



# CONNECTED VEHICLE PILOT Deployment Program



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# OVERVIEW



- Connected Vehicles Pilot Deployment Program Overview
- Overview of CV Pilot Program Award Sites
  - Wyoming DOT (WYDOT) CV Pilot Deployment
  - New York City (NYC) DOT CV Pilot Deployment
  - Tampa (THEA) CV Pilot Deployment
- Interoperability Testing Summary
- How to Stay Connected





# CV PILOT DEPLOYMENT PROGRAM GOALS



## Spur Early CV Tech Deployment



Wirelessly Connected Vehicles



Mobile Devices



Infrastructure

## Measure Deployment Benefits



Safety



Mobility



Environment

## Resolve Deployment Issues



Technical



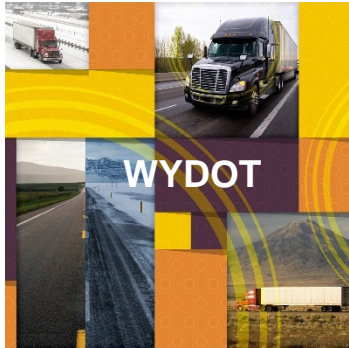
Institutional



Financial



# THE THREE PILOT SITES



- Reduce the number and severity of adverse weather-related incidents in the I-80 Corridor in order to improve safety and reduce incident-related delays.
- Focused on the needs of commercial vehicle operators in the State of Wyoming.



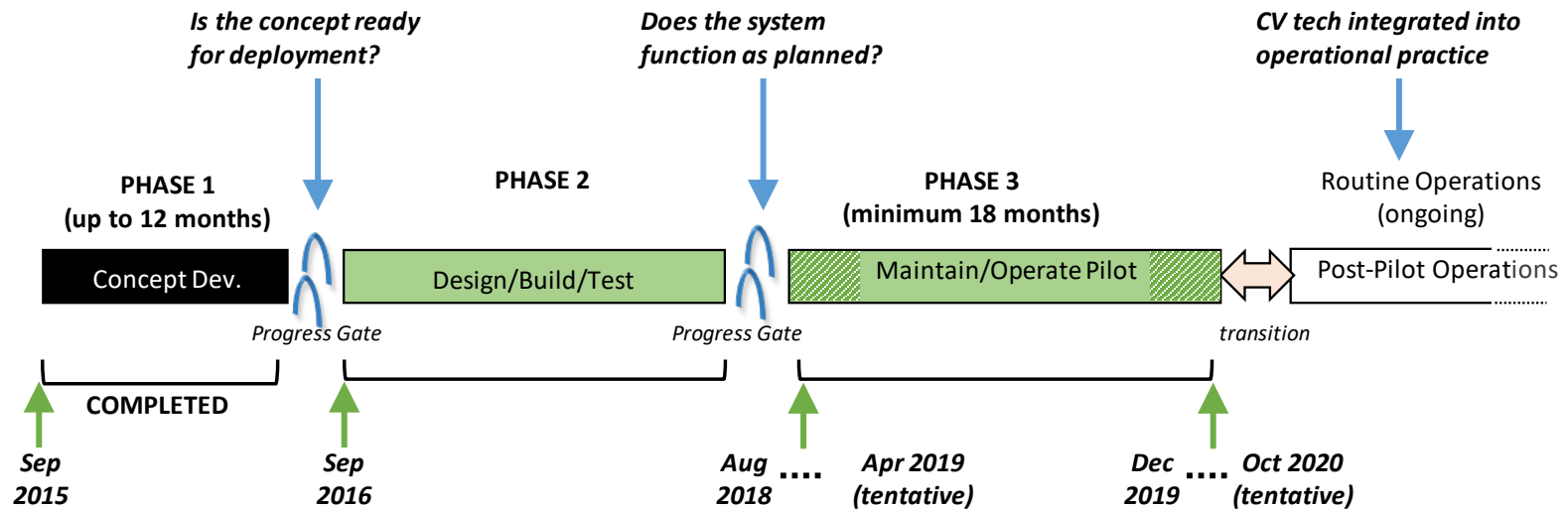
- Improve safety and mobility of travelers in New York City through connected vehicle technologies.
- Vehicle to vehicle (V2V) technology installed in up to 8,000 vehicles in Midtown Manhattan, and vehicle to infrastructure (V2I) technology installed along high-accident rate arterials in Manhattan and Central Brooklyn.



