Example CV Pilot Deployment Concepts:
District 13 Operations

Gabe Guevara (FHWA)
District 13 Operations

District 13 – State DOT:
- Three-county district in Northern U.S.
- Winter season focused on snow removal, significant and frequent snowfall each season
- Summer season focused on pavement assessment and maintenance/repair
- Work zones coincide with increased summer travel, causing delays
Stakeholders Convene and Identify Key Transportation Challenges

- **Improve Efficiency of Snow and Ice Operations**
  - Frequent snow falls during winter season increasingly costly while maintenance budgets continue to shrink
    - Optimize the use of materials and resources
    - Improve LOS Improve “Regain-time”
    - Improve safety and mobility (WRTM)
    - Conduct winter maintenance operations in a sustainable fashion
  - Reduce fuel costs of plowing operations

- **Improve Pavement Maintenance**
  - Leverage technology to identify and classify pavement issues before they become critical without significant increases in operating costs

- **Improve Work Zone Planning and Management**
  - Unpredictable congestion during summer months due to concurrent roadwork and tourism
  - Plan work zones better to reduce delays
  - Improve traveler information on congestion resulting from work zones
  - Improve work zone safety of workers and travelers
### Stakeholder Set Three Key Improvement Targets

<table>
<thead>
<tr>
<th>Goal</th>
<th>Performance Measure</th>
<th>Performance Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase snow removal efficiency</td>
<td>Snow removal time and plowing operations costs</td>
<td>Reduce snow removal time by 10% while lowering plowing operations costs 10% (fuel, materials, labor, etc.)</td>
</tr>
<tr>
<td>Improve ridability experience</td>
<td>Number of customer calls regarding dangerous pot holes on roads</td>
<td>Reduce number of customer calls regarding dangerous pot holes on roads by 25%</td>
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<tr>
<td>Reduce work zone delay</td>
<td>Number of work zone crashes and delay during summer season</td>
<td>Cut work zone crashes and delay by 80% and 30% respectively during summer season</td>
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### Applications Considered for Improving Snow Removal

#### V2I Safety
- Red Light Violation Warning
- Curve Speed Gap Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

#### V2V Safety
- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

#### Environment
- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Smart Traffic Signal Prioritization
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

#### Mobility
- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization

#### Agency Data
- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

#### Smart Roadside
- Wireless Inspection
- Smart Truck Parking
Applications Considered for Improving Pavement Maintenance

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Situational Awareness/Enhanced Ride Experience

Motorist Advisories and Warnings (MAW)
Enhanced MDSS
Vehicle Data Translator (VDT)
Weather Response Traffic Information (WxTINFO)

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Road Weather

- Eco-Approach and Departure at Signalized Intersections
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Manage Work Zones

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U.S. Department of Transportation
ITS Joint Program Office
## Connected Vehicle Applications Selected in Performance-Driven Approach

### Improve Snow Removal
- Enhanced Maintenance Decision Support System

### Improve Situational Awareness
- Probe-based Pavement Maintenance

### Improve Management of Work Zones
- Work Zone Traveler Information
Projected Synergies and Impacts from Snow Removal Applications in the Deployment Concept

Addition of Snow Removal Apps

- Enhanced MDSS

Projected Impacts:

- Plow fleet shares data on visibility, temperature, road conditions, and treatment recommendation
- Reduced snow removal time (10%)
- More effective application of anti-icing agents
- Reduced fuel consumption for snow plows (10%)
- Reduced emissions from snow plows
- Decrease in crashes due to unplowed and icy roads
Projected Synergies and Impacts from Pavement Management Applications in the Deployment Concept

Projected Impacts:
- Automatic reporting of road maintenance needs decreases customer calls by 25%
- Decrease in crashes due to poor pavement conditions
- Better detection of pavement maintenance needs results in faster repairs and reduced lane closures
- Decreased time of lane closures, reduces congestion and worker safety concerns

Addition of Pavement Management Apps
- Probe-based Pavement Maintenance
Projected Synergies and Impacts from Work Zone Applications in the Deployment Concept

Projected Impacts:

- State vehicles act as traffic probes, integrated with private sector probe data
- Better traveler information regarding work zones results in a 30% increase in travel time reliability
- Travelers can adjust their travel patterns based on more reliable traveler information
- Fewer vehicles traveling through work zones reduces congestion and improves worker safety
Integrated Concept for District 13 Operations

State maintenance vehicles act as probes for weather data, congestion data, and pavement data.

Compatible communications leveraged in both snow and work zone seasons, reducing costs.

Information from vehicles and infrastructure are sent to TMC.

TMCs receive messages for several applications.