New York City DOT’s Pilot Update at the Operational Readiness Milestone

Mohamad Talas, Project Management Lead
Bob Rausch, Site Deployment Lead
David Benevelli, System Engineering Lead
Betsy Williams, ORD Lead

ITS Joint Program Office
Purpose of this Webinar

- Provide an overview of New York City DOT’s approach to test and demonstrate that the deployed system operates as designed in a safe and secure manner.
- Share results, baseline performance measures and security-related lessons learned from the tests and demonstrations.

Webinar Content

- Connected Vehicle Pilot Deployment Program Overview
- New York City DOT’s Pilot Operational Readiness Approach, Results, and Lessons Learned
- Stakeholder Q&A

Webinar Protocol

- Please mute your phone during the entire webinar.
- You are welcome to ask questions via chat box at the Q&A Section.
- The webinar recording and the presentation material will be posted on the CV Pilots website.
Please keep your phone muted

Please use chat box to ask questions

Questions will be answered in the order in which they were received
New York CV Pilot Deployment Overview

Mohamad Talas
RSU Support Site (Citywide)
RSU Support Location Accuracy
V2V Safety Applications

- Vehicle Turning Right in Front of Bus Warning: VTRW
- Forward Collision Warning: FCW
- Emergency Electronic Brake Light: EEBL
- Blind Spot Warning: BSW
- Lane Change Warning/Assist: LCA
- Intersection Movement Assist: IMA
V2I Safety Applications

- Red Light Violation Warning: RLVW
- Speed Compliance: SPD-COMP
- Curve Speed Compliance: CSPD-COMP
- Speed Compliance/Work Zone: SPDCOMPWZ
- Oversize Vehicle Compliance: OVC
  - Prohibited vehicle (parkways)
  - Overheight
- Emergency Communications and Evacuation Information: EVACINFO
  *(Using the traveler information features)*
Pedestrian and Mobility

- Mobile Ped Signal System (visually impaired)
  - Intersection Signal Information Assistance
- Pedestrian in Signalized Intersection Warning
  - Using Conventional Infrared pedestrian detection

- CV Data for Intelligent Traffic Signal System
  - Measuring travel times between RSUs
  - Input to the City’s Adaptive Control System (MIM, ACDSS)
New York CV Pilot Deployment
System Considerations

Bob Rausch
Overview of the NY CV System

Roadside CV and ITS Systems

Traffic Controller

Network Interface Devices

Roadside Unit (RSU)

Traffic Control System

Connected Vehicle Back Office Systems

Central Back Office

Network Firewall

Hardware Security Module

Traffic Control System

Network Backhaul Media

Internet

CV and ITS External Support Systems

CV Device Vendors

Security Credential Management Systems (SCMS)

Data Sharing USDOT and Others

Enrollment

4G... Broadband Media

Certification Authority

V2I-V2V Localized Media

Cell Phone Apps

After Market Device (ASD/OBU)

Vehicle HMI

Other Vehicle Systems

Vehicle CAN BUS

In-Vehicle Systems

4G... Broadband Media

Certification Authority

V2I-V2V Localized Media

Cell Phone Apps

After Market Device (ASD/OBU)

Vehicle HMI

Other Vehicle Systems

Vehicle CAN BUS
RF Monitoring First/Last
- RSU Receives BSMs from the ASD
- ASD Receives TIM/SPaT/MAP from the RSU
- ASD logs other ASDs - *encounters*

Traffic data collection
- Temporary ASD Breadcrumbs for application tuning & validation
- Vehicle travel times RSU to RSU – adaptive control

Event (Warnings/Alerts) History Uploading
- Activities surrounding Warnings & Alerts
- Encryption and uploading

Uploading other logs for reliability and anomaly detection

OTA Firmware Updates - ASD Applications and operating system

OTA application parameter management
- Tuning the operation of the applications
RSU (34th/47th Queens) Sighting ASD - First/Last RF Data Sample

Green = First
Red = Last

500+M
840+M
1100+M
New York City DOT CV Pilot
Operational Readiness Approach

David Benevelli
CV System Installations

- Outfitted 4 demonstration vehicles
- Installed RSUs in Manhattan and Queens
- Installed AT&T FirstNet backhaul to test intersections
- Configured RSUs for WSAs to support V2I and SCMS

Typical RSU Installation

Through the glass antenna mount

CAN bus interface
Propagation Testing for Antenna Locations

Test Run 2 ----[05/03/2019]
2011 Ford Crown Vic
Location Accuracy – Hitting the Mark

- Tested absolute and relative accuracy
- Sample absolute test results on right
- Test tracks and stop locations shown below
Operational Readiness Approach

- Identify use cases to be demonstrated
- Identify potential demonstration locations
- Test demonstration locations with
  - Multiple drivers
  - Multiple vehicle types
  - Multiple vehicles of each type, if available
- Develop and work punch list
- Dry run demonstrations
- Actual demonstrations
- Collect all log data on-board for post analysis
New York City DOT’s CV Pilot
Operational Readiness
Test/Demonstration Results

Betsy Williams
Demonstration Results

- Use cases demonstrated
- Locations
- Number of vehicles
- Results
- Use cases postponed
## Apps Demonstrated

