CONNECTED VEHICLE PILOT
Deployment Program

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ITS Joint Program Office

U.S. Department of Transportation

WHAT TO EXPECT IN THIS SESSION

- Overview of the Connected Vehicles Deployment Program
- Deeper dive into the THEA CV pilot
- Q & A

NYCDOT

Tampa (THEA)

WYDOT

USDOT

CV Pilot Deployment Program Goals

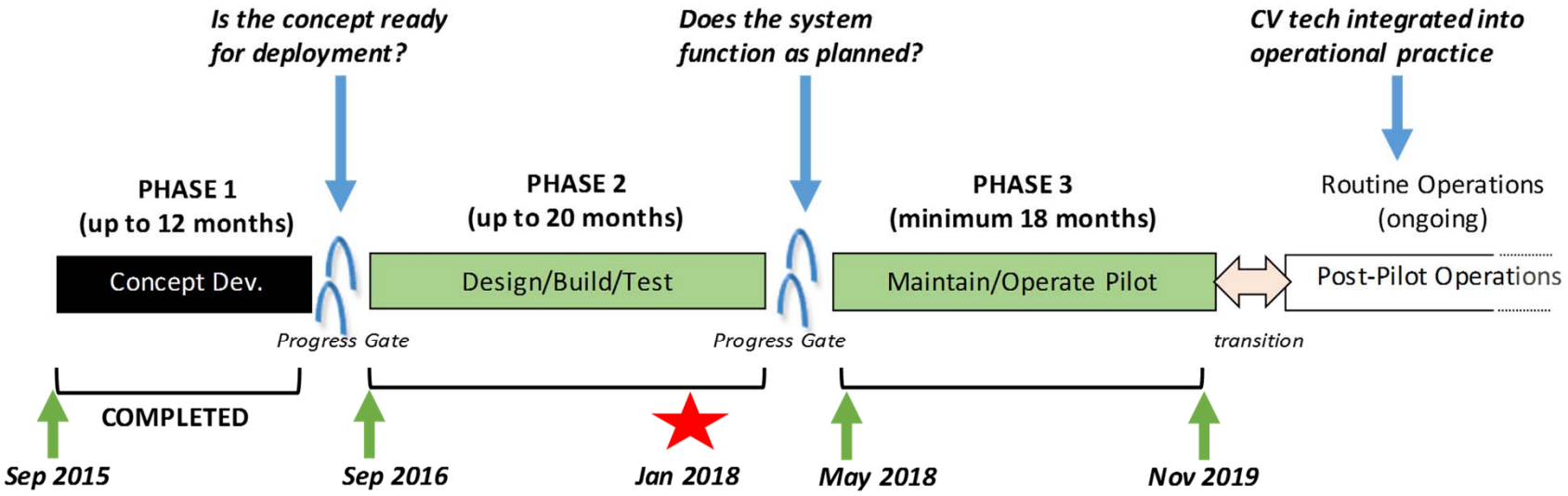
THE THREE PILOT SITES

- 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.