- Alleviate congestion and improve safety during morning commuting hours.
- 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 transportation challenges.



# CV PILOT DEPLOYMENT SCHEDULE



Last updated: June 12, 2018

- **Phase 1: Concept Development (COMPLETE)**
  - Creates the foundational plan to enable further design and deployment
- **Phase 2: Design/Deploy/Test**
  - Detailed design and deployment followed by testing to ensure deployment functions as intended (both technically and institutionally)
- **Phase 3: Maintain/Operate**
  - Focus is on assessing the performance of the deployed system
- Post Pilot Operations (CV tech integrated into operational practice)





# WYDOT PILOT DEPLOYMENT OVERVIEW

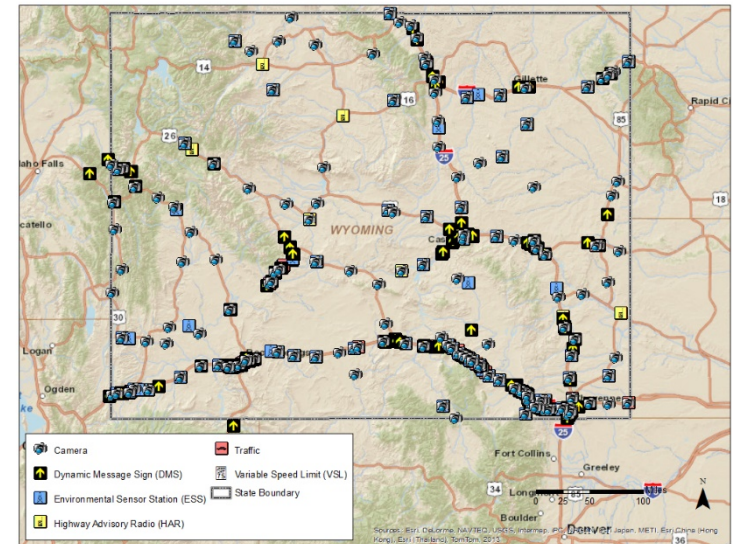


## Objective:

- Reduce the number and severity of adverse weather-related incidents (including secondary incidents) in the I-80 Corridor in order to improve safety and reduce incident-related delays.
  - Focused on the needs of the commercial vehicle operator in the State of Wyoming

## Approach:

- Equip fleet vehicles (combination of snow plows, maintenance fleet vehicles, emergency vehicles, and private trucks) that frequently travel the I-80 corridor to transmit basic safety messages (BSMs), collect vehicle and road condition data and provide it remotely to the WYDOT TMCs
- Deploy DSRC roadside equipment (RSE) to supplement existing assets and initiatives
- Road weather data shared with freight carriers who will transmit to their trucks using existing in-vehicle systems



