Mobile Apps
Social Media
Connected Vehicles

ENTERPRISE
# Multi-Agency Project Team

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Area(s) of Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cory Johnson</td>
<td>Minnesota DOT</td>
<td>ITS</td>
</tr>
<tr>
<td>Luke Biernbaum</td>
<td>Michigan DOT</td>
<td>ITS</td>
</tr>
<tr>
<td>Willy Sorenson</td>
<td>Iowa DOT</td>
<td>Safety &amp; ITS</td>
</tr>
<tr>
<td>John McCellan</td>
<td>Minnesota DOT</td>
<td>TMC Operations</td>
</tr>
<tr>
<td>Kelly Braunig</td>
<td>Minnesota DOT</td>
<td>Traveler Information</td>
</tr>
<tr>
<td>Sinclair Stolle</td>
<td>Iowa DOT</td>
<td>Traveler Information</td>
</tr>
<tr>
<td>Chris Brookes</td>
<td>Michigan DOT</td>
<td>Work Zones</td>
</tr>
<tr>
<td>Kristi Ericksen</td>
<td>Kansas DOT</td>
<td>Work Zones</td>
</tr>
<tr>
<td>Sheila Johnson &amp; Dave Tody</td>
<td>Minnesota DOT</td>
<td>Work Zones</td>
</tr>
<tr>
<td>Angie Kremer</td>
<td>Michigan DOT</td>
<td>Work Zones and TIM</td>
</tr>
<tr>
<td>Roy Hulli</td>
<td>Ontario Ministry of Transportation</td>
<td>ITS</td>
</tr>
<tr>
<td>Doug Tomlinson</td>
<td>PennDOT</td>
<td>ITS/TMC Operations</td>
</tr>
<tr>
<td>Tim Simodynes</td>
<td>Iowa DOT</td>
<td>ITS/TMC Operations</td>
</tr>
</tbody>
</table>
Systems Engineering Process and Outcomes

• **Systems Engineering Process**
  – Variety of agencies and expertise areas on Project Team
  – Input from Project Team via webinars and a workshop in Aug. 2016

• **Products to be Developed**
  – “Model” Concept of Operations & “Model” System Requirements
  – Designed to be customized for agency-specific deployments

• **Phase 2 Demonstration**
  – Several ENTERPRISE agencies interest in participating
    » Construction Lane Closures
    » Mobile Maintenance Operations
  – Evaluation to be conducted by ENTERPRISE
Project Information and Contacts

For more information:

» Visit the project web page at: www.enterprise.prog.org

» ENTERPRISE Project Champion:
  Cory Johnson, Minnesota DOT - Coryj.Johnson@state.mn.us

Chris Brookes, Michigan DOT
  BrookesC@michigan.gov
  517-242-6486

Video