Addressing Rural Challenges: Technology and Connected Vehicles

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CHALLENGES WE FACE

- Congestion
- Safety
- Travel and Transit Reliability
- Expanded Traveler Information
- Truck Parking (I-15 / I-80 / I-70)
- Managing Freight Movements
- Winter Inversion / Poor Air Quality
- Specific Road Weather Information
- Reliable / Real-time Construction Information

CONNECTED VEHICLE TECHNOLOGY CAN HELP US
OVERVIEW

• New Technologies:
  – Automated vs. Connected Vehicles
  – What is Happening, and Where?

• Connected Vehicle Applications
  – Early Applications
  – Rural Applications

• Tools and Resources
Electricity may be the driver. One day your car may speed along an electric super-highway, its speed and steering automatically controlled by Bosch.
Automated Features:
- LiDAR
- Digital Imagery
- Radar
- GPS

Open Road Testing in:
- Mountain View CA, Phoenix, Austin, Kirkland WA
- 1.5 million self-driving miles
VEHICLE AUTOMATION

THE TRANSITION BETWEEN PARTIALLY AND HIGHLY AUTOMATED DRIVING REPRESENTS A MAJOR STEP.

<table>
<thead>
<tr>
<th>Driver performs longitudinal AND lateral control at all times.</th>
<th>Driver performs longitudinal OR lateral control at all times.</th>
<th>Driver must actively monitor the system at all times.</th>
<th>Driver no longer needs to actively monitor the system.</th>
<th>Longitudinal and lateral control tasks are performed entirely by the vehicle, within specific applications. The driver does not need to monitor the system.</th>
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<tbody>
<tr>
<td>e.g. Speed Limit Info</td>
<td>e.g. Parking Assistant</td>
<td>e.g. Traffic Jam Assistant</td>
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<td>No actuated assistance systems.</td>
<td>The other (longitudinal or lateral) control task is performed by the vehicle. (for a certain period of time and/or in specific situations).</td>
<td></td>
<td></td>
<td>Longitudinal and lateral control tasks are performed by the vehicle (for a certain period of time and/or in specific situations).</td>
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Regulated by law and introduced into the market.  

Not regulated by law and under research.  

**Diagram:**

- **Driver only**  
- **Assisted**  
- **Partially automated**  
- **Highly automated**  
- **Fully automated**  

(Source: BASI Working Group 2012)
EXISTING AUTOMATED APPLICATIONS

• Lane Departure Warnings / “Lane Assist”
• Adaptive Cruise Control
  – Freeway Driving: automated braking, acceleration, lane change
• Collision Warning
• Automated braking
• Unoccupied self parking
“By the time we get to the autonomous vehicle, it won’t be that big of a deal”

- Bill Ford,
  Executive Chairman, Ford Motor Co
The Connected Vehicle system will combine technologies:
- advanced roadside infrastructure,
- wireless communications,
- advanced vehicle sensors,
- onboard computer processing, and

- to provide vehicles the capability to detect threats and hazards on the roadway and to communicate this to the driver through alerts and warnings.
Could potentially address up to 80% of non-impaired driver crash scenarios
Connected Automation for Greatest Benefits

**Autonomous Vehicle**
Operates in isolation from other vehicles using internal sensors

**Connected Vehicle**
Communicates with nearby vehicles and infrastructure

**Connected Automated Vehicle**
Leverages autonomous and connected vehicle capabilities
WHEN WILL THESE CHANGES TAKE PLACE?