Source: Wyoming DOT

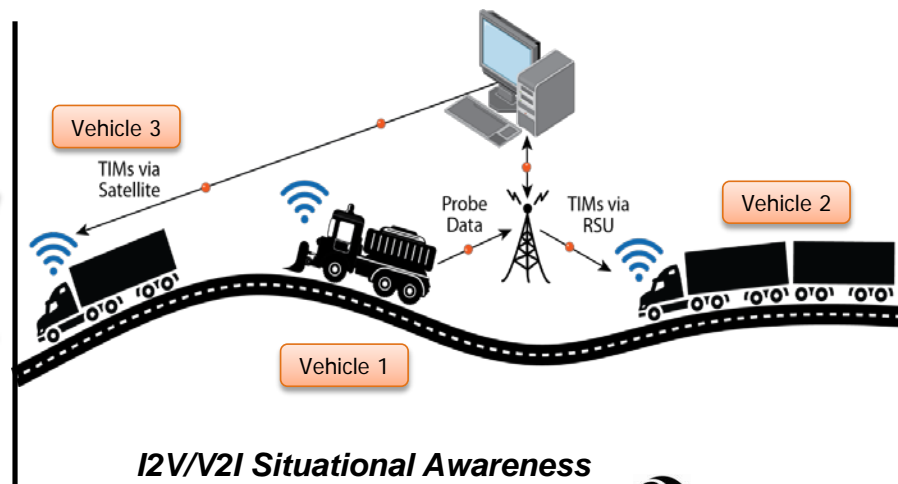
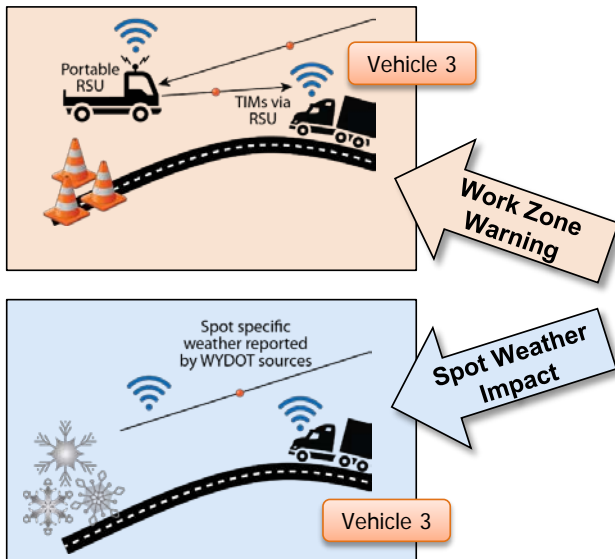


# WYDOT PILOT DEPLOYMENT PROPOSED CV APPLICATIONS & DEVICES



Category	WYDOT – CV Application
V2V Safety	Forward Collision Warning (FCW)
V2I/I2V Safety	Situational Awareness
	Work Zone Warnings (WZW)
	Spot Weather Impact Warning (SWIW)
V2I and V2V Safety	Distress Notification (DN)

WYDOT – Devices	Estimated Number
Roadside Unit (RSU)	75
WYDOT Fleet Subsystem OBU	100
Integrated Commercial Truck Subsystem OBU	150
Retrofit Vehicle Subsystem OBU	25
Basic Vehicle Subsystem OBU	125
<i>Total Equipped Vehicles</i>	400



**I2V/V2I Situational Awareness**  
Source: WYDOT



# WYDOT Pilot Deployment Vision

## Traffic Management Center



- 400 Equipped Trucks:
- 100 WYDOT Fleet
- 150 Integrated Commercial Trucks
- 25 Retrofit Vehicles
- 125 Basic Vehicles



75 RSU



122 VSL Signs



55 Parking Locations



402 Miles of I-80



# NYCDOT PILOT DEPLOYMENT OVERVIEW



## 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 8,000 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 310 traffic signals along 1st, 2nd, 5th, and 6th Avenues in Manhattan and Flatbush Avenue in Central Brooklyn (emergency evacuation route). In addition to the north/south avenues, five east/west two-way cross streets (14th, 23rd, 34th, 42nd, and 57th Streets) will be secondary corridors.
  - Deploy Roadside equipment (RSE) along FDR Drive



