CONNECTED VEHICLE PILOT
Deployment Program

New York City

Jonathan Walker (FHWA), New York City CV Pilot Site COR

ITS Joint Program Office
OVERVIEW

- Connected Vehicles Pilot Deployment Program Overview
  - Goals
  - Organizing Principles
  - CV Applications
  - Program Schedule and Future Milestones
  - CV Pilots Sites Wave 1 Sites:
    - ICF/Wyoming, New York City, Tampa (THEA)
- New York City (NYC) CV Pilot Deployment Overview
  - Pilot Objective
  - Pilot Deployment Site
  - Pilot Site Needs, CV Applications and Performance Measures
  - Fleet Distribution
  - Pilot Deployment Vision
  - Timeline and Phase 1 Deliverable Schedule
- How to Stay Connected
The Connected Vehicle (CV) Pilot Deployment Program

- Keystone effort in connected vehicle area
- Also plays a key role in other strategic areas, including accelerating deployment, promoting interoperability, and enterprise data

CV Pilot Deployments offer a unique opportunity related to getting CV technology to the field and making a difference in many areas, including:

- Needs-driven planning and investment
- Integrated performance measurement
- Lowering barriers to deployment
CV PILOT DEPLOYMENT PROGRAM GOALS

- Spur Early CV Tech Deployment
- Measure Deployment Benefits
- Resolve Deployment Issues

Wirelessly Connected Vehicles

Safety

Technical

Mobile Devices

Mobility

Institutional

Infrastructure

Environment

Financial
CV Pilots are *pilot deployments*, that is, real-world environment deployments

- The successful, deployed technologies are expected to remain as permanent operational elements

Deployment concepts are *needs-driven*

- Each site has different needs, focus and applications
  - That is, each pilot deployment will address critical problem(s)
  - The needs of each site will drive the deployment process

Pilot deployments are expected to be both *large-scale with multiple applications*

- *Large-scale* implies pilot deployments will have measureable impact, not a specific minimum geographic or vehicle fleet size
- Sites will deploy *multiple applications* drawing on the products of USDOT and other connected vehicle research
CV PILOT DEPLOYMENT REQUIREMENTS

- Multiple connected vehicle applications will be deployed together

- Pilot deployments should leverage USDOT-sponsored research

- Pilot deployments include the capture of data from multiple sources
  - Integrated or carry-in devices for connected vehicles capable of generating an SAE J2735 Basic Safety Message (BSM)
  - Look to pilot deployment data while protecting privacy and intellectual property

- Dedicated Short Range Communications (DSRC) 5.9 GHz will be utilized as the communications technology

- Well-defined, focused, quantitative performance measures
  - Support an independent evaluation effort

- Security and credentialing management system
The USDOT has made a significant investment in foundational research and initial development of 50+ connected vehicle applications

- Concepts of Operations
- System Requirements
- Prototype Design and Testing
- Prototype Impacts Assessment
- Analytics, Modeling and Simulation to Assess Potential Long-Term Impacts

Not all CV Application efforts are in the same state of maturity, few are complete

- But a large number of application development efforts across multiple programs have been completed
- GOAL: move deployment-ready application concepts forward into integrated deployments addressing key performance concerns
### USDOT Sponsored CV Applications

#### V2I Safety
- Red Light Violation Warning
- Curve Speed 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-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- 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 Measurement (F-ATIS)
- Drayage Optimization (DR-OPT)

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

### Smart Roadside
- Wireless Inspection
- Smart Truck Parking

### 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
CV PILOT DEPLOYMENT PROGRAM SCHEDULE: WAVE 1 (PHASES 1-3)

Phase 1: Concept Development (Current Phase)
- Creates the foundational plan to enable further design and deployment
- **Progress Gate: Is the concept ready for deployment?**

Phase 2: Design/Deploy/Test
- Detailed design and deployment followed by testing to ensure deployment functions as intended (both technically and institutionally)
- Progress Gate: Does the system function as planned?

Phase 3: Maintain/Operate
- Focus is on assessing the performance of the deployed system

Post Pilot Operations (CV tech integrated into operational practice)

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U.S. Department of Transportation
MOVING FORWARD: ADDITIONAL MILESTONES

2011
- Defined V2V Apps

2012
- Defined Safety (V2I), Mobility (V2I and V2V), AERIS and Weather Apps

2013
- Application Development

2014
- NHTSA Decision Light Vehicles

2015
- NHTSA Decision Heavy Vehicles

2016
- NPRM Connected Vehicle Pilot Deployment Standards

2017
- Final: FHWA Guidance
- Security Credential Management System Prototypes
- Wave 2: Connected Vehicle Pilot Deployments

2018
- Wave 1: Connected Vehicle Pilot Deployments
**CONNECTED VEHICLE**
**WAVE 1 PHASE 1 SITES SELECTED**

- **Solicitation Date:** 1/30/2015
- **Award Date:** 09/14/2015
- **Period of Performance:** 09/14/2015 – 09/13/2016
New York City
Objective:
- Improve safety and mobility of travelers in New York City through connected vehicle technologies
  - Aligned with the NYC’s Vision Zero initiative, which seeks to reduce crashes and pedestrian fatalities, and increase safety of travelers in all modes of transportation