• Today – Automated features on many new cars
• 2017 – GM to have DSRC on luxury models
• 2020 – Google / Ford driverless car available
• 2020 – DSRC on all new light vehicles
• 2020 – Highly automated car available (BMW)
• 2025 – Fully automated car available (Bosch)
• 2035 – Most cars will have DSRC on board
<table>
<thead>
<tr>
<th>CONNECTED VEHICLE APPLICATIONS</th>
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<tr>
<td><strong>V2I Safety</strong></td>
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<tr>
<td>Red Light Violation Warning</td>
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<tr>
<td>Curve Speed Warning</td>
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<tr>
<td>Stop Sign Gap Assist</td>
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<tr>
<td>Spot Weather Impact Warning</td>
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<tr>
<td>Reduced Speed/Work Zone Warning</td>
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<tr>
<td>Pedestrian in Signalized Crosswalk Warning (Transit)</td>
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<tr>
<td><strong>V2V Safety</strong></td>
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<tr>
<td>Emergency Electronic Brake Lights (EEBL)</td>
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<td>Forward Collision Warning (FCW)</td>
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<tr>
<td>Intersection Movement Assist (IMA)</td>
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<tr>
<td>Left Turn Assist (LTA)</td>
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<tr>
<td>Blind Spot/Lane Change Warning (BSW/LCW)</td>
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<tr>
<td>Do Not Pass Warning (DNPW)</td>
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<tr>
<td>Vehicle Turning Right in Front of Bus Warning (Transit)</td>
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<tr>
<td><strong>Environment</strong></td>
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<tr>
<td>Eco-Approach and Departure at Signalized Intersections</td>
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<tr>
<td>Eco-Traffic Signal Timing</td>
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<td>Eco-Traffic Signal Priority</td>
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<tr>
<td>Connected Eco-Driving</td>
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<td>Wireless Inductive/Resonance Charging</td>
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<td>Eco-Lanes Management</td>
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<td>Eco-Speed Harmonization</td>
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<td>Eco-Cooperative Adaptive Cruise Control</td>
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<td>Eco-Trader Information</td>
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<td>Eco-Ramp Metering</td>
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<tr>
<td>Low Emissions Zone Management</td>
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<tr>
<td>AFV Charging / Fueling Information</td>
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<tr>
<td>Eco-Smart Parking</td>
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<tr>
<td>Dynamic Eco-Routing (light vehicle, transit, freight)</td>
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<tr>
<td>Eco-ICM Decision Support System</td>
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<tr>
<td><strong>Mobility</strong></td>
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<tr>
<td>Advanced Traveler Information System</td>
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<tr>
<td>Intelligent Traffic Signal System (I-SIG)</td>
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<tr>
<td>Signal Priority (transit, freight)</td>
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<td>Mobile Accessible Pedestrian Signal System (PED-SIG)</td>
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<tr>
<td>Emergency Vehicle Preemption (PREEMPT)</td>
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<tr>
<td>Dynamic Speed Harmonization (SPD-HARM)</td>
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<td>Queue Warning (Q-WARN)</td>
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<td>Cooperative Adaptive Cruise Control (CACC)</td>
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<td>Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)</td>
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<tr>
<td>Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)</td>
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<td>Emergency Communications and Evacuation (EVAC)</td>
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<td>Connection Protection (T-CONNECT)</td>
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<td>Dynamic Transit Operations (T-DISP)</td>
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<td>Dynamic Ridesharing (D-RIDE)</td>
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<td>Freight-Specific Dynamic Travel Planning and Performance</td>
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<td>Drayage Optimization</td>
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<td><strong>Agency Data</strong></td>
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<td>Probe-based Pavement Maintenance</td>
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<td>Probe-enabled Traffic Monitoring</td>
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<td>Vehicle Classification-based Traffic Studies</td>
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<td>CV-enabled Turning Movement &amp; Intersection Analysis</td>
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<td>CV-enabled Origin-Destination Studies</td>
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<td>Work Zone Traveler Information</td>
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<tr>
<td><strong>Smart Roadside</strong></td>
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<td>Wireless Inspection</td>
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<td>Smart Truck Parking</td>
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Question 3: CV Applications Included in Agencies Plans or Proposals for Deployment
(Top 11 Applications Selected; # of Responders = 21)

- Road Weather
- Motorist Alert and Incident Scene Work Zone Alerts
- Queue Warning
- Speed Harmonization
- Vehicle Data for Traffic Operations
- Emergency Vehicle Preemption
- Intelligent Traffic Signal System
- Signal Phase and Timing
- Curve Speed Warning
- Warnings about Hazards in a Work Area
- Warnings about Upcoming Work Area

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Top 11 Applications Selected; # of Responders = 21
RURAL CONNECTED VEHICLE APPLICATIONS

- Freight Mobility
  - Truck Parking (Michigan)
  - Winter Driving Conditions / Information
  - Traveler Information including crashes
  - Inspection / Regulatory
  - Technology, such as Platooning
  - Probe / Data sharing
RURAL CONNECTED VEHICLE APPLICATIONS

- Weather Information and Warnings
  - Snow Plows as mobile cameras and probes
  - Variable Speed Limit (Wyoming)
- Work Zones
  - Lane Closure Information / Work Zone Traveler Information
  - Worker Safety
- Safety Information
  - Bridge Height
  - Curve Speed Warnings
  - Queue Warnings
RURAL CONNECTED VEHICLE APPLICATIONS

Wyoming Pilot Idea

Source: Wyoming CV Pilot Comprehensive Deployment Plan Webinar
UTAH APPLICATION DEPLOYMENTS

• Multi-modal Intelligent Traffic Signal System (MMITSS)
  – Urban signalized intersection application

• Rural Weather Probes
  – US-40 to SLC

• Truck Platooning
  – Peloton
CONNECTED VEHICLES

• What investments could be made to leverage a nationwide fleet of equipped vehicles in support of state and local policy and operational objectives including safety?

