CONNECTED VEHICLE PILOT Deployment Program

Tampa Hillsborough Expressway Authority Pilot Update at the Application Design Stage

Govind Vadakpat, USDOT
Dave Miller, Siemens

ITS Joint Program Office
Today’s Agenda

- **Purpose of this Webinar**
  - Share experiences of designing CV applications
  - Talk about how these applications are being designed/developed
  - Identify technical and other barriers and how they are being overcome
  - Discuss how these apps will eventually be tested and their performance measured

- **Webinar Content**
  - Connected Vehicle Pilot Deployment Program Overview
  - Tampa (THEA) CV Application Design Experiences
  - Stakeholder Q&A

- **Webinar Protocol**
  - Please mute your phone during the entire webinar
  - You are welcome to ask questions via chatbox at the Q&A Section
  - The webinar recording and the presentation material will be posted on the CV Pilots website
CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM

PROGRAM GOALS

- Participate in Design/Build/Test Phase Webinars/Conference Presentations from the three Pilot Sites (see website for exact dates and times)

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<tbody>
<tr>
<td>TRB</td>
<td>Application Deployment</td>
<td>SXSW</td>
<td>Operational Readiness</td>
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STAY CONNECTED

- Visit Program Website for Updates: http://www.its.dot.gov/pilots
- Contact: Kate Hartman, Program Manager, Kate.Hartman@dot.gov
Tampa Hillsborough Expressway Authority CV Pilot Deployment Overview

Dave Miller
Pilot Site Overview

Pilot Location
- Tampa FL
- THEA
  - Selmon Expressway
  - Meridian Signals
- West: Brandon
- East: MacDill AFB
- Study area
  - Midway of Selmon
  - Red box
Pilot Site Overview

Source: Siemens Industry Inc.
Pilot Site Overview

1,600 Privately Owned Vehicles
500+ Pedestrian Smartphones
10 TECO Line Streetcar Trolleys
10 Hillsborough Area Regional Transit (HART) buses
Pilot Site Enterprise View

Florida Highway Patrol + Tampa Police Department

Tampa Bay Lightning + Amalie Arena + Tampa Downtown Partnership + Tampa Convention Center + Tampa Bay Port Authority

GM + Honda + BMW

AFB Travelers

Driver

Streetcar Operator

Participant + Pedestrian

Private Driver + Participant

Pedestrian

U.S. Department of Transportation

10
THEA CV Application Design Experiences

Dave Miller
Design Experience: The Plan

Fully-realized Connect Vehicle system that fulfills the project Scope

_identify_ existing real-world safety and mobility issues

_measure_ the Current Situation: “Before” metrics

_apply_ existing Connected Vehicle technology as mitigation

_measure_ the Effect: “After” metrics

Measures of Success

👉 Success = **Effective CV apps are promoted** for wider deployment

👉 Success = **Ineffective CV app are retired**, sunk cost = $ 0
CV Design Experience: The Plan

Systems Engineering with a Difference: No planned app “Design”

Source: Siemens Industry Inc.

Range of Uncertainty
CV Design Experience: The Plan

Systems Engineering with a Difference: No planned app "Design"

Source: Siemens Industry Inc.
CV Design Experience: The Plan

Systems Engineering with a Difference: No planned app “Design”

Source: Siemens Industry Inc.
Systems Engineering with a Difference: No planned app “Design”

