CONNECTED VEHICLE PILOT Deployment Program

TAMPA (THEA)
Tampa Hillsborough Expressway Authority

Govind Vadakpat (HRDO), Tampa (THEA) 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 Wave 1 Sites:
    - ICF/Wyoming, New York City, Tampa (THEA)
- Tampa Hillsborough Expressway Authority (THEA) CV Pilot Deployment Overview
  - Pilot Objective
  - Pilot Deployment Site: Target Areas
  - Pilot Site Needs, CV Applications and Performance Measures
  - 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


USDOT ITS Strategic Plan, pg. 14
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 PILOT ORGANIZING PRINCIPLES

- 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 measurable 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
Multiple connected vehicle applications must 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).
- Share pilot deployment data while protecting privacy and intellectual property.

Multiple forms of communications technologies are desired:
- Dedicated Short Range Communications (DSRC) 5.9 GHz utilized as one communication 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
### 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
CONNECTED VEHICLE APPLICATIONS (CONTINUED)

**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

**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)
Solicitation Date: 1/30/2015
Award Date: 09/14/2015
Period of Performance: 09/14/2015 – 09/13/2016
Tampa (THEA)
Tampa Hillsborough Expressway Authority
Objective:
- The primary objective of this deployment is to alleviate congestion and improve safety during morning commuting hours.
  - Deploy a variety of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) safety, mobility, and agency data applications to create reinforcing benefits for motorists, pedestrians, and transit operation.

Approach:
- 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 following transportation challenges:
  - Morning peak hour queues, wrong-way entries, pedestrian safety, bus rapid transit (BRT) signal priority optimization, trip time and safety, streetcar trolley conflicts, and enhanced signal coordination and traffic progression.
## TAMPA (THEA) PILOT DEPLOYMENT TEAM

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<tr>
<th>Project Sponsor</th>
<th>ITS Joint Program Office</th>
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<tr>
<td><strong>Prime Consultant</strong></td>
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<td><strong>Sub Consultants</strong></td>
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TAMPA (THEA) PILOT DEPLOYMENT SITE NEEDS: MORNING PEAK HOUR QUEUES

Avoid Crashes due to Excessive Queues from Exit Ramp to Travel Lane
Warn Approaching Vehicles of Queue Backup in Curve
Reduce Queue Backup on Curve and Improve Signal Timing Progression

V2V Safety: FCW and EEBL
Curve Speed Warning (CSW)
Intelligent Traffic Signal System (I-SIG)

Performance Measures
- Congestion Impact
- Incident Rates
- Travel Time and Reliability of Travel Time
- Emission and Fuel Consumption

Target Area
Intersection of Twiggs Street and Meridian Avenue at Reversible Express Lanes Entrance/Exit

FCW: Forward Collision Warning | EEBL: Emergency Electronic Brake Lights
**Tampa (THEA) Pilot Deployment Site Needs: Wrong-Way Entries**

- **Improve Safety at the Entry/Exit Point**
- **Effectively Detect Wrong Way Entries to the REL**
- **Signal Control at Express Lane Entries**

**Performance Measures**
- Congestion Impact
- Reversible Express Lane (REL) Operation
- Travel Time and Reliability of Travel Time
- Wrong Way Incidents
- Warnings Issued

**Target Area**
Entry/Exit Points Along Selmon and Reversible Express Lanes (REL)
Tampa (THEA) Pilot Deployment Site Needs: Pedestrian Safety

- Improve Pedestrian Safety at Mid-Block Crossing Locations
- Provide Pedestrian Crossing Signal Timing

Pedestrian in Signalized Crosswalk Warning

Mobile Accessible Pedestrian Signal (PED I-SIG) and I-SIG

Performance Measures

- Application Acceptance
- Transit/ Auto/Pedestrian Conflicts
- Pedestrian Behavior (e.g., Jaywalking behavior)

Target Area
Midblock of Twiggs Street at Hillsborough County Courthouse
TAMPA (THEA) PILOT DEPLOYMENT SITE NEEDS: BUS RAPID TRANSIT/TRANSIT OPERATIONS

Improve Signal Timing Progression

Intelligent Traffic Signal System (I-SIG)

Improve Bus On-schedule Performance

Transit Signal Priority (TSP)

Performance Measures
- Transit Ridership
- Travel Time and Reliability of Travel Time
- Bus Headway / On-Schedule Performance
- Bus Tailpipe Emissions
- Fuel Consumption

Target Area
Express Route through Downtown City Streets to Marion Street Transit Station
TAMPA (THEA) PILOT DEPLOYMENT SITE NEEDS: STREET CARS/VEHICLES CONFLICTS

Avoid Potential Vehicle Conflicts
Vehicle Turning Right in Front of Bus Warning

Improve Signal Timing for Special Events
Intelligent Traffic Signal System (I-SIG)

Performance Measures
- Transit/ Auto Conflicts
- Travel Time and Reliability of Travel Time
- Incident Rates
- Streetcar Headway / On-Schedule Performance

Target Area
- Adamo Drive (SR 60)/ Channelside Drive
- Amalie Arena/Channelside Drive Area
Tampa (THEA) Pilot Deployment Site Needs: Signal Coordination and Progression

Effectively Monitor Peak Queuing and Congestion

Probe Enabled Traffic Monitoring

Improve Traffic Progression

Intelligent Traffic Signal System (I-SIG)

Target Area
- Along Twiggs Street from Selmon to Marion Street
- Along Meridian Avenue from REL to Channelside Drive

Performance Measures
- City Traffic Management Center (TMC) Operation Enhancements
- Transit Agency Scheduling
- Travel Time and Reliability of Travel Time
- Fuel Consumption
TAMPA (THEA) PILOT DEPLOYMENT SITE NEEDS: ISSUES AND APPLICATIONS RELATIONSHIP

CV APPLICATIONS

- V2I SAFETY
  Curve Speed Warning
- V2V SAFETY
  EEBL and FCW
- V2I SAFETY
  Pedestrian in Signalized X-walk
- V2I SAFETY
  Mobile Accessible Pedestrian Signal PED-SIG
- V2I SAFETY
  IMA
- MOBILITY
  I-Sig
- AGENCY DATA
  Probe Enabled Traffic Monitoring
- MOBILITY
  TSP
- V2V SAFETY
  Vehicle Turning In Front of Bus

USE CASE/NEED

- MORNING BACKUPS
- PEDESTRIAN CONFLICTS
  PEDESTRIAN SAFETY
- WRONG WAY ENTRIES
- TRAFFIC PROGRESSION
  TRIP TIMES
  SAFETY
- BRT OPTIMIZATION
  STREETCAR/AUTO/PED/BIKE CONFLICTS

LOCATION

- REL at Twiggs Street
- Twiggs Street - Courthouse
- REL at Twiggs Street
- Meridian Avenue
- MacDill AFB
- BRT-REL to Marion Street
- Channelside
Tampa THEA Pilot Deployment Vision

Data exchange will use DSRC (Dedicated Short Range Communications) or other wireless media. SCMS (Security Credential & Management System) will be used where appropriate.
### Timeline - Tampa (THEA)

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- **Public Webinar**
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Stay Connected

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

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