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Collision Warning</td>
<td>V2V</td>
</tr>
<tr>
<td>Emergency Electronic Brake Light</td>
<td>V2V</td>
</tr>
<tr>
<td>Blind Spot Warning</td>
<td>V2V</td>
</tr>
<tr>
<td>Lane Change Warning/Assist</td>
<td>V2V</td>
</tr>
<tr>
<td>Intersection Movement Assist</td>
<td>V2V</td>
</tr>
<tr>
<td>Red Light Violation Warning</td>
<td>V2I</td>
</tr>
<tr>
<td>Speed Compliance</td>
<td>V2I</td>
</tr>
<tr>
<td>Curve Speed Compliance</td>
<td>V2I</td>
</tr>
<tr>
<td>Speed Compliance/Work Zone</td>
<td>V2I</td>
</tr>
<tr>
<td>Oversize Vehicle Compliance</td>
<td>V2I</td>
</tr>
<tr>
<td>Emergency Communication/Evacuation Info</td>
<td>V2I</td>
</tr>
</tbody>
</table>
Queens Test Locations
Manhattan Demonstration Route

[Map of the Manhattan Demonstration Route with numbered points and use cases.

- **Use Case: UC14D1**
  - Speed: greater than 5 mph
  - Signal: N/A

- **Use Case: UC13D1**
  - Speed: greater than 10 mph
  - Signal: N/A

- **Use Case: UC11D1**
  - Speed: greater than 10 mph
  - Signal: N/A]
V2V Testing in a Controlled Environment
# O&M Apps Demonstrated

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTA firmware download</td>
<td>O&amp;M</td>
</tr>
<tr>
<td>OTA data upload</td>
<td>O&amp;M</td>
</tr>
<tr>
<td>SCMS certificate top-off</td>
<td>O&amp;M</td>
</tr>
<tr>
<td>V2X location applications in Manhattan</td>
<td>O&amp;M</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Collision Warning</td>
<td>Pass</td>
</tr>
<tr>
<td>Emergency Electronic Brake Light</td>
<td>Pass</td>
</tr>
<tr>
<td>Blind Spot Warning</td>
<td>Pass</td>
</tr>
<tr>
<td>Lane Change Warning/Assist</td>
<td>Pass</td>
</tr>
<tr>
<td>Intersection Movement Assist</td>
<td>Pass</td>
</tr>
<tr>
<td>Red Light Violation Warning</td>
<td>Pass</td>
</tr>
<tr>
<td>Speed Compliance</td>
<td>Pass</td>
</tr>
<tr>
<td>Curve Speed Compliance</td>
<td>Pass</td>
</tr>
<tr>
<td>Speed Compliance/Work Zone</td>
<td>Pass</td>
</tr>
<tr>
<td>Oversize Vehicle Compliance</td>
<td>Pass</td>
</tr>
<tr>
<td>Emergency Communication/Evacuation Info</td>
<td>Pass</td>
</tr>
</tbody>
</table>
Postponed Use Cases

- PEDINXWALK – pending configuration of ASTC
- PED-SIG – Still working with the stakeholders
- VTRW – Required vehicle config. - Completed
- Vehicle trip initiation
- ASD RF monitoring
New York City DOT CV Pilot
Lessons Learned from Operational Readiness Test/Demonstration

Betsy Williams
David Benevelli
Bob Rausch
Controlling the Test Conditions

- Challenges of selecting locations
  - City-owned, off-street locations
  - On-street locations
  - Privately managed off-street locations
- Inconsistent testing environments
  - Weather
  - Other vehicles (on-street locations)
  - OTA interference
- “Live” driving to trigger alerts is not easy
Lessons Learned in Demonstrations

- Log file upload minimums (10 → 3)
- EVAC alert frequency
- Audio settings
  - Volume
  - Clarity
  - Ambient noise conditions
NYC is transitioning the backhaul
- NYCWiN cellular to AT&T cellular network (FirstNet)

Addition of DTLS and credentials for all exchanges brings new problems

Security credentials have time and location limits
- Tuesday is renewal day
- Keeping all devices up to date takes planning
- Preparing for the testing – we experienced top-off complications
Current Project Achievements

- Deployed Dedicated Short-Range Communications (DSRC)
- Fully integrated 1609.2 Security Credentials including top-off
- Verified Over-the-Air (OTA) update for firmware and application parameters.
- Stabilized V2V and V2I applications through daily testing.
- Verified that data retrieved from TMC back office, ASDs, and RSUs is usable.
- Verified V2XLocate for location augmentation & accuracy in Manhattan.
- Confirmed a reliable passive CAN bus interface.
- Proven that the glass antenna system works for buses.
- Expansion of RSU deployment into the project area.
Where We Are Today

- ~675 Vehicles and increasing
- ~290 RSUs and increasing
- OTA firmware updates - working efficiently
  - (<2 min. for 10 MB)
  - Continues collecting as it passes RSUs
- OTA data collection is working – validating data
  - Preparing to export to the USDOT Secure Data Commons
- SCMS “top-off” is working along with Central Signing of TIM/MAP with a TMC *Hardware Security Module* (HSM)
- V2V and V2I applications are being tuned from the data
- Security to all field devices – is fully operational
Questions

- 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:

- NYCDOT 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