What the Public Works Community Needs to Know about Connected Vehicles

PWX: Public Works Expo

Presentation Overview

- Our Transportation Challenges
- USDOT Multimodal Collaboration
- ITS Over the Past 20 Years
- Where We’re Headed – the ITS Strategic Plan
  - Connected Vehicles
  - Smart Cities
  - Deployment Resources
Today's Transportation Challenges

**Safety**
- 35,200 highway deaths in 2015
- 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:

In particular, in 2014 there were approximately...

- 8,664 fatalities at intersections
- 669 crashes in work zones
- 5,897 fatalities from weather-related crashes

Data Sources:
USDOT Modal Collaboration and Partnership

ITS Strategic Plan 2015-2019

http://its.dot.gov/strategicplan/index.html
Vision and Mission

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.

Strategic Plan
Program Categories

- Connected Vehicles: Focuses on adoption and deployment
- Automation: Focuses on automated road-vehicle systems that transfer some vehicle control from the driver to the vehicle
- Emerging Capabilities: Focuses on future generations of transportation systems
- Enterprise Data: Focuses on operational data capture from sensors, mobile devices, and vehicles, and applying data across all modes of transport
- Interoperability: Emphasizes effective connectivity among devices and systems
- Accelerating Deployment: Advances ITS work from adoption to wider scale deployment in coordination with multiple disciplines and stakeholders
Imagine a Transportation System in which VEHICLES CAN SENSE & COMMUNICATE Things That You Can't.
How Connected Vehicles Work

1. A wireless device in a car sends basic safety messages 10 times per second.
2. Other nearby cars and roadside equipment receive the messages.
3. Drivers get a warning of a potential crash.

Connected vehicles have the potential to reduce non-impaired crash scenarios by 80%.

*Source: NHTSA

Connected Vehicle Ecosystem

[Diagram showing various connected devices in a vehicle ecosystem]
Connected Vehicles
What can they do?

- Save lives by significantly reducing traffic accidents
- Make travel easier, more efficient, and more enjoyable
- Help curb pollution

Connected Infrastructure

Devices installed along the roadway capable of sending and receiving messages…and can interface with traffic control systems (e.g., traffic signal controllers)
Communication with Infrastructure Presents Tremendous Opportunities

The USDOT is developing V2I applications in areas such as:

- Signage/Intersections
- Work Zones
- First Response
- Road Weather
- Transit

Connecting Our Signage

Stop Sign Gap Assist
Connecting Our Work Zones

Connecting Our First Responders
Connecting Our Snow Plows

Connecting Our Transit

Transit Bus Stop Pedestrian Warning
Connecting Our Pedestrians

Pedestrian in Signalized Crosswalk Warning

Connecting Passengers and Public Transit

Connection Protection
### Safety Pilot Model Deployment Program

- 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
- 1 year of data collection to support 2013 NHTSA decision
- Transitioned to an operational environment
Connected Vehicle Pilot Deployment Program

**New York City**
- Improve safety and mobility of travelers in New York City through connected vehicle technologies.
- Vehicle-to-vehicle (V2V) technology installed in up to 10,000 vehicles in Midtown Manhattan, and vehicle-to-infrastructure (V2I) technology installed along high-accident rate arterials in Manhattan and Central Brooklyn.

**ICF/Wyoming**
- Reduce the number and severity of adverse weather-related incidents in the I-80 corridor to improve safety and reduce incident-related delays.
- Focused on the needs of commercial vehicle operators in the State of Wyoming.

**Tampa (THEA)**
- Alleviate congestion and improve safety during morning commuting hours.
- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the transportation challenges.
Infrastructure Deployment Planning

- National Cooperative Highway Research Program ([NCHRP 03-101](#))
  - Costs and Benefits of Public-Sector Deployment of Vehicle to Infrastructure Technologies
- AASHTO National Connected Vehicle Field Infrastructure Footprint Analysis
- Standardized interfaces ([CVRIA](#))
- Certification processes
- Nationwide Security Credential Management System (SCMS)
- State and local agency test beds

**FHWA V2I Deployment Guidance**

- Guidance includes policy positions, guidance, guidelines, whitepapers, and practitioner tools
- Assists in planning for future investments and deployment of V2I systems
- Does not impose any new requirements on local governments
- Work will be harmonized with related efforts by other USDOT modal agencies
- Subsequent guidance updates will also incorporate ITS research findings
There are Levels of Automation

Automation builds off current driver assistance technologies such as adaptive cruise control, lane departure warning and left turn assist

- NHTSA has defined 5 levels of automation
- Various combinations of levels 1, 2, and 3 are on the road today
CONNECTED AUTOMATION - GREATEST BENEFITS

Autonomous Vehicle
Operates in isolation from other vehicles using internal sensors

Connected Automated Vehicle
Leverages autonomous and connected vehicle capabilities

Connected Vehicle
Communicates with nearby vehicles and infrastructure

THE BIG PICTURE
"Beyond Traffic 2045"

The USDOT’s new 30 Year Framework for the future addresses many of the issues around Smart Cities and provides additional food for thought

- How will we move?
- How will we move things?
- How will we move better?
- How will we adapt?
- How will we align decisions and dollars, and invest the trillions of dollars our transportation system needs in the smartest way possible?

