



CONNECTED VEHICLE PILOT Deployment Program



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



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Bob Rausch, Site Deployment Lead
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Betsy Williams, ORD Lead

ITS Joint Program Office



TODAY'S AGENDA



- 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.



STAKEHOLDER Q&A



- Please keep your phone **muted**
- Please use **chat box** to ask questions
- Questions will be answered in the order in which they were received





CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM

PROGRAM GOALS

Spur Early CV Tech Deployment



Wirelessly Connected Vehicles



Mobile Devices



Infrastructure

Measure Deployment Benefits



Safety



Mobility



Environment

Resolve Deployment Issues



Technical



Institutional



Financial

PILOT SITES



WYDOT

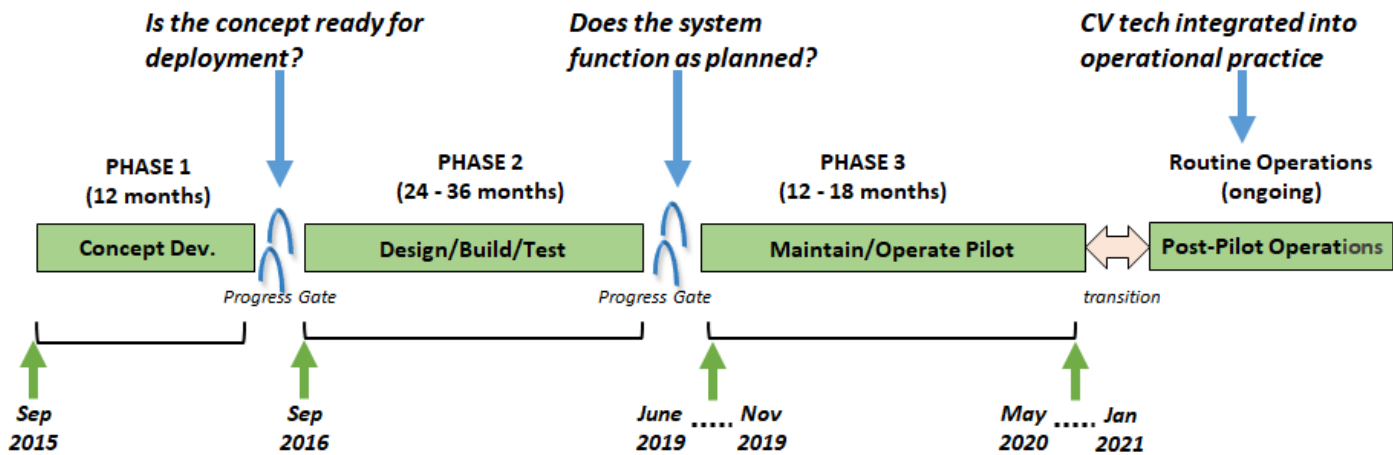


NYCDOT



Tampa (THEA)

PROGRAM SCHEDULE



Last updated: October 2019



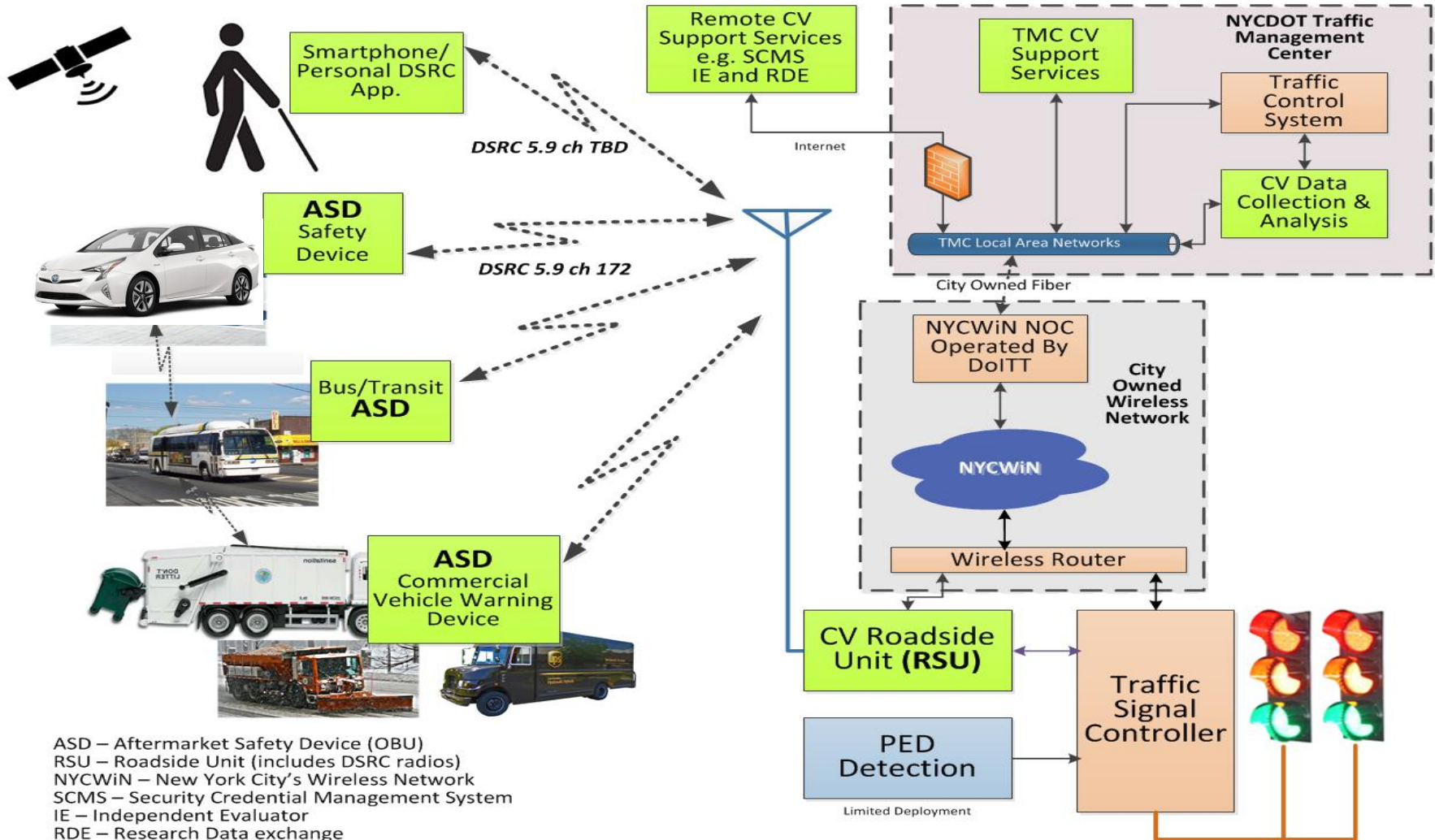
U.S. Department of Transportation



New York CV Pilot Deployment Overview

Mohamad Talas

NY CV Pilot Concept Overview



ASD – Aftermarket Safety Device (OBU)
 RSU – Roadside Unit (includes DSRC radios)
 NYCWiN – New York City's Wireless Network
 SCMS – Security Credential Management System
 IE – Independent Evaluator
 RDE – Research Data exchange
 TMC – Traffic Management Center

