Future of Transportation

Planning for Connected Automated Vehicles in Smart Cities

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Egan Smith P.E. PTOE PTP
Managing Director, Intelligent Transportation System Joint Program Office (ITS JPO)
U.S. Department of Transportation (USDOT)
ITS Strategic Plan 2015-2019

http://its.dot.gov/strategicplan/index.html
VISION

Transform the Way Society Moves

Conduct research, development, and education activities to facilitate the adoption of information and communication technology to enable society to move more safely and efficiently.
USDOT Action – “Facilitate the appropriate consideration of Connected Vehicles in transportation planning activities carried out by States, MPOs and local agencies”

- How should connected vehicles be considered across a range of planning activities?
- What changes are needed in techniques, tools, supporting data, organizational skills and expertise?
- What new stakeholders will be involved and how will the role of existing stakeholders change?
- How will needs vary in different contexts?
Imagine a Transportation System in which
VEHICLES CAN SENSE
Things That You Can’t.
Connected Vehicles (CV) are vehicles that can communicate with
- each other (V2V)
- roadside devices (traffic signals) (V2I),
- or non-motorized users (smart phones and other advanced devices) (V2X)
AUTONOMOUS VEHICLES

- Autonomous & Driverless Car
  - Array of sensors to detect other vehicles and obstacles
  - Requires Detailed map
  - Use machine learning to make software smarter
  - Doesn’t rely on communication with other vehicles

Google’s automated vehicle
Innovation Through Technology

- **Technologies available today:**
  - Adaptive Cruise Control
  - Lane-Keeper Assistance
  - Braking Assistance

- **In the near-term:**
  - Connected Automated Cruise Control (CACC)
  - Vehicle Platooning
  - Speed Harmonization
  - Cooperative Merging
Connectivity is critical to achieving the 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.
- Technologies will advance – and roles will change
  - As an example, the relationship between connected and automated will evolve and change as it matures.
- Planners don’t need to know “guts” of technology but need to track developments
  - Conceptual knowledge of systems and technological readiness
  - Timeframes for implementation (is implementation referring to technology or project?)
  - Funding – who pays and how?
  - Societal/organizational impacts
  - Adapting to disruption in both public and private sectors
  - Understand data outputs to support planning needs
The Planning Process

- Where do we/you want to go?
- How are we/you going to get there?
- What will it take?
- How did we do?
Where do we/you want to go?
...Where do we/you want to go?

