Mobility Applications for Connected Vehicle Data: Policy Workshop

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Overview

- Mobility Program and High-Priority Applications
- SAE J2735 Basic Safety Message (BSM) Fundamentals
- Current Mobility-Related BSM Assessment
- Next Steps in BSM Assessment
Mobility Program

Real-time Data Capture and Management

- Vehicle Status Data
- Infrastructure Status Data
- Weather Data
- Truck Data
- Transit Data
- Location Data

Dynamic Mobility Applications

- Reduce Speed 35 MPH
- Transit Signal Priority
- Weather Application
- Fleet Management/Dynamic Route Guidance
- Signal Phase & Timing Adjusts Real-Time Conditions
- Safety Alerts and Warnings

Data Environment
High-Priority Dynamic Mobility Applications

“INFLO” Application Bundle
- Coordinated Adaptive Cruise Control
- Speed Harmonization
- Queue Warning

“M-ISIG” Application Bundle
- Intelligent Traffic Signal System
- Transit Signal Priority
- Mobile Accessible Pedestrian Signal System

“R.E.S.C.U.M.E” Application Bundle
- Emergency Communications and Evacuation
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders
- Incidents Scene Work Zone Alerts for Drivers and Workers
High-Priority Dynamic Mobility Applications (2 of 2)

“IDTO” Application Bundle
- Transit Connection Protection
- Dynamic Transit Operations
- Dynamic Ridesharing

“FRATIS” Application Bundle
- Freight Traveler Information

“EnableATIS” Application Bundle
- Traveler Information

- Next Generation Integrated Corridor Management
## FOUNDATIONAL ANALYSIS PHASE 1

- **Organizing and Utilizing Connected Vehicle Data**
  - Develop Research Data Exchange
  - Prototype Data Environment

## RESEARCH, DEVELOPMENT & TESTING PHASE 2

- **Defining, Prototyping and Testing Applications**
  - Determine Application Data and Communications Needs
  - Applications Identification
  - Application Prototyping and Testing
  - CONOPS

- **Real-World Application Demonstrations**
  - Safety Pilot Model Deployment
  - Demo Coordination Planning
  - Other Demonstrations (e.g., FDOT)

- **Role of Standards**
  - Standards Planning and Development

- **Mobility Benefits Evaluation**
  - Define Mobility Measures
  - Develop and Refine Tools/Analytics For Impacts Assessment
  - Assess App. Impact -- Models
  - Assess App. Impact -- Demos

- **BSM Assessment**
  - BSM Assessment/OEM Engagement

## DEMONSTRATION PHASE 3

- **Phase 3 Demonstration(s)**
  - Data to RDE

### LEGEND:
- **RDE**
- **Data Feed**
- **Mobility Applications**
- **Research Data Exchange**
- **Data Environment**
- **Decision Point**
- **BSM Assessment Papers**
- **Final Key Activity**
- **Informing BSM Assessment**
Basic Safety Message (BSM) Fundamentals

- Connected V2V safety applications are built around the SAE J2735 BSM, which has two parts
  - BSM Part 1:
    - Contains the core data elements (vehicle size, position, speed, heading acceleration, brake system status)
    - Transmitted approximately 10x per second
  - BSM Part 2:
    - Added to part 1 depending upon events (e.g., ABS activated)
    - Contains a variable set of data elements drawn from many optional data elements (availability by vehicle model varies)
    - Transmitted less frequently
  - No on-vehicle BSM storage of BSM data
  - The BSM is transmitted over DSRC (range ~1,000 meters)

- The BSM is tailored for low latency, localized broadcast required by V2V safety applications
Mobility Programs: BSM Assessment Activity

- Assess the extent to which the BSM supports or enables mobility applications
  - To what degree is a DSRC-based BSM Part 1 message critical to realizing transformative benefits from mobility applications?
  - What key elements of BSM Part 2 or other vehicle-based data might be needed? Where and how often?
  - Can other messages tailored for cellular communication augment a DSRC-based BSM?
  - As we add data from mobile devices and fixed sensors, how much improvement do we see in application effectiveness?
Role of BSM Part 1 Via DSRC In Support of Mobility Applications