Safety



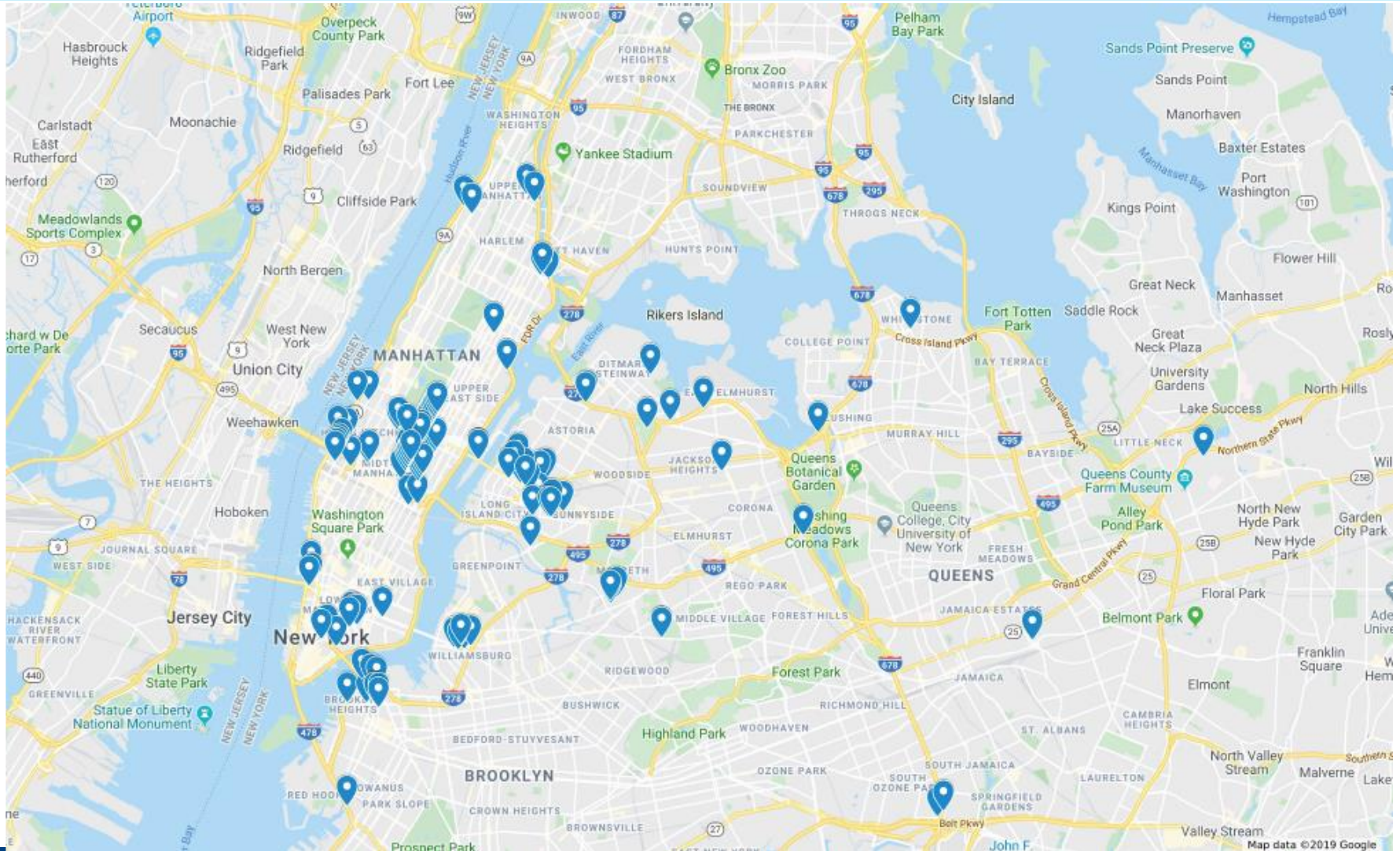
V2I Safety Arterials Manhattan

- 1st Ave
- 2nd Ave
- 5th Ave
- 6th Ave
- 14 St
- 23 St
- 34 St
- 42 St
- 57 St

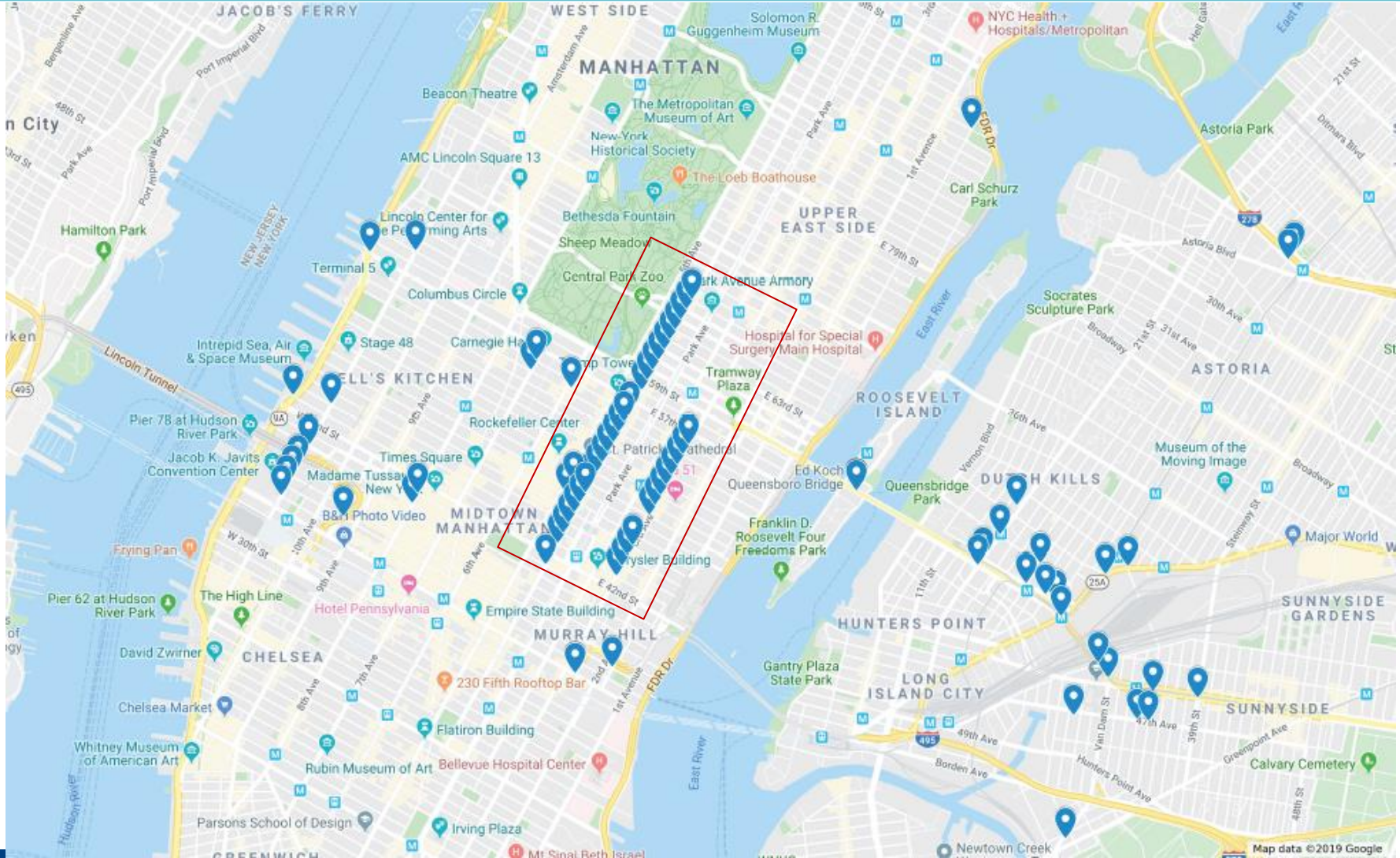


V2I Safety Other Roadways FDR Dr Flatbush Av

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
(Using the traveler information features) EVACINFO