Approach:
- Equip up to 10,000 vehicles (taxis, buses, commercial fleet delivery trucks, and City-owned vehicles) that frequently travel in Midtown Manhattan and Central Brooklyn to transmit and receive connected vehicle data
- Install V2I technology at high-accident rate arterials:
  - Upgrade 239 traffic signals along 1st, 2nd, 5th, and 6th Avenues in Manhattan and Flatbush Avenue in Central Brooklyn (emergency evacuation route)
  - Deploy Roadside equipment (RSE) along FDR Drive

Status:
- Kickoff conducted on 9/29-10/1
- ConOps under development
### NYC Pilot Deployment Team

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<thead>
<tr>
<th>Project Sponsor</th>
<th>ITS Joint Program Office</th>
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NYC 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
NYC Pilot Deployment Site Needs: Mobility and Environmental

Balance Mobility in Heavily Congested Areas

- Average speed
- Average wait time at stops
- Average travel time
- Average throughput at intersections
- Number of hard accelerations/decelerations

potential Performance Measures

 Intelligent Traffic Signal System (I-SIG)

Maintain 25 mph Speed Limit (Discourage spot speeding)

- Average stop
- Average speed
- Average emission
- Number of hard acceleration/deceleration events

potential Performance Measures

 Modified Eco-Speed Harmonization
NYC Pilot Deployment Site Needs: Pedestrian Safety

Improve Pedestrian Safety on Heavily Traveled Bus Routes

Pedestrian in Signalized Crosswalk Warning

Potential Performance Measures
- Pedestrian collisions with transit buses
- Number of warnings generated

Improve Safety of Visually Impaired Pedestrians

Mobile Accessible Pedestrian Signal System

Potential Performance Measures
- Waiting time at intersections for crossing
- Number of pedestrian crossing violation reductions
NYC PILOT DEPLOYMENT SITE NEEDS: TRANSIT BUS SAFETY

Reduce Bus Related Crashes on Heavily Traveled Bus Routes

Vehicle Turning Right in Front of Bus Warning

Potential Performance Measures
• Number of warnings generated
NYC PILOT DEPLOYMENT SITE NEEDS: TRUCK SAFETY AND PRODUCTIVITY

Improve Truck Safety on Curves
- Curve Speed Warning

Address Bridge Low Clearance Issues
- Freight Dynamic Travel Planning

Potential Performance Measures
- Accident at ramps
- Number of warnings generated

Enforce Truck Route Restrictions and Improve Productivity
- Freight Dynamic Travel Planning

Potential Performance Measures
- Truck route violations
- Truck load/offload zone delays
- Truck travel times
NYC Pilot Deployment Site Needs: Intersection and Work Zone Safety

Reduce Accidents at High Incident Intersections

- Red Light Violation Warning
  - Potential Performance Measures:
    - Signal violations
    - Accidents at intersections

Improve Work Zone Safety

- Reduced Speed/Work Zone Warning
  - Potential Performance Measures:
    - Average speed at work zone compared to posted speeds
NYC PILOT DEPLOYMENT SITE NEEDS: POTENTIAL V2V SAFETY AND EVACUATION

Reduce crashes and injuries

V2V Applications (FCW, EEBL, BSW, LCA, IMA, SVA)

Potential Performance Measures
- Crash incidence
- Injury incidence
- Property damage costs
- Comparisons between instrumented and non-instrumented arterials

Provide evacuation and unusual situation alerts

In-vehicle information

Potential Performance Measures
- Acceptance and driver interviews
NYC Pilot Deployment Proposed CV Applications: Summary

V2I Safety
- Red Light Violation Warning
- Curve Speed 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)*
- Blind Spot Warning (BSW)*
- Lane Change Assist (LCA)*
- Stationary Vehicle Ahead (SVA)*
- Vehicle Turning Right in Front of Bus Warning (Transit)

Mobility
- Advanced Traveler Information System
- Intelligent Traffic Signal System (I-SIG)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Communications and Evacuation (EVAC)
- Freight-Specific Dynamic Travel Planning and Performance Measurement (F-ATIS)

Environment
- Eco-Speed Harmonization

*Deployment of applications is dependent upon Final ConOps and funding
## NYC Pilot Deployment Proposed CV Application-Fleet Distribution

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<tr>
<th>CV Application</th>
<th>Taxi &amp; Limousine</th>
<th>NYC DOT/ Sanitation</th>
<th>MTA/NYCTA Buses</th>
<th>Commercial Vehicles</th>
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# Timeline

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Public Webinar
# CV PILOTS PHASE 1 DELIVERABLE SCHEDULE

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STAY CONNECTED

- Join us for the Getting Ready for Deployment Series (link to webinars)
  - Discover more about the Wave 1 CV Pilot Sites
  - Learn the Essential Steps to CV Deployment
  - Engage in Technical Discussion

Contact for CV Pilots NYC:
Jonathan Walker, NYC Site COR
Jonathan.b.Walker@dot.gov

Contact for CV Pilots Program:
Kate Hartman, Program Manager
Kate.hartman@dot.gov

Website: http://www.its.dot.gov/pilots
Twitter: @ITSJPODirector
Facebook: https://www.facebook.com/DOTRITA