- Today
- Future CV Environment
Transportation Challenges

**Safety**
- 32,675 highway deaths in 2014
  - 6.1 million crashes in 2014
  - Leading cause of death for ages 11, 16-24

**Mobility**
- 6.9 billion hours of travel delay
- $160 billion cost of urban congestion

**Environment**
- 3.1 billion gallons of wasted fuel
- 56 billion lbs of additional CO₂

Data Sources:
Quick Facts: 2014 Data, National Highway Traffic Safety Administration (January 2016); 2015 Annual Urban Mobility Report, Texas Transportation Institute (Aug 2015); Centers for Disease Control
<table>
<thead>
<tr>
<th>V2I Safety</th>
<th>Environment</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Light Violation Warning</td>
<td>Eco-Approach and Departure at Signalized Intersections</td>
<td>Advanced Traveler Information System</td>
</tr>
<tr>
<td>Curve Speed Warning</td>
<td>Eco-Traffic Signal Timing</td>
<td>Intelligent Traffic Signal System (I-SIG)</td>
</tr>
<tr>
<td>Stop Sign Gap Assist</td>
<td>Eco-Traffic Signal Priority</td>
<td>Signal Priority (transit, freight)</td>
</tr>
<tr>
<td>Spot Weather Impact Warning</td>
<td>Connected Eco-Driving</td>
<td>Mobile Accessible Pedestrian Signal System (PED-SIG)</td>
</tr>
<tr>
<td>Reduced Speed/Work Zone Warning</td>
<td>Wireless Inductive/Resonance Charging</td>
<td>Emergency Vehicle Preemption (PREEMPT)</td>
</tr>
<tr>
<td>Pedestrian in Signalized Crosswalk Warning (Transit)</td>
<td>Eco-Lanes Management</td>
<td>Dynamic Speed Harmonization (SPD-HARM)</td>
</tr>
<tr>
<td>V2V Safety</td>
<td>Eco-Speed Harmonization</td>
<td>Queue Warning (Q-WARN)</td>
</tr>
<tr>
<td>Emergency Electronic Brake Lights (EEBL)</td>
<td>Eco-Cooperative Adaptive Cruise Control</td>
<td>Cooperative Adaptive Cruise Control (CACC)</td>
</tr>
<tr>
<td>Forward Collision Warning (FCW)</td>
<td>Eco-Traveler Information</td>
<td>Incident Scene Pre-Arrival Staging</td>
</tr>
<tr>
<td>Intersection Movement Assist (IMA)</td>
<td>Eco-Ramp Metering</td>
<td>Guidance for Emergency Responders (RESP-STG)</td>
</tr>
<tr>
<td>Left Turn Assist (LTA)</td>
<td>Low Emissions Zone Management</td>
<td>Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)</td>
</tr>
<tr>
<td>Blind Spot/Lane Change Warning (BSW/LCW)</td>
<td>AFV Charging / Fueling Information</td>
<td>Emergency Communications and Evacuation (EVAC)</td>
</tr>
<tr>
<td>Do Not Pass Warning (DNPW)</td>
<td>Eco-Smart Parking</td>
<td>Connection Protection (T-CONNECT)</td>
</tr>
<tr>
<td>Vehicle Turning Right in Front of Bus Warning (Transit)</td>
<td>Dynamic Eco-Routing (light vehicle, transit, freight)</td>
<td>Dynamic Transit Operations (T-DISP)</td>
</tr>
<tr>
<td>Agency Data</td>
<td>Road Weather</td>
<td>Dynamic Ridesharing (D-RIDE)</td>
</tr>
<tr>
<td>Probe-based Pavement Maintenance</td>
<td></td>
<td>Freight-Specific Dynamic Travel Planning and Performance</td>
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<tr>
<td>Probe-enabled Traffic Monitoring</td>
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<td>Driveage Optimization</td>
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<td>Vehicle Classification-based Traffic Studies</td>
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<tr>
<td>CV-enabled Turning Movement &amp; Intersection Analysis</td>
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<td></td>
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<td>CV-enabled Origin-Destination Studies</td>
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How are we/you going to get there?
73 miles of instrumented roadway with 27 roadside units in Ann Arbor, MI

Over 2,800 vehicles equipped with a variety of device types

Various V2V and V2I applications

Testing of prototype security mechanisms and device certification processes

One year of data collection to support 2013 NHTSA decision

Transitioned to an operational environment
September 2015, Secretary Foxx announced the CV Pilot Sites

New York City
Wyoming
Tampa, FL
CV PILOT DEPLOYMENT PROGRAM GOALS

Spur Early CV Tech Deployment
Wirelessly Connected Vehicles
Mobile Devices
Infrastructure

Measure Deployment Benefits
Safety
Mobility
Environment

Resolve Deployment Issues
Technical
Institutional
Financial
New York City DOT

Jonathan Walker (FHWA), NYCDOT CV Pilot Site COR
NYCDOT PILOT DEPLOYMENT SITE

Manhattan Grid
- Closely spaced intersections (600’ x 250’)
- Day vs. Night conditions
- Residential/commercial mix
- High accident rate (red dot) (2012-2014)
  - 20 fatalities
  - 5,007 injuries
- 204 intersections

Central Brooklyn – Flatbush Ave
- Over-Height restrictions
  - Tillary St.; Brooklyn Bridge
- High accident rate (red dots) (2012-14)
  - 1,128 injuries
  - 8 fatalities
- Average AM speed 15 mph
- 35 intersections

Manhattan – FDR Drive
- Limited access highway
- Excludes trucks/buses
- Short radius of curvature
- Over-Height restrictions
- $1,958,497 in Over-Height incident delay costs (2014)
  - 24% of City-wide total

Source: NYC DOT
Govind Vadakpat (HRDO), Tampa (THEA) CV Pilot Site COR
Tampa (THEA) Pilot Deployment Site
An Overview of Downtown Tampa
Successful deployment begins with disciplined Concept Development and System Planning

- To mitigate technical, institutional, and financial risk
- To design and deploy on schedule and within budget
- To routinely assess safety, mobility and environmental impacts
- To create long-term technical and financial sustainability

Leverage Material from the CV Pilots (on-line)

- Tasks and deliverables
- Guidance and technical assistance material (e.g., on-line webinars)
- Examples from 3 Pilot Sites
- Available @ http://www.its.dot.gov/pilots/index.htm
THE BIG PICTURE
Smart City

“A city that uses information and communications technology to enhance its livability, workability, and sustainability.”