- BSM Part 1 via DSRC provides the vehicle data needed to support a few mobility applications that require low latency and localized broadcast exchange
  - Cooperative Adaptive Cruise Control
  - Queue Warning

- These applications will likely be successful wherever DSRC-capable roadside infrastructure (RSEs) is deployed
  - Key intersections
  - Major interchanges
Key Elements of BSM Part 2 Needed for Mobility Applications

- BSM Parts 1 and 2 via DSRC provides the vehicle data needed to support some localized mobility applications

<table>
<thead>
<tr>
<th>MOBILITY APPLICATIONS (where roadside units deployed)</th>
<th>KEY PART 2 DATA ELEMENTS TO SUPPLEMENT PART 1 DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cooperative Adaptive Cruise Control</td>
<td>- Weather Data (with examples)</td>
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<tr>
<td>- Speed Harmonization</td>
<td>- Ambient Temperature</td>
</tr>
<tr>
<td>- Queue Warning</td>
<td>- Ambient Air Pressure</td>
</tr>
<tr>
<td>- Transit Signal Priority</td>
<td>- Traction Control Status</td>
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<tr>
<td>- Incident Scene Work Alerts</td>
<td>- Wiper Status</td>
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<tr>
<td>- Emergency Road-Weather Conditions (Diagnosis/Prediction)</td>
<td>- Vehicle Data (with examples)</td>
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<td>- Exterior Lights Status</td>
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<td></td>
<td>- Type</td>
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<td></td>
<td>- Antilock Brake System Status</td>
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</tbody>
</table>

- HOWEVER: DSRC link burdened by redundant Part 2 elements
Using Cellular Messages to Augment BSM for Mobility Applications

- Most mobility applications do not require BSMs 10 times per second
- Many applications require data captured over a wide area, not just localized data near a roadside unit (storage and/or wide-area communications needed)

Possible Approach:
- Vehicles transmit BSM Part 1 plus key Part 2 elements less frequently
- Transmit via DSRC when available, Cellular otherwise

Augmenting BSM with key Part 2 elements via Cellular provides the vehicle data needed to support nearly all mobility applications

- Cooperative Adaptive Cruise Control
- Speed Harmonization
- Queue Warning
- Intelligent Traffic Signal System
- Transit Signal Priority
- Mobile Accessible Pedestrian Signal System
- Emergency Communications and Evacuation
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders
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- Traveler Information
Basic Safety Message
(or other message, such as probe data)
1 & 2+, at a regular interval via cellular

Basic Safety Message 1 & 2 via DSRC, at a regular interval

Mobility and environmental services

Even more mobility and environmental services

More mobility and environmental services
Summary of Initial Assessment: BSM and Mobility Applications

- The Mobility Program (DCM/DMA) is currently engaged in a research program intended to identify:
  - Key Part 2 and other vehicle-based data elements required by high-priority mobility applications
    - Required frequency and latency
    - Likelihood of OEMs to make this data available publicly
  - Requirements for data storage on vehicles
  - Identify potential targeted use of triggers to reduce data redundancy
  - In conjunction with the safety/policy program, identify business and financial models to support deployment
  - Examine vehicle data needs in light of additional data from mobile devices and fixed sensors
Mobility Program: Schedule of BSM-Related Next Steps

- Updates to BSM Role Assessment Research
  - May 2012: Application ConOps Update
  - September 2012: BSM Data Analysis Update
  - May 2013: Impacts Assessment Update

- Specific Stakeholder Engagement to Date
  - OEM Engagement – through VIIC
  - AASHTO Engagement – through Pooled Fund Study/AASHTO Working Group
  - Policy Workshop Presentation

- Specific BSM Data Analysis
  - Obtaining Safety Pilot Model Deployment Data
  - Will Conduct Mobility-related Technology Testing
What’s Next and Contacts

- DMA Application Concepts of Operations Coming Soon
- Data Capture and Management Research Data Exchange

MOBILITY Workshop, May 24, Washington, DC

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- Many FHWA, FTA, and FMCSA staff supporting the programs.