# NYCDOT PILOT DEPLOYMENT PROPOSED CV APPLICATION-FLEET DISTRIBUTION



Category	NYCDOT – CV Application	NYCDOT – Devices	Estimated Number
V2I/I2V Safety	Speed Compliance	Roadside Unit (RSU) at Manhattan and Brooklyn Intersections and FDR Drive	353
	Curve Speed Compliance		
	Speed Compliance/Work Zone	Taxi Equipped with Aftermarket Safety Device (ASD)*	5,850
	Red Light Violation Warning		
	Oversize Vehicle Compliance		
	Emergency Communications and Evacuation Information	MTA Fleet Equipped with ASD*	700
V2V Safety	Forward Crash Warning (FCW)	UPS Truck Equipped with ASD*	400
	Emergency Electronics Brake Lights (EEBL)	NYCDOT Fleet Equipped with ASD*	800
	Blind Spot Warning (BSW)	DSNY Fleet Equipped with ASD*	250
	Lane Change Warning/Assist (LCA)		
	Intersection Movement Assist (IMA)	Vulnerable Road User (Pedestrians/Bicyclists) Device	100
	Vehicle Turning Right in Front of Bus Warning		
V2I/I2V Pedestrian	Pedestrian in Signalized Crosswalk	PED Detection System	10 + 1 spare
	Mobile Accessible Pedestrian Signal System (PED-SIG)	<i>Total Equipped Vehicles</i>	<i>8,000</i>
Mobility	Intelligent Traffic Signal System (I-SIGCVDATA)		

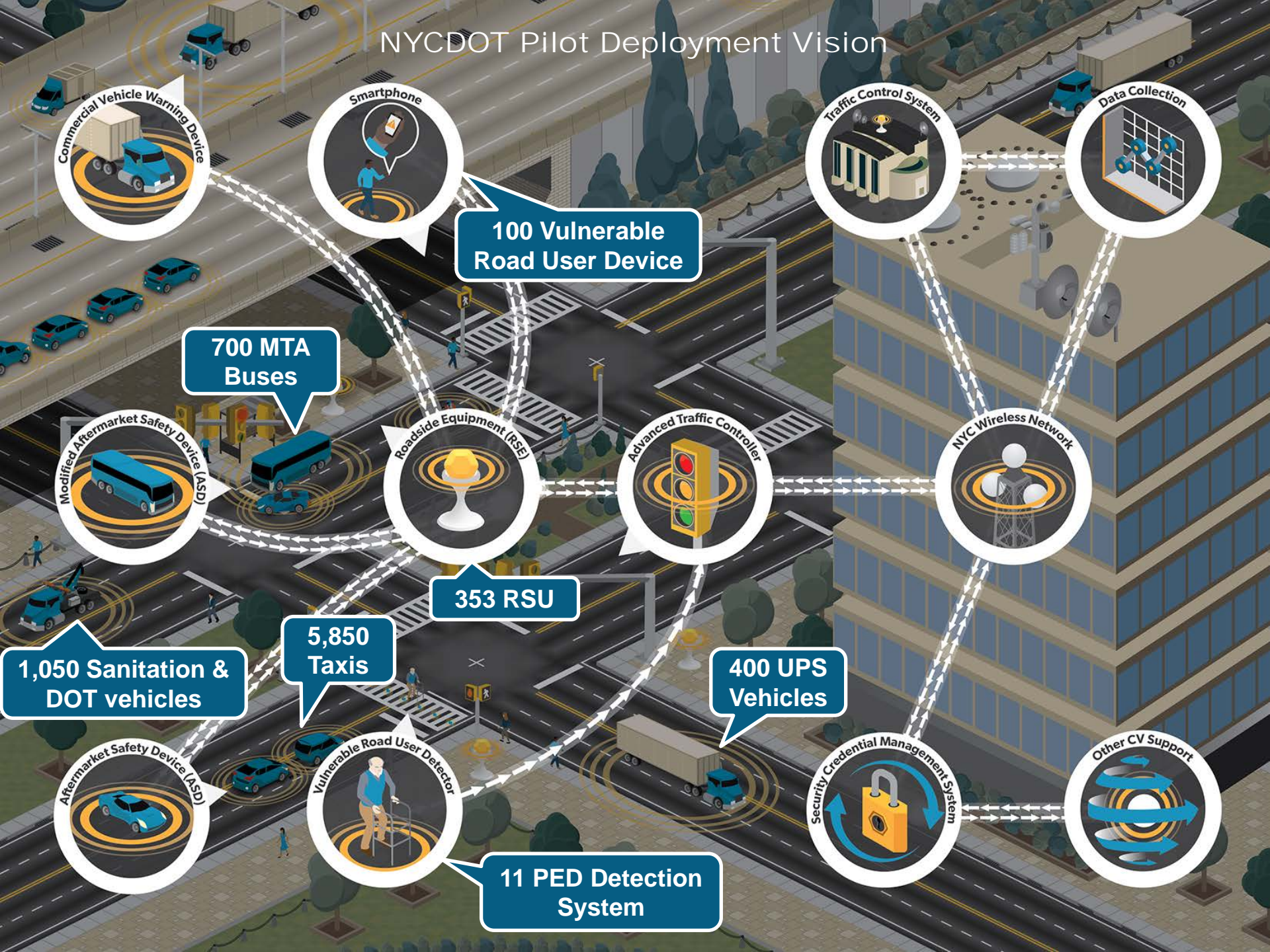
MTA: Metropolitan Transportation Authority; DSNY: City of New York Department of Sanitation