Other V2I Applications



Pedestrian and Mobility

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

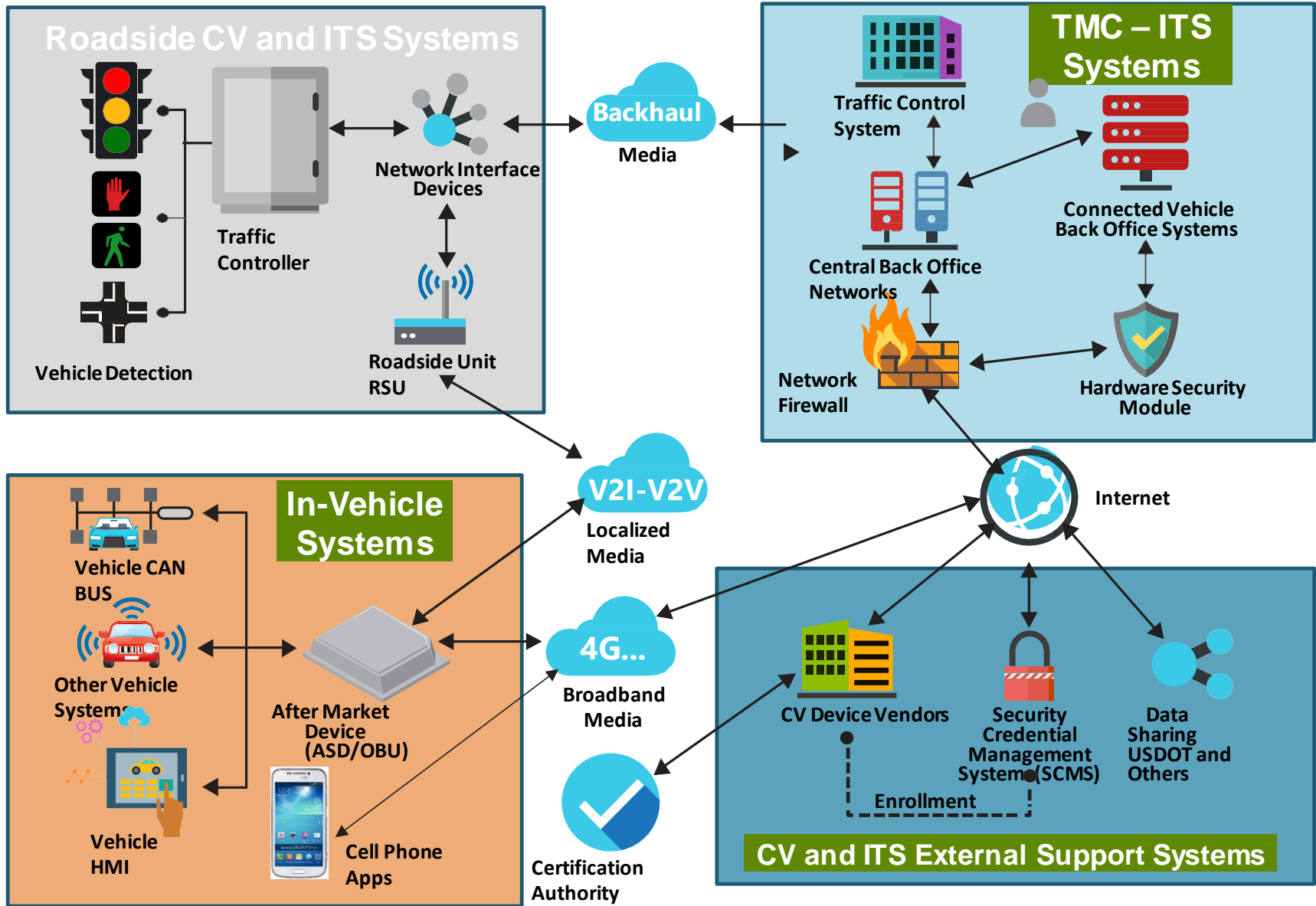
- CV Data for Intelligent Traffic Signal System
 - Measuring travel times between RSUs
 - Input to the City's Adaptive Control System (MIM, ACDSS)



New York CV Pilot Deployment System Considerations

Bob Rausch

Overview of the NY CV System



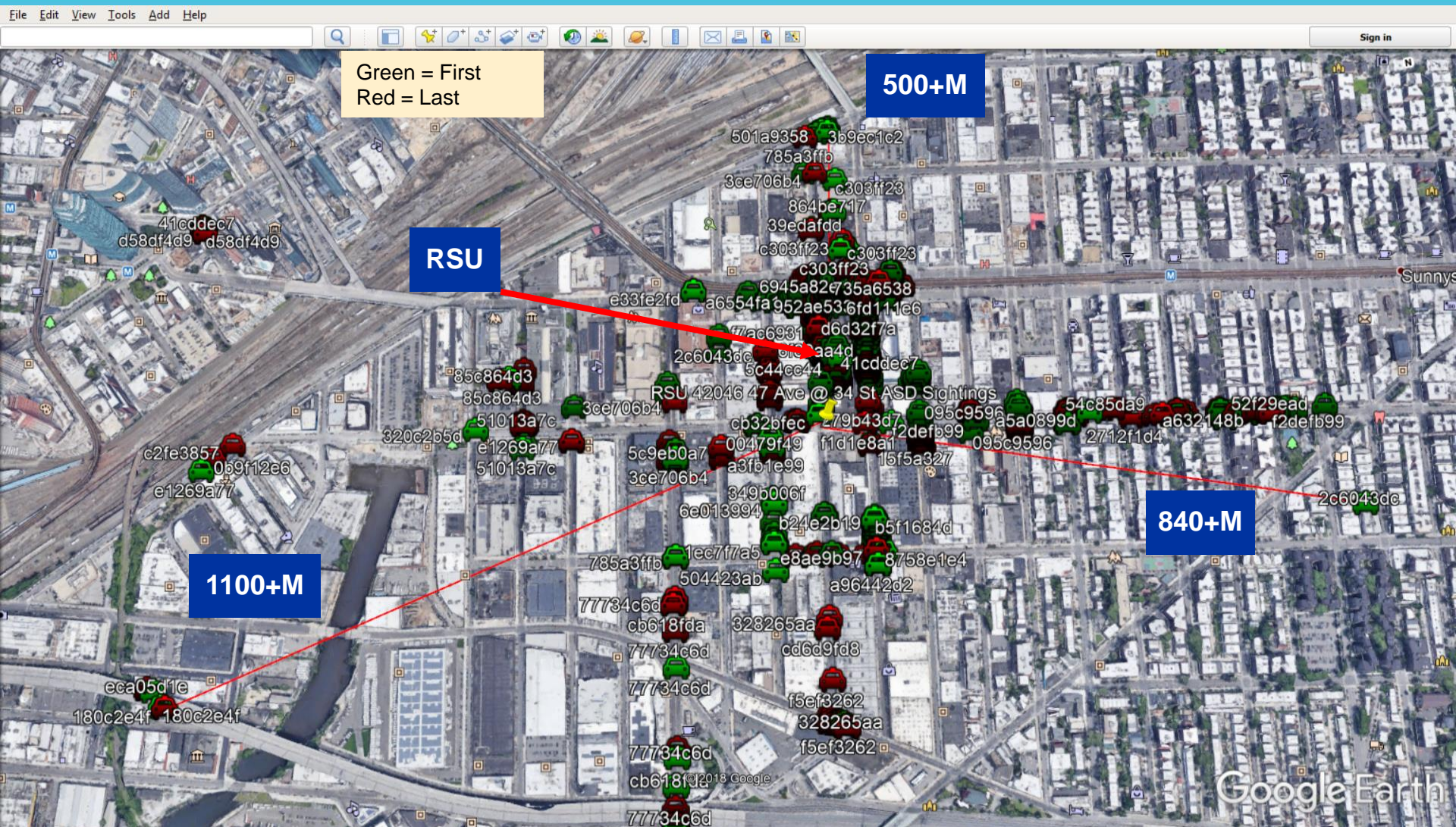
Other Support Operations and Maintenance Applications & Performance Measurement