Source: USDOT

http://www.dot.gov/BeyondTraffic

Smart City

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

The Smart Cities Council
USDOT Smart City Challenge

Vision Elements

TECHNOLOGY ELEMENTS
- Vision Element #1: Urban Automation
- Vision Element #2: Connected Vehicles
- Vision Element #3: Intelligent, Sensor-based Infrastructure

INNOVATIVE APPROACHES TO URBAN TRANSPORTATION ELEMENTS
- Vision Element #4: User-Focused Mobility Services and Choices
- Vision Element #5: Urban Analytics
- Vision Element #6: Urban Delivery and Logistics
- Vision Element #7: Strategic Business Models & Partnering
- Vision Element #8: Smart Grid, Resilience, Electrification, & EVs
- Vision Element #9: Connected, Involved Citizens

SMART CITY ELEMENTS
- Vision Element #10: Architecture and Standards
- Vision Element #11: Low-Cost, Efficient, Secure & Resilient ICT
- Vision Element #12: Smart Land Use

The Smart City Challenge Applicants

$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

USDOT Smart City Challenge
Vision Elements

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Smart Cities and Connected Vehicles

Smart Cities incorporate and expand connected transportation to ensure that connected transportation data, technologies and applications – as well as connected travelers – are fully integrated with other systems across a city, and fulfill their potential to improve safety, mobility and environmental outcomes in a complexly interdependent and multimodal world that supports a more sustainable relationship between transport and the city.

Example Deployment in a Smart City

Data collected from connected vehicles provide insights into the performance of the city.

Handheld and infrastructure devices support pedestrian safety.

Traffic signal support vehicle automation applications (Eco-Glide Path).

Transit vehicles leverage connected vehicle technologies for transit signal priority.
Advanced Technologies and Smart Cities
Technology convergence will revolutionize transportation, dramatically improving safety and mobility while reducing costs and environmental impacts.

Benefits
- Order of magnitude safety improvements
- Reduced congestion
- Reduced emissions and use of fossil fuels
- Improved access to jobs and services
- Reduced transportation costs for govt and users
- Improved accessibility and mobility

Connected Vehicles
Vehicle Automation
Internet of Things
Machine Learning
Big Data
Sharing Economy

What will it take?
- How should connected vehicles and ITS generally, be considered across a range of public works 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?
- What resources are available?
- How will ITS systems meet community needs?
- How do communities make the decision?
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?

Typical Planning Products and Processes

- 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
Performance Measurement & Evaluation

- **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
ITS JPO Offers Free Resources to Assist in Deployment

- Research Data Exchange
- Connected Vehicle Test Bed
- Professional Capacity Building ITS Training
- Connected Vehicle Test Beds
- Connected Vehicle Basics Microsite
- Research Fact Sheets
- National Transportation Library
- Connected Vehicle Help Desk
- Connected Vehicle Pilots

Funding for ITS Deployment

- General eligibility
  - CV deployments are eligible for Federal aid funding where eligibility for ITS investments have been previously established

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Funding for ITS Deployment

- **Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Grants:** $60M annually in competitive grants between 2016 and 2020 for the development of model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. [http://www.grants.gov/custom/viewOppDetails.jsp?oppId=282433](http://www.grants.gov/custom/viewOppDetails.jsp?oppId=282433)

- **Mobility on Demand (MOD) Sandbox:** Provides a venue through which integrated MOD concepts and solutions are demonstrated in real-world settings. FTA seeks to fund $8M for project teams to innovate, explore partnerships, develop new business models, integrate transit and MOD solutions, and investigate new, enabling technical capabilities. Proposals Due: 7/5/16 [https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program](https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program)

U.S. DOT and Commerce Discretionary Grant Programs

- **Transportation Investment Generating Economic Recovery (TIGER)**
  - Application Deadline: April 29, 2016

- **University Transportation Center (UTC)**
  - Application Deadline: May 13, 2016

- **FTA – Buses and Bus Facilities & Low or No Emission**
  - Application Deadline: May 13, 2016

- **FTA – Enhanced Mobility/Rides to Wellness/Innovative Coordinated Access**
  - Application Deadline: May 31, 2016

- **FTA – Tribal Transit Program**
  - Application Deadline: May 13, 2016

- **FTA – Mobility on Demand**
  - Application Deadline: July 5, 2016

- **FRA – Railroad Safety Technology for Positive Train Control (PTC)**
  - Application Deadline: May 19, 2016

- **FHWA – Surface Transportation System Funding Alternatives (SFTSA) Program**
  - Application Deadline: May 20, 2016

- **EDA – Regional Innovation Strategies (RIS) Program**
  - Application Deadline: June 25, 2016
For More Information

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