Source: Siemens Industry Inc.
## CV Design Experience: Actual v Plan

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>App</th>
<th>ADP</th>
<th>Actual</th>
<th>Barrier Overcome</th>
</tr>
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<tbody>
<tr>
<td>Wrong Way Entry (WWE)</td>
<td>WWE</td>
<td>CAMP</td>
<td>Tier 1</td>
<td>RLV → WWE, SPaT no CU</td>
</tr>
<tr>
<td>Pedestrian in Signalized Crosswalk (PED-X)</td>
<td>PED-X</td>
<td>CAMP</td>
<td>Tier 1</td>
<td>IMA → PCW</td>
</tr>
<tr>
<td>Exit Ramp Deceleration Warning (ERDW)</td>
<td>ERDW</td>
<td>CSW</td>
<td>Tier 1</td>
<td>CSW → ERDW, MAP no CU</td>
</tr>
<tr>
<td>Intersection Movement Assist (IMA)</td>
<td>IMA</td>
<td>CAMP</td>
<td>Tier 1</td>
<td>Over the Air Updates (3 OBU)</td>
</tr>
<tr>
<td>Emergency Electronic Brake Lights (EEBL)</td>
<td>EEBL</td>
<td>CAMP</td>
<td>Tier 1</td>
<td>Over the Air Updates (3 OBU)</td>
</tr>
<tr>
<td>Forward Collision Warning (FCW)</td>
<td>FCW</td>
<td>CAMP</td>
<td>Tier 1</td>
<td>Over the Air Updates (3 OBU)</td>
</tr>
<tr>
<td>Vehicle Turning Right In Front of Transit Vehicle (VTRFTV)</td>
<td>VTRFTV</td>
<td>TRP</td>
<td>Tier 1</td>
<td>TRP → VTRFTV</td>
</tr>
<tr>
<td>Pedestrian Transit Movement Warning (PTMW)</td>
<td>PMTW</td>
<td>New</td>
<td>Siemens</td>
<td>PCW accuracy → PMTW</td>
</tr>
<tr>
<td>Pedestrian Collision Warning (PCW)</td>
<td>PCW</td>
<td>CAMP</td>
<td>Tier 1</td>
<td>IMA → PCW J -2735 2016</td>
</tr>
<tr>
<td>Intelligent Traffic Signal System (I-SIG)</td>
<td>I-SIG</td>
<td>OSADP</td>
<td>OSAPD</td>
<td>Generalize → OSADP</td>
</tr>
<tr>
<td>Transit Signal Priority (TSP)</td>
<td>TSP</td>
<td>OSADP</td>
<td>OSADP</td>
<td>Add TSP Central</td>
</tr>
<tr>
<td>Mobile Accessible Pedestrian Signal (PED-SIG)</td>
<td>PED-SIG</td>
<td>OSADP</td>
<td>OSADP</td>
<td>Generalize → OSADP</td>
</tr>
<tr>
<td>Probe-Enabled Traffic Monitoring (PDETM)</td>
<td>PDETM</td>
<td>NEW</td>
<td>Siemens</td>
<td>CAM → BSM, DENM → TIM</td>
</tr>
</tbody>
</table>

Source: Siemens Industry Inc.
Realization: Parallel Efforts

Siemens
- Infrastructure
- Central
- PSD
- Security

Brand Motion
- OBU
- Installation
- Test

Source: Siemens Industry Inc.
Wrong-Way Entry

Wrong-way Entry
Intersection Movement Assist (IMA)
MAP
Signal Phasing and Timing (SPaT)
WWE: What the OBU “Sees”

Source: Siemens Industry Inc.
Wrong Way Entry

In Car Wrong Way Driver Alerts - :19

This demonstration on the Tampa Hillsborough Expressway Authority’s Reversible Express Lanes leaving downtown Tampa occurred while the road was closed to regular traffic. Recorded on September 18, 2017
Wrong Way Entry
Wrong Way Entry
Wrong Way Entry
Wrong Way Entry
Wrong Way Entry
Wrong Way Entry
Pedestrian Safety

Pedestrian in a Signalize Crosswalk Warning (Ped-X)

Pedestrian Collision Warning (PCW)

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)
PCW: What the OBU “Sees”

- No False Positives
- No False Negatives
- CUTR: Lidar vs. PSD location service
- Use for PTMW Geo Fence settings
Challenge: Collect All Data
## Challenge: Phase 3 Cyber Security

<table>
<thead>
<tr>
<th>Guide</th>
<th>Implement</th>
<th>Assure</th>
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<tbody>
<tr>
<td><strong>Oversee</strong> the entire security implementation</td>
<td><strong>Harden</strong> system components</td>
<td><strong>Monitor</strong> component vulnerabilities</td>
</tr>
<tr>
<td><strong>Ensure</strong> security experts are available for consultation for all project participants</td>
<td><strong>Integrate</strong> certificate management system</td>
<td><strong>Assess</strong> interactions and subsystems</td>
</tr>
<tr>
<td><strong>Define</strong> security and privacy program</td>
<td><strong>Train</strong> operational personnel</td>
<td><strong>Perform</strong> red / blue team and incident response exercises.</td>
</tr>
</tbody>
</table>

Ensure the project and system achieve the desired protection level

Protect individual elements and interactions adequately

Enable operational confidence with robust testing and validation

Source: Siemens Corporate Technology
• Please keep your phone muted

• Please use chatbox to ask questions

• Questions will be answered in the order in which they were received
Join us for the Getting Ready for Deployment Series

- Discover more about the CV Pilot Sites
- Learn the Essential Steps to CV Deployment
- Engage in Technical Discussion

Visit the Pilot Site Websites for more Information:

- NYC DOT Pilot: https://www.cvp.nyc/
- Tampa (THEA): https://www.tampacvpilot.com/
- Wyoming DOT: https://wydotcvp.wyoroad.info/

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

Contact for Pilot Sites:
- Kate Hartman, WYDOT Site AOR
  Kate.Hartman@dot.gov
- Jonathan Walker, NYCDOT Site AOR
  Jonathan.b.Walker@dot.gov
- Govind Vadakpat, THEA Site AOR
  G.Vadakpat@dot.gov