- 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
- Edge Computing at ASD and RSU – reduces volume of data

RSU (34th/47th Queens) Sighting ASD

First/Last RF Data Sample

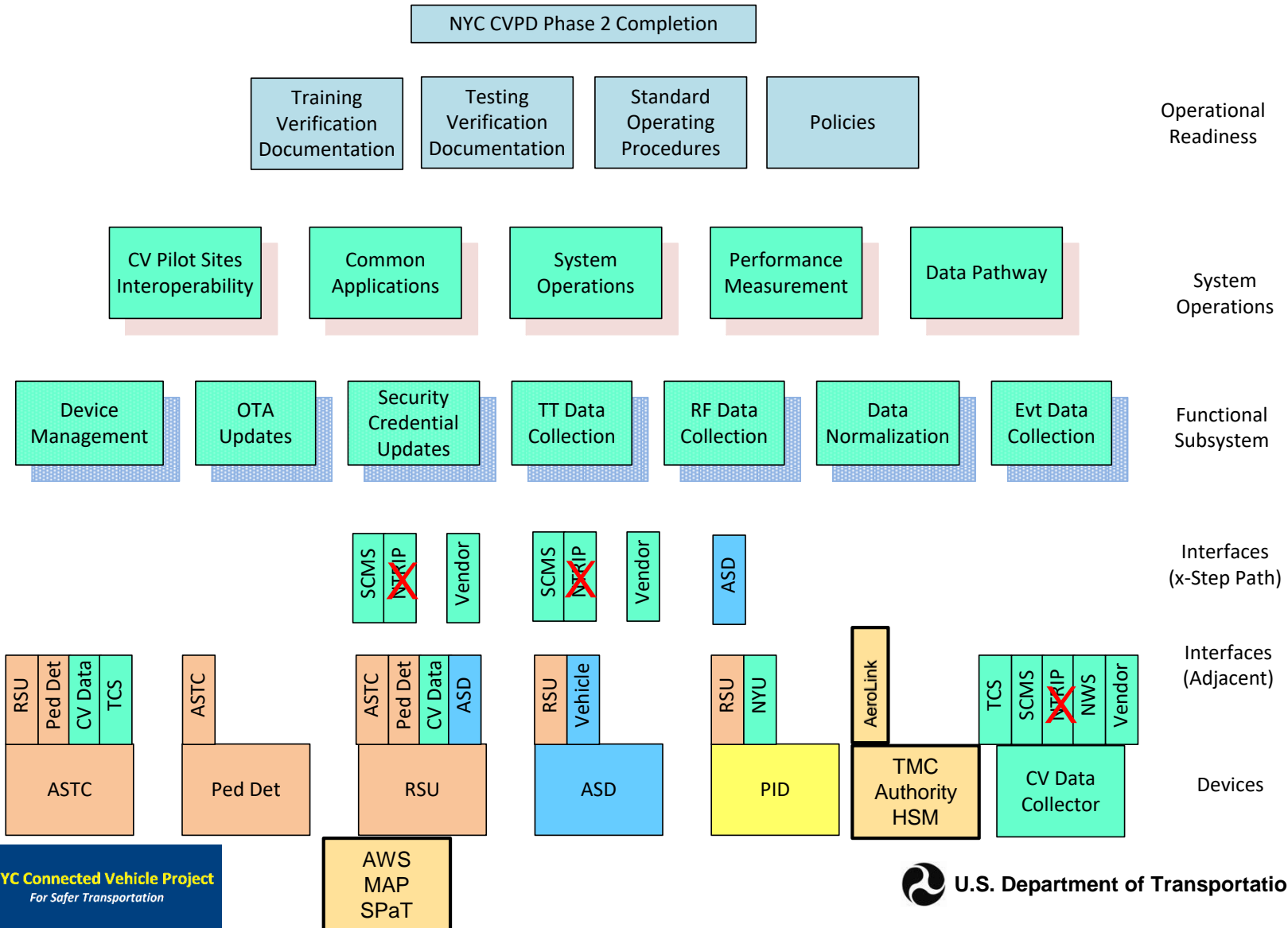




New York City DOT CV Pilot Operational Readiness Approach

David Benevelli

Operational Readiness Pyramid (Revised)