\* In addition, 600 spare ASDs will be purchased.





# NYCDOT Pilot Deployment Vision





# TAMPA (THEA) PILOT DEPLOYMENT OVERVIEW



## 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.



Source: THEA



# TAMPA (THEA) PILOT DEPLOYMENT PROPOSED CV APPLICATIONS & DEVICES



Category	Tampa (THEA) – CV Application	Tampa (THEA) – Devices	Estimated Number
V2I Safety	End of Ramp Deceleration Warning (ERDW)	Roadside Unit (RSU) at Intersection	44
	Wrong Way Entry (WWE)	Vehicle Equipped with OBU	1,580
	Pedestrian in Signalized Crosswalk Warning (PED-X)	Pedestrian Equipped with App in Smartphone	500
	Pedestrian Collision Warning (PCW)	HART Transit Bus Equipped with OBU	10
	Pedestrian Transit Movement Warning (PTMW)	TECO Line Street Car Equipped with OBU	10
V2V Safety	Emergency Electronic Brake Lights (EEBL)	<b>Total Equipped Vehicles</b>	<b>1,600</b>
	Forward Collision Warning (FCW)		
	Intersection Movement Assist (IMA)		
	Vehicle Turning Right in Front of a Transit Vehicle (VTRFTV)		
Mobility	Mobile Accessible Pedestrian Signal System (PED-SIG)		
	Intelligent Traffic Signal System (I-SIG)		
	Transit Signal Priority (TSP)		
Agency Data	Probe Date Enabled Traffic Monitoring (PDETM)		