• Important issues for state and local agencies:
  – What the deployment decision could mean to you
  – How do you get started?
  – What you need to know to prepare for the emerging connected vehicle environment
TOOLS AND RESOURCES

The Connected Vehicle - Next Generation ITS

The Real "Car Talk" - Vehicles that Can Communicate with Each Other

The U.S. DOT Research and Innovative Technology Administration (RITA) ITS Joint Program Program Office (ITS JPO) is the major sponsor of the Connected Vehicle program. Connected Vehicle focuses on localized Vehicle-to-Vehicle, Vehicle-to-Infrastructures and Vehicle-to-Device Systems (V2X) to support safety, mobility, and environmental applications using Vehicle Dedicating Short Range Communications (DSRC) Wireless Access for Vehicular Environments (WAVE). This program has support from most of the automakers and a number of state departments of transportation.

The ITS America Connected Vehicle Task Force addresses a number of challenges and explores opportunities to achieve deployment of short range vehicle-to-X safety, and mobility applications and related wireless communications-based intelligent transportation systems. Issues examined include technical risks such as ensuring interoperability, information security and institutional risks such as addressing liability and privacy issues, meeting stakeholder needs, and ensuring system sustainability.

The ITS America Connected Vehicle Task Force does this through dialogue with industry and public sector members, focusing on the challenges of establishing viable public-private partnerships and business models. These models are ones that make deployment attractive for both industry and the public sector, that ensures long term technical support and implementation, and assist USDOT, the FCC and state and local authorities in establishing leadership and governance models.

With the globalization of the auto-industry and active vehicle communications research programs in other countries, ITS America Connected Vehicle Task Force also seeks cooperation and the sharing of lessons learned through international partnerships with association counterparts such as ITS Japan, ITS Canada, Europe’s ERTICO, and their stakeholders.

ITS America and the ITS America Connected Vehicle Task Force also interfaces with the Transportation Research Board (TRB), the Institute of Transportation Engineers (ITE), the American Association of State Highway Transportation Officials (AASHTO), the International Road Federation (IF), the Society of Automotive Engineers (SAE), the Consumer Electronics Association (CEA) and CTIA - The Wireless Association, among others. The Task Force also works to...
AASHTO Footprint Analysis

- A vision of a national CV infrastructure
- Guidance on:
  - Regional & Nat’l Infrastructure Needs
  - Illustrations of typical deployments
  - System and equipment needs
  - Siting requirements
  - Operations & maintenance issues
  - Deployment cost estimates

http://stsmo.transportation.org/Pages/connected_vehicles_new.aspx
TOOLS AND RESOURCES

- FHWA Deployment Guidance
- Planning
- Procurement
- Benefit Cost Analysis
- Interoperability
- Communication Technology
- Hardware Certification
- Security Management / Data Access / Privacy
- Legacy Systems
- Systems Engineering Process
- Deployment Guidelines / Best Practices

Help communities prepare for connected vehicles
Available late 2016
GETTING INVOLVED

- **AASHTO Connected and Automated Vehicle Working Group**
  - Within the STSMO structure
- **Connected Transportation System Pooled Fund Study**
  - Lead state: Virginia DOT
- **V2I Deployment Coalition**
  - Joint effort of AASHTO, ITS-America, ITE
  - Five technical working groups
- **ITS-America Connected Vehicle Task Force**
- **ITE Connected Vehicle Task Force**
AASHTO & V2I Deployment Coalition Effort

Encourage agencies to deploy DSRC – broadcasting the “signal phase and timing” message – on their corridors

20 Signals along a corridor in each state

Spur Deployment
• Connected and Automated Vehicle Technologies can – and will – help improve rural safety and traveler information
• There are resources to help us begin deployments
• There is no better time than now
QUESTIONS / DISCUSSION