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

34th & 47th



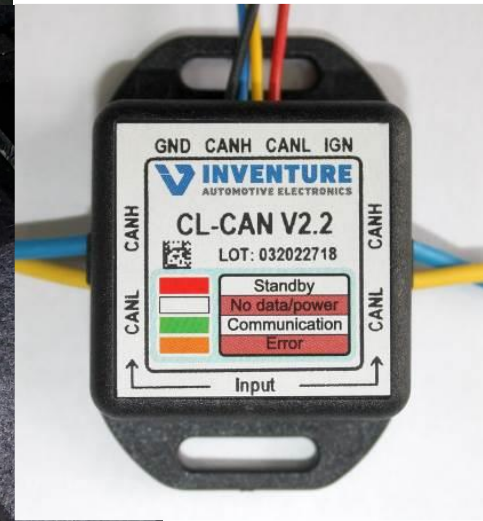
Through the glass antenna mount



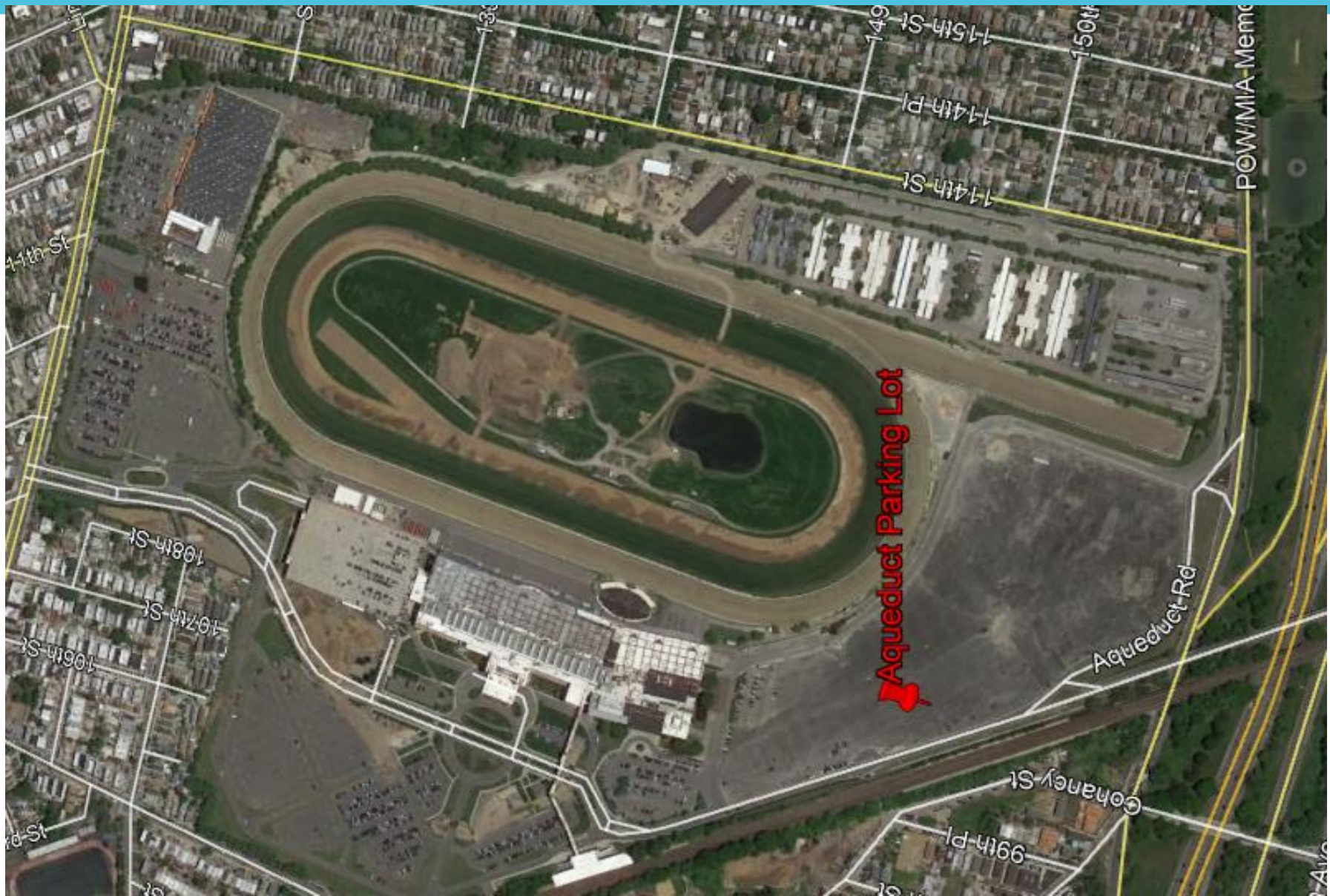
Typical RSU Installation



CAN bus interface



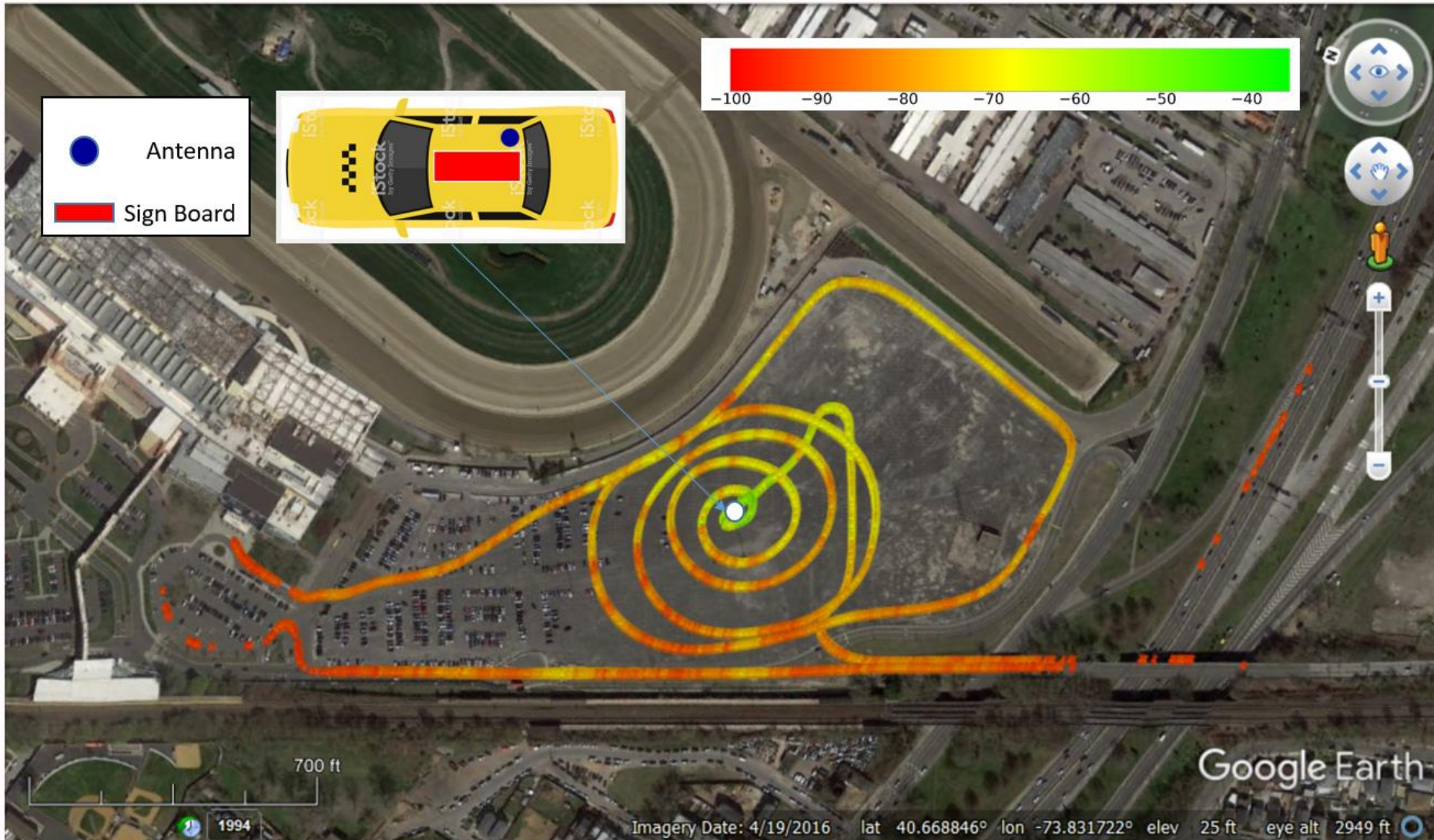
Isolated Test Facility



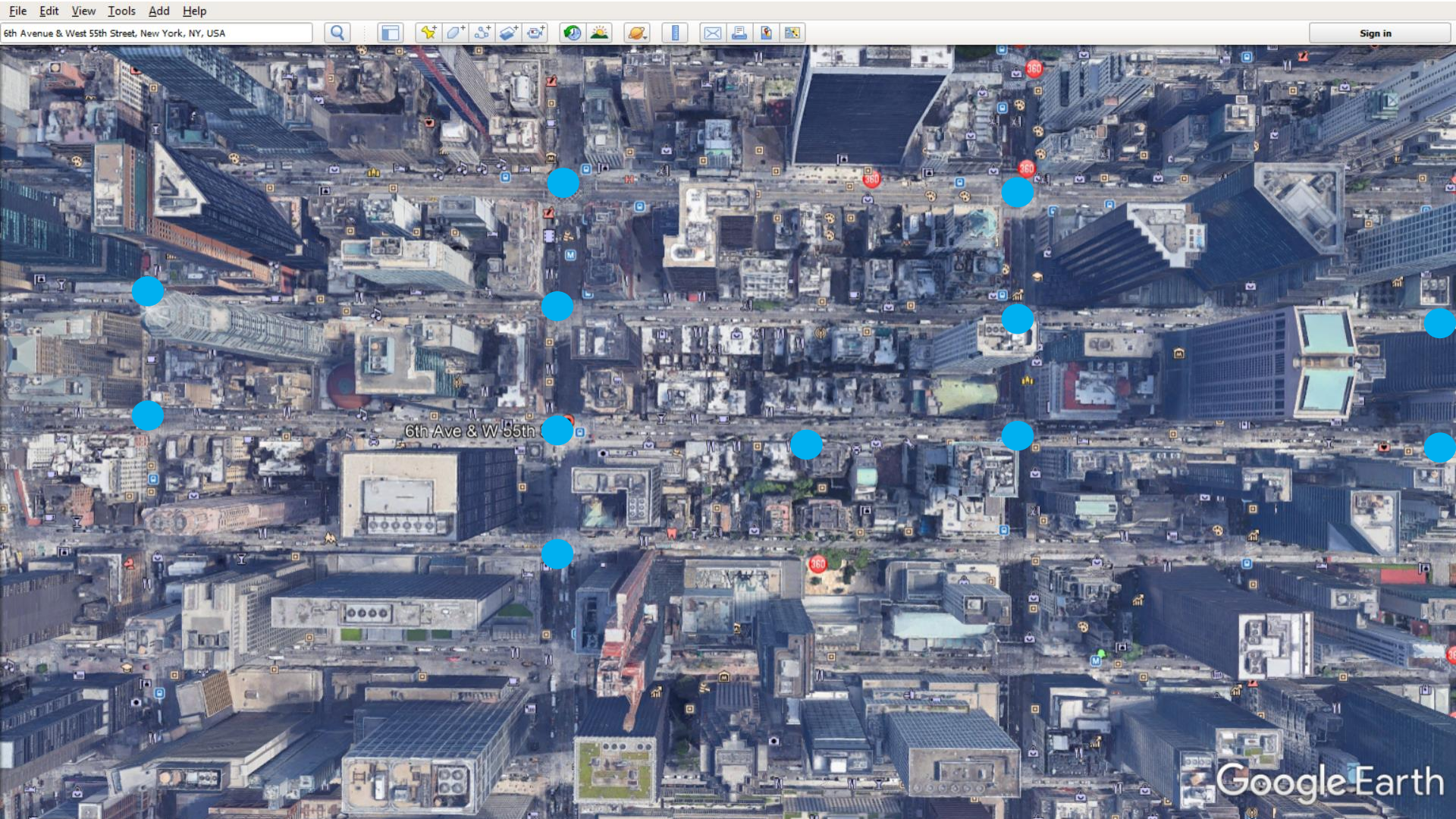