The Smart Cities Council
The Smart City Challenge

$500 million in partnerships identified in by the seven Smart City Challenge Finalists

150+ partnerships identified by the Smart City Challenge Finalist

78 applications received for the Smart City Challenge

7 Smart City Challenge Finalists announced in March 2016

1 Smart City Challenge Winner

#DOTSmartCity
www.transportation.gov/smartcity
Connected Vehicle Technology for Mobility

**ALTERNATE TRAVEL OPTIONS AVAILABLE**

- **Metro**: 12 min
  - Blue line to Largo: 8:02 AM
  - Blue line to Largo: 8:22 AM
- **Car**: 24 min
- **Via 798 West**: 8:16 AM
  - Via Fleetwood Ave: 8:31 AM
- **Bus**: 32 min
  - Bus 16C West: 8:22 AM
  - Bus 23D West: 9:12 AM
- **Bike**: 1 hour, 15 min
  - Via Rockwood Trail: 9:05 AM

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**DYNAMIC TRANSIT OPERATIONS**
OUR VISION
What will it take?
Other Initiatives Advancing Smart Cities

- **Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD)**
  - $56.6 million awarded to 8 projects.
  - Up to $60M in funding available annually between 2016 and 2020.

- **Mobility on Demand (MOD) Sandbox**
  - $8 million awarded to 11 projects that will use innovative public-private partnerships to demonstrate and evaluate on-demand concepts in transit.

- With twenty (20) communities moving forward with almost $350 million in advanced technology investments, the U.S. DOT is leading a national conversation about how to revolutionize our transportation system.
Keys to the Federal-Aid Program – Through the Planning Process
<table>
<thead>
<tr>
<th>National Highway Performance Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Transportation Block Grant Program</td>
</tr>
<tr>
<td>Transportation Alternatives Set-aside</td>
</tr>
<tr>
<td>Recreational Trails Program Set-aside</td>
</tr>
<tr>
<td>Surface Transportation Block Grant Program (net of TA &amp; Rec Trails)</td>
</tr>
<tr>
<td>Congestion Mitigation &amp; Air Quality Improvement</td>
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<tr>
<td>Highway Safety Improvement Program</td>
</tr>
<tr>
<td>Railway-Highway Crossings Program</td>
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<tr>
<td>Metropolitan Planning</td>
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<td>National Highway Freight Program</td>
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</tbody>
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Potential Benefits of ITS – Key Solution

- **Safety.** The injuries and fatalities of both vehicle occupants and vulnerable road users will be reduced and mitigated.
- **Mobility.** The information about travel conditions and options for both system users and operators will be increased and improved.
- **Environment.** The impact of vehicle travel will be reduced by promoting greener transportation choices and driver/vehicle behavior.
- **Data.** New and cost-effective data sources and collection methods will be introduced that will improve asset management, network operations, just-in-time maintenance, and incident response, among other functions.

**Benefits are expected to grow over time as more vehicles, infrastructure and travelers are equipped.**
**Typical Planning Products and Processes**

- Unified Planning Work Program
- Long-range visioning
- Metropolitan Transportation Plan
  - Statewide/regional long-range transportation plan
- Transportation Improvement Program
- Short-range transportation plan
- Congestion management plan
- Asset management plan
- ITS and operations plan
- ITS Architecture
- State implementation plan
- Strategic Highway Safety Plan
- Highway Safety Improvement Program
- Transit development plan
- Transportation demand management plan
- Non-motorized (bicycle and pedestrian) plan
- Corridor studies (modal or multimodal)
- Public participation/involvement plan
- Freight plans
- Financing plans
How did we do?
Performance Measurement

- Means of assessing the progress made towards attaining established goals
- Not just about data collection, verification, and cleaning but also about using the data to understand the system

Performance Monitoring

- Ongoing tracking of performance to assess if targets have been or likely to be met
- Enables system managers to take corrective and proactive actions to control and manage the system
- Allows system managers to understand the impacts of investments and policies

Performance Evaluation

- Systematic and objective examination of measures and outcomes to understand the impacts of investments and policies have on performance, thus improving current and future planning and investment decisions
- Conducted by an independent party who has no vested interest or stake in the project
LESSONS LEARNED IN CV PILOTS CONCEPT DEVELOPMENT PHASE

- Stakeholder interaction early and often
- Sites are eager to consume USDOT technical assistance
- Site-to-site coordination can be useful
- Building in performance measurement to a deployed system requires some serious thinking in the concept development phase
- We didn’t forget a key area in Phase 1 (so far), e.g., training or safety management
- The deliverables from the sites are creating examples for others to follow
- Concept development takes some time to conduct
- Using standards (intelligently) can help to advance sites systems engineering
Egan Smith
Managing Director, Intelligent Transportation System Joint Program Office (ITS JPO)
U.S. Department of Transportation (USDOT)
Email: Egan.Smith@dot.gov

ITS Pilot Deployments
www.its.dot.gov/its_deployments.htm

Smart City Challenge Website
www.transportation.gov/smartcity