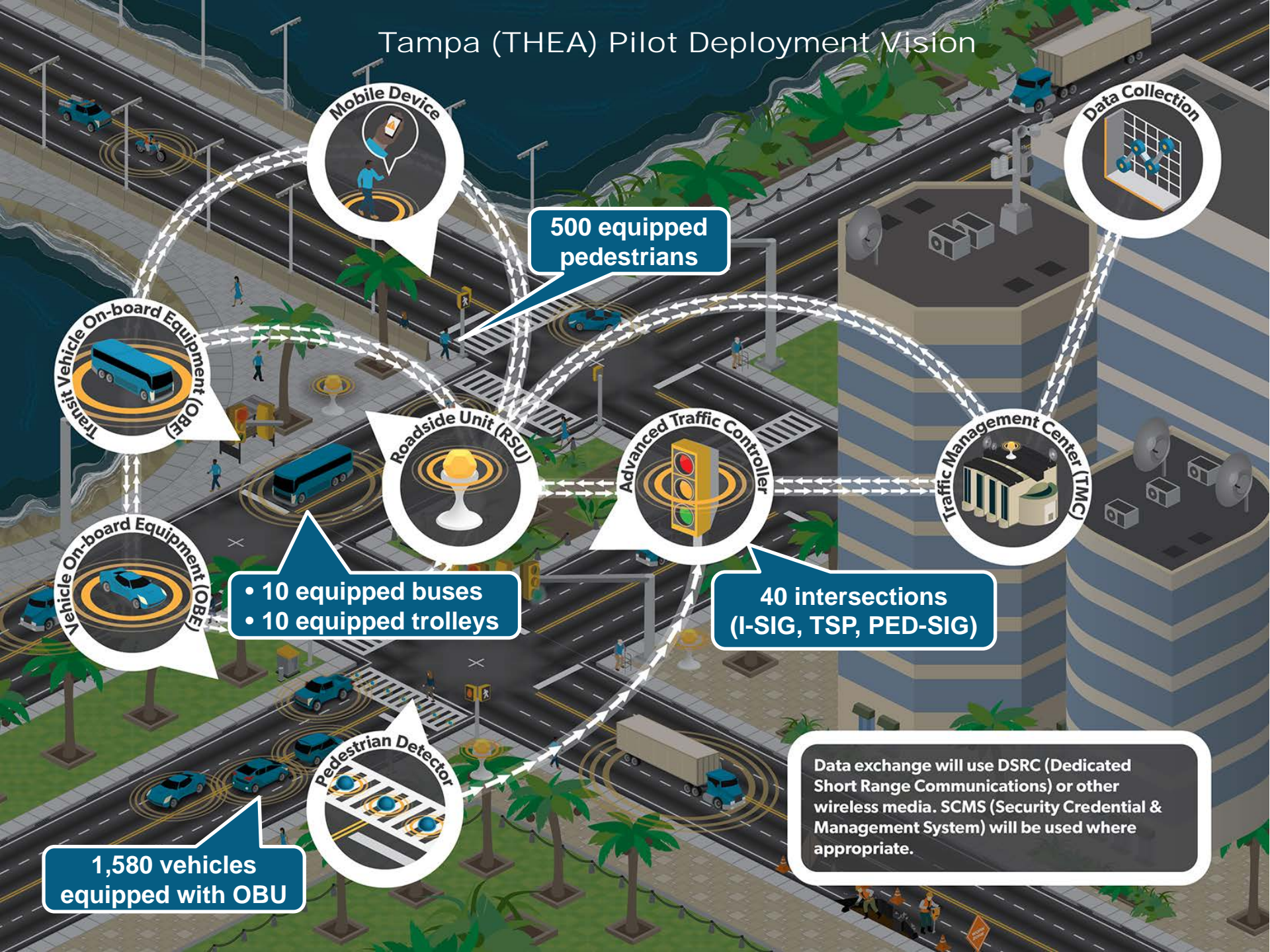


Source: THEA





# Tampa (THEA) Pilot Deployment Vision



• 10 equipped buses  
• 10 equipped trolleys

500 equipped pedestrians

40 intersections (I-SIG, TSP, PED-SIG)

1,580 vehicles equipped with OBU

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



# OVERVIEW OF INTEROPERABILITY TEST



- Dates/Location:
  - June 25 – 28, 2018 at FHWA Turner-Fairbank Highway Research Center (TFHRC)
- Objectives:
  - Test interoperability among connected vehicle (CV) devices from the three sites as well as to identify potential interoperability issues that may require resolution prior to the sites advancing to an operational phase of the CV Pilot Deployment Program later in 2018.
- Interoperability Definition (defined by the team):
  - *“A vehicle with an onboard unit (OBU) from one of the three CV Pilot sites is able to interact with OBUs and roadside units (RSUs) from each of the other sites in accordance with the key connected vehicle interfaces and standards.”*



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Tampa (THEA)



WYDOT



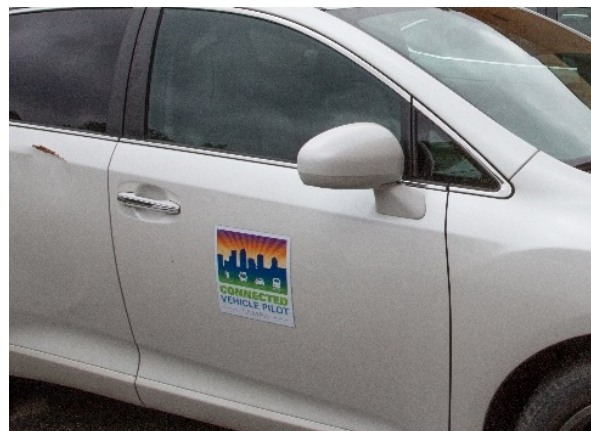
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# OVERVIEW OF TEST PLAN