Propagation Testing for Antenna Locations



Test Run 2 ----[05/03/2019]
2011 Ford Crown Vic



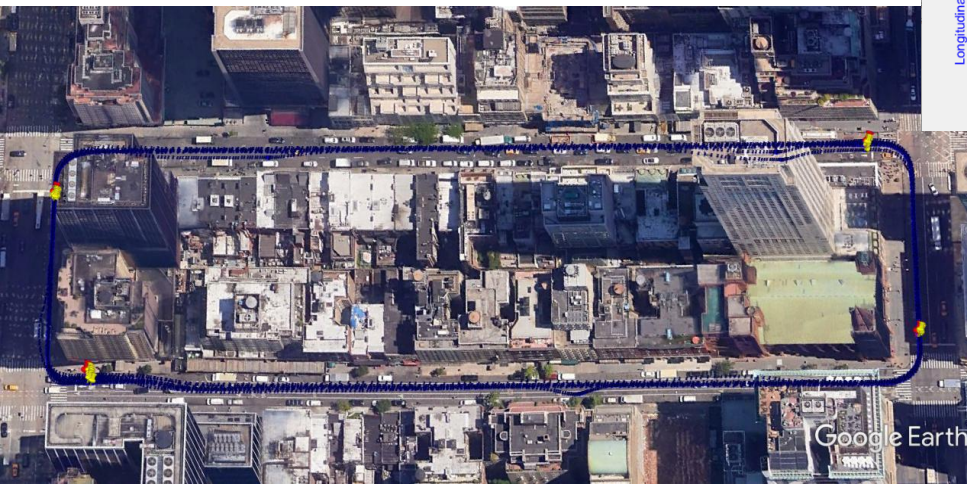
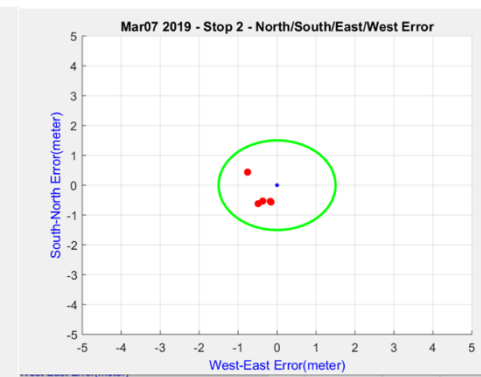
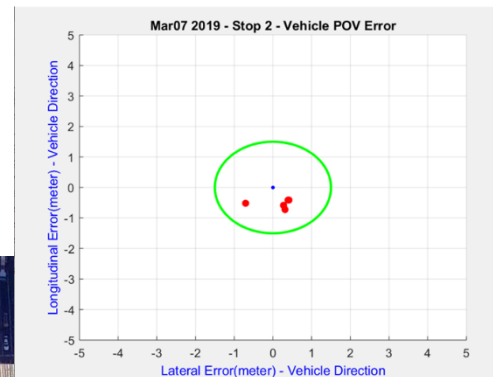
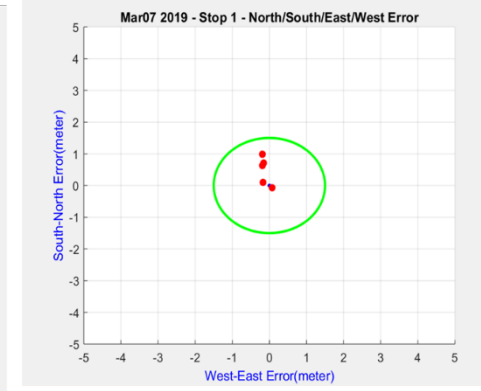
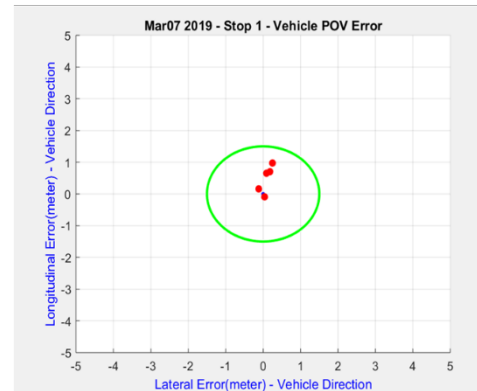
Manhattan Location Accuracy Tests



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

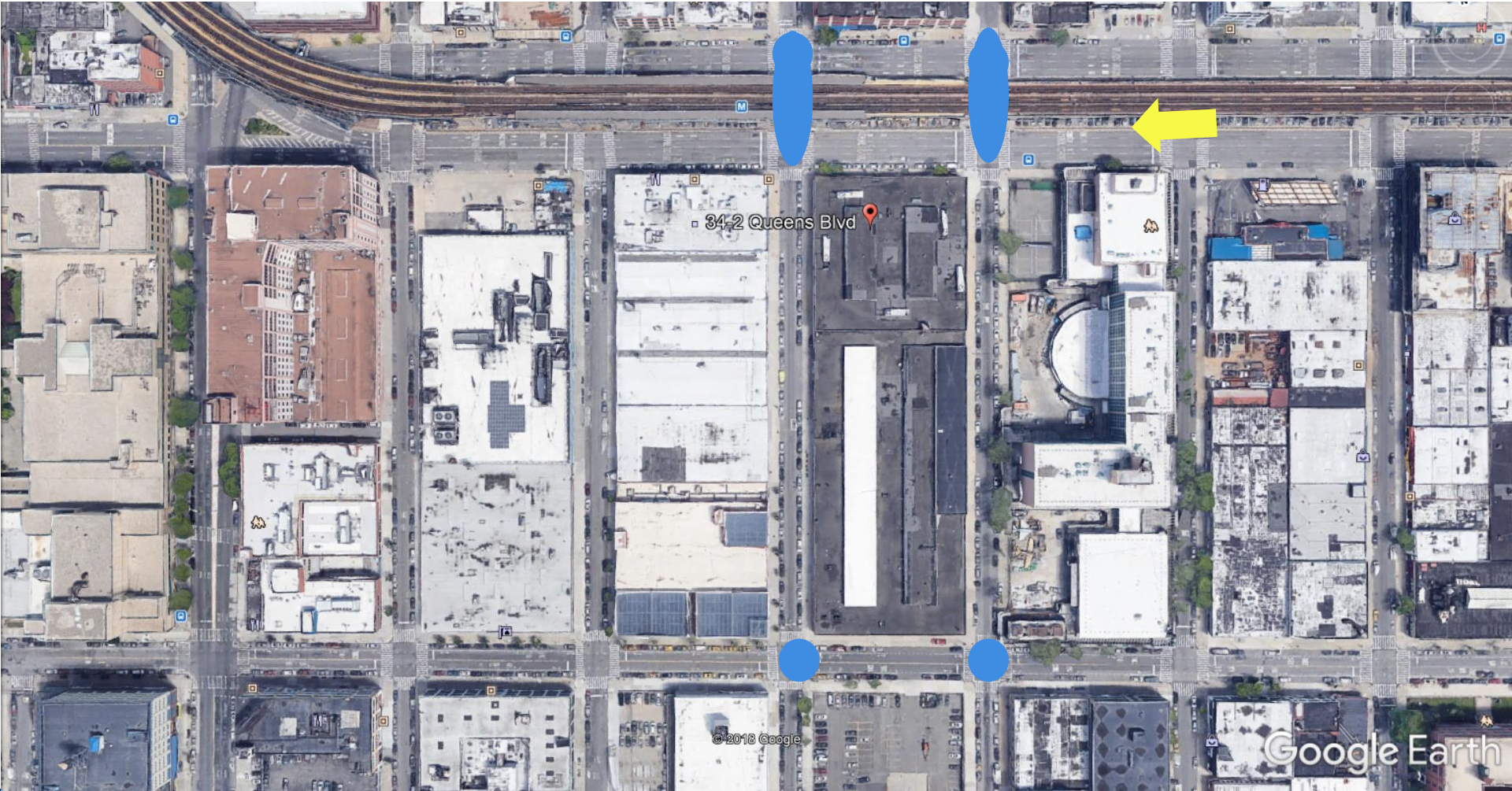
- Use cases demonstrated
- Locations
- Number of vehicles
- Results
- Use cases postponed



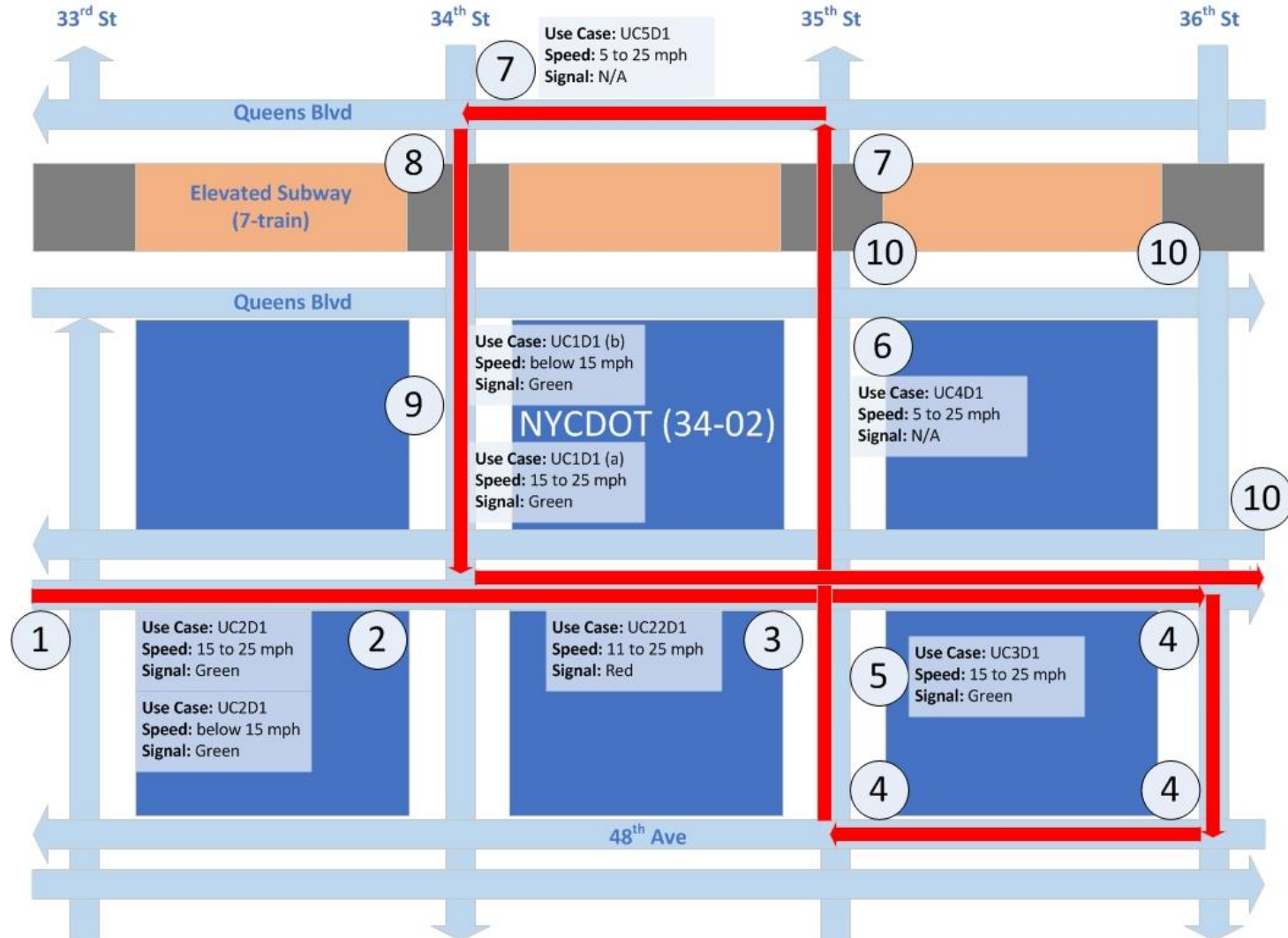
Apps Demonstrated

Application	Type
Forward Collision Warning	V2V
Emergency Electronic Brake Light	V2V
Blind Spot Warning	V2V
Lane Change Warning/Assist	V2V
Intersection Movement Assist	V2V
Red Light Violation Warning	V2I
Speed Compliance	V2I
Curve Speed Compliance	V2I
Speed Compliance/Work Zone	V2I
Oversize Vehicle Compliance	V2I
Emergency Communication/Evacuation Info	V2I