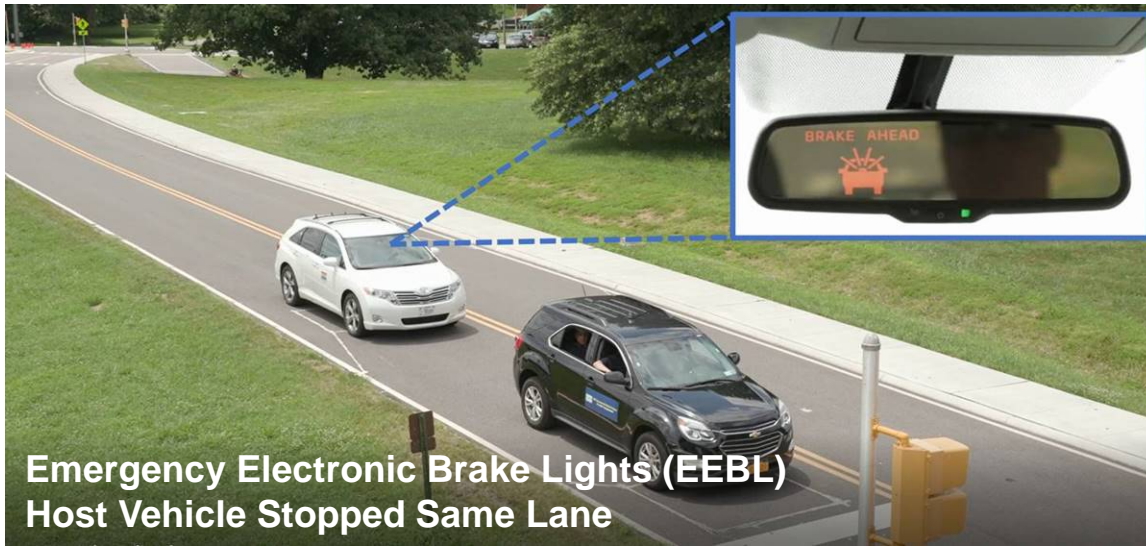


- CV Pilots Phase 2 Interoperability Test demonstrated interactions among different site's OBUs and among selected OBUs and RSUs.
  - OBU Interactions :
    - ᵃ Receive Basic Safety Messages (BSMs) transmitted by the other site's OBUs via DSRC; authenticate them as needed; parse them; and process them in accordance with SAE J2945/1.
    - ᵃ CV applications: Forward Collision Warning (FCW), Electronic Emergency Brake Light (EEBL), and Intersection Movement Assist (IMA) - only NYC/Tampa
  - OBU and RSU interactions:
    - ᵃ Signal Phase and Timing (SPaT) and MAP (only NYC and Tampa)





# PHOTOS FOR EXAMPLE TESTS



Emergency Electronic Brake Lights (EEBL)  
Host Vehicle Stopped Same Lane



Forward Collision  
Warning (FCW)  
Stationary Remote  
Vehicle Same Lane



Intersection Movement Assist (IMA) Host Vehicle Stopped



# SUMMARY



## ■ Key Results

- More than 100 test runs within three days.
- Successful message transfer via multiple communications.
- Interoperability demonstrated inclusive of SCMS enrollment.
- Nearly 5 GB of test data generated for analysis.

## ■ Testimonials with Respect to Value

- Test Team did an outstanding job planning and organizing the tests.
- Everyone had a good experience with the testing.
- A test of this nature had never been conducted before.



NYCDOT



Tampa (THEA)



WYDOT



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# STAY CONNECTED



## 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:

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

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