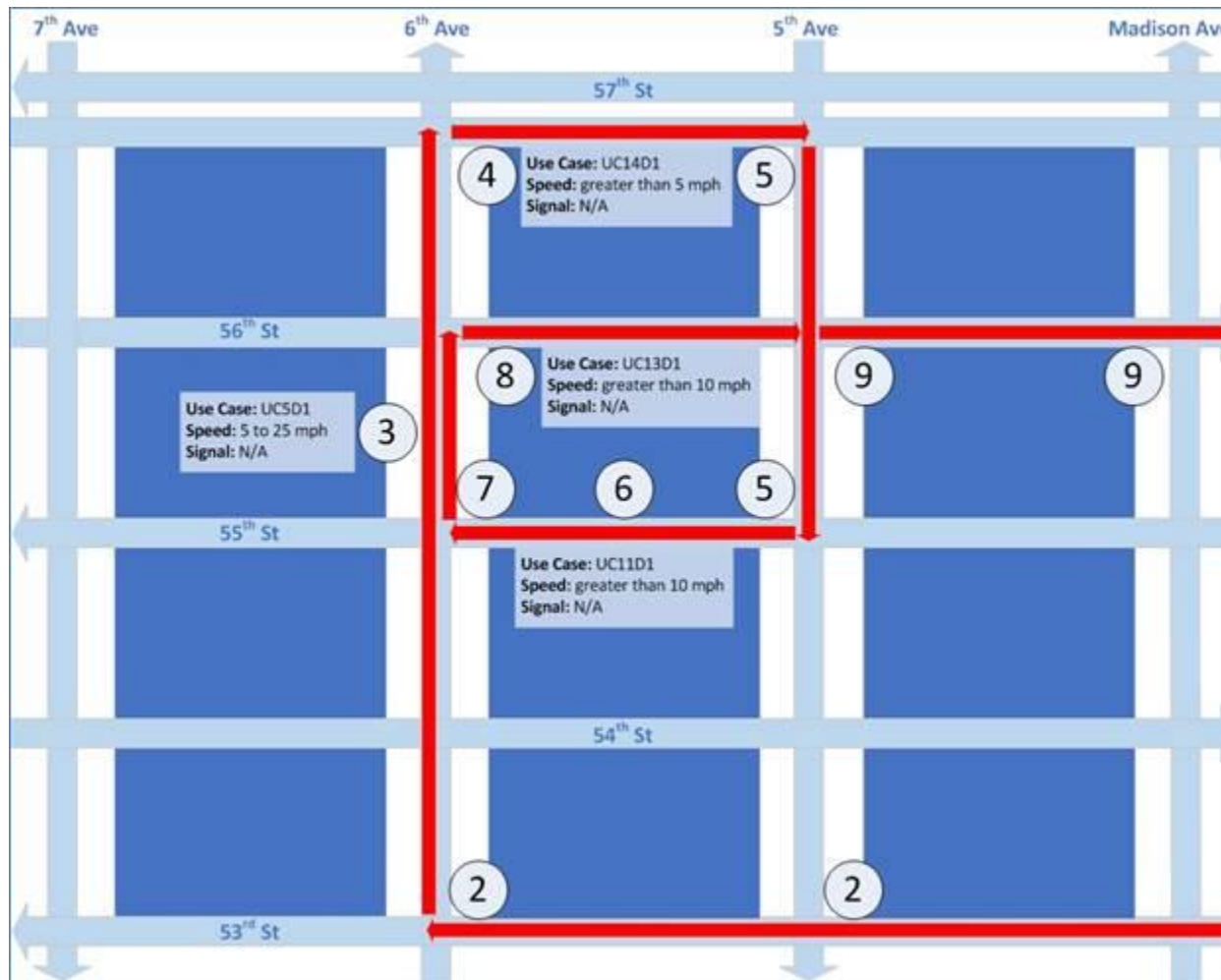
Queens Test Locations



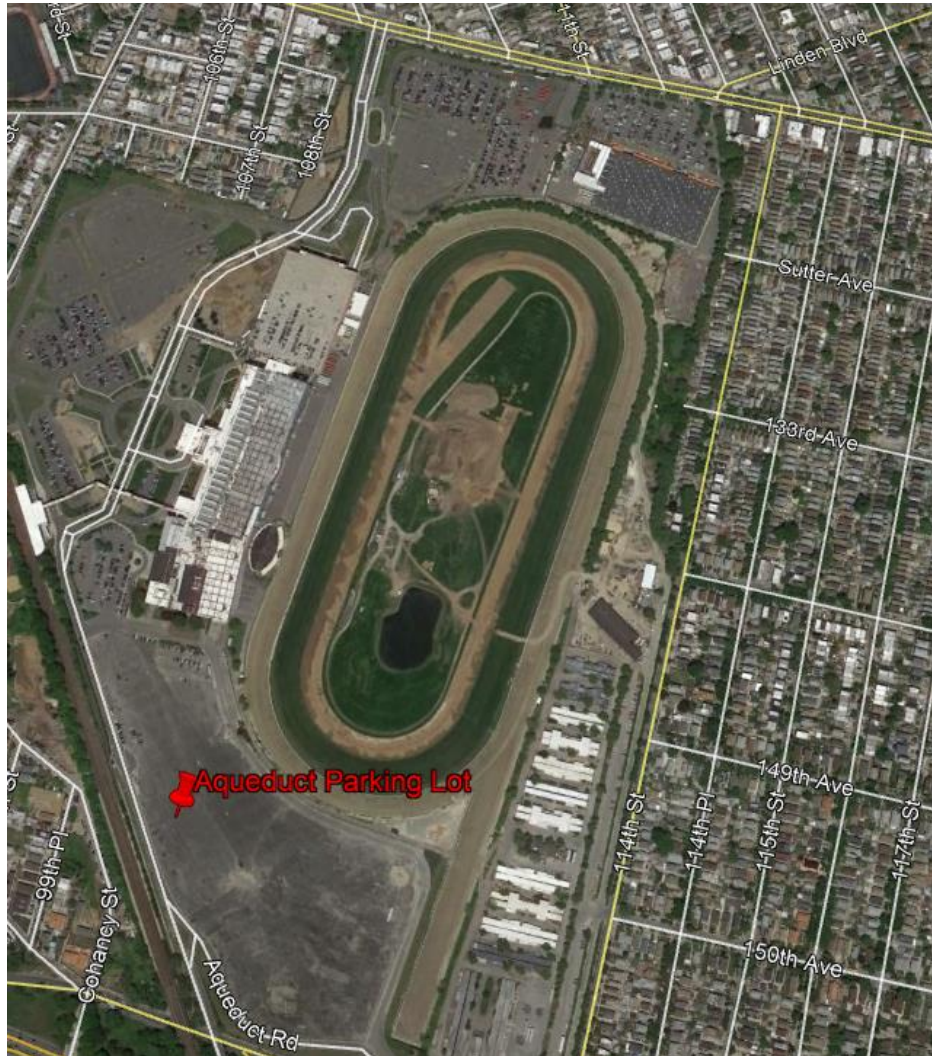
Queens Demonstration Route



Manhattan Demonstration Route



Aqueduct Demonstration Location



V2V Testing in a Controlled Environment



Vehicles/Participants at Aqueduct



Demonstration Observation



O&M Apps Demonstrated



Application	Type
OTA firmware download	O&M
OTA data upload	O&M
SCMS certificate top-off	O&M
V2X location applications in Manhattan	O&M

Results



Demonstration	Result
Forward Collision Warning	Pass
Emergency Electronic Brake Light	Pass
Blind Spot Warning	Pass
Lane Change Warning/Assist	Pass
Intersection Movement Assist	Pass
Red Light Violation Warning	Pass
Speed Compliance	Pass
Curve Speed Compliance	Pass
Speed Compliance/Work Zone	Pass
Oversize Vehicle Compliance	Pass
Emergency Communication/Evacuation Info	Pass



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



STAY CONNECTED



Join us for *Using Connected Vehicle Technologies to Solve Real-World Operational Problems Series at*

<https://www.its.dot.gov/pilots/>

- 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://wydotcwp.wyoroad.info/>

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