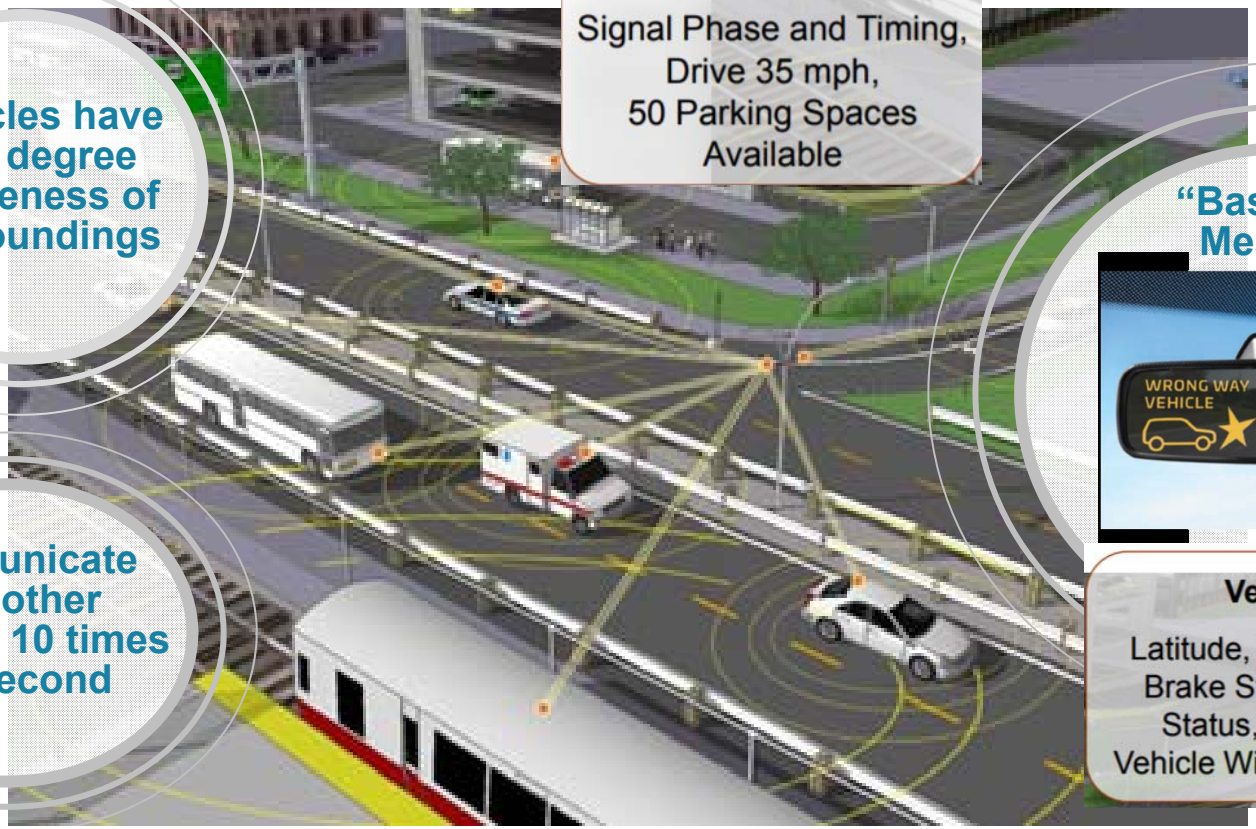
- Alleviate congestion and improve safety during morning commuting hours.
- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the transportation challenges.

CV Pilot Deployment Schedule



Starting from May 2018, these deployments are scheduled to enter an operational phase.

Connected Vehicle Communication



Infrastructure Data:

Signal Phase and Timing,
Drive 35 mph,
50 Parking Spaces
Available

Vehicles have 360 degree awareness of surroundings

Communicate with other vehicles 10 times per second

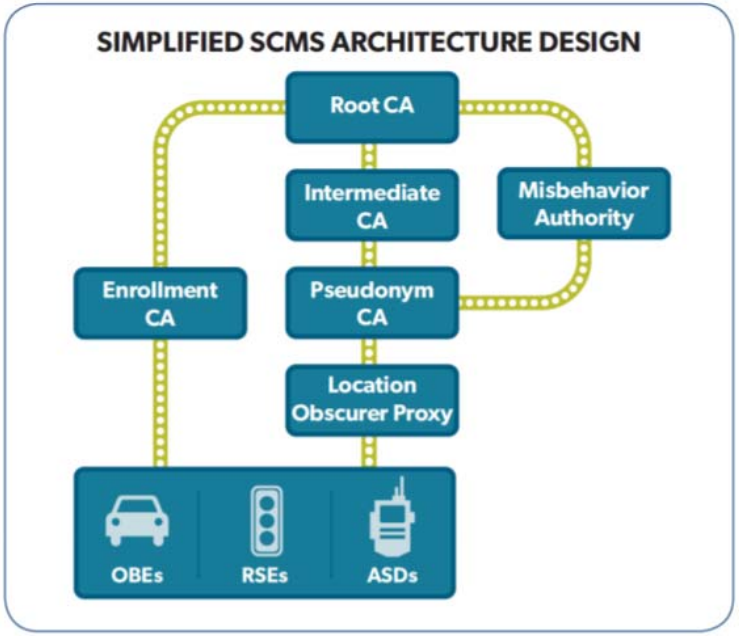
"Basic Safety Messages"

Vehicle Data:

Latitude, Longitude, Speed, Brake Status, Turn Signal Status, Vehicle Length, Vehicle Width, Bumper Height

How are we securing the messages

- The SCMS POC provides the security infrastructure to issue and manage the security certificates that form the basis of trust for Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication.
- Connected vehicle devices enroll into the SCMS, obtain security certificates from certificate authorities (CAs), and attach those certificates to their messages as part of a digital signature.
- The SCMS system and processes provide a high level of confidence that the device is a trusted actor in the system, while also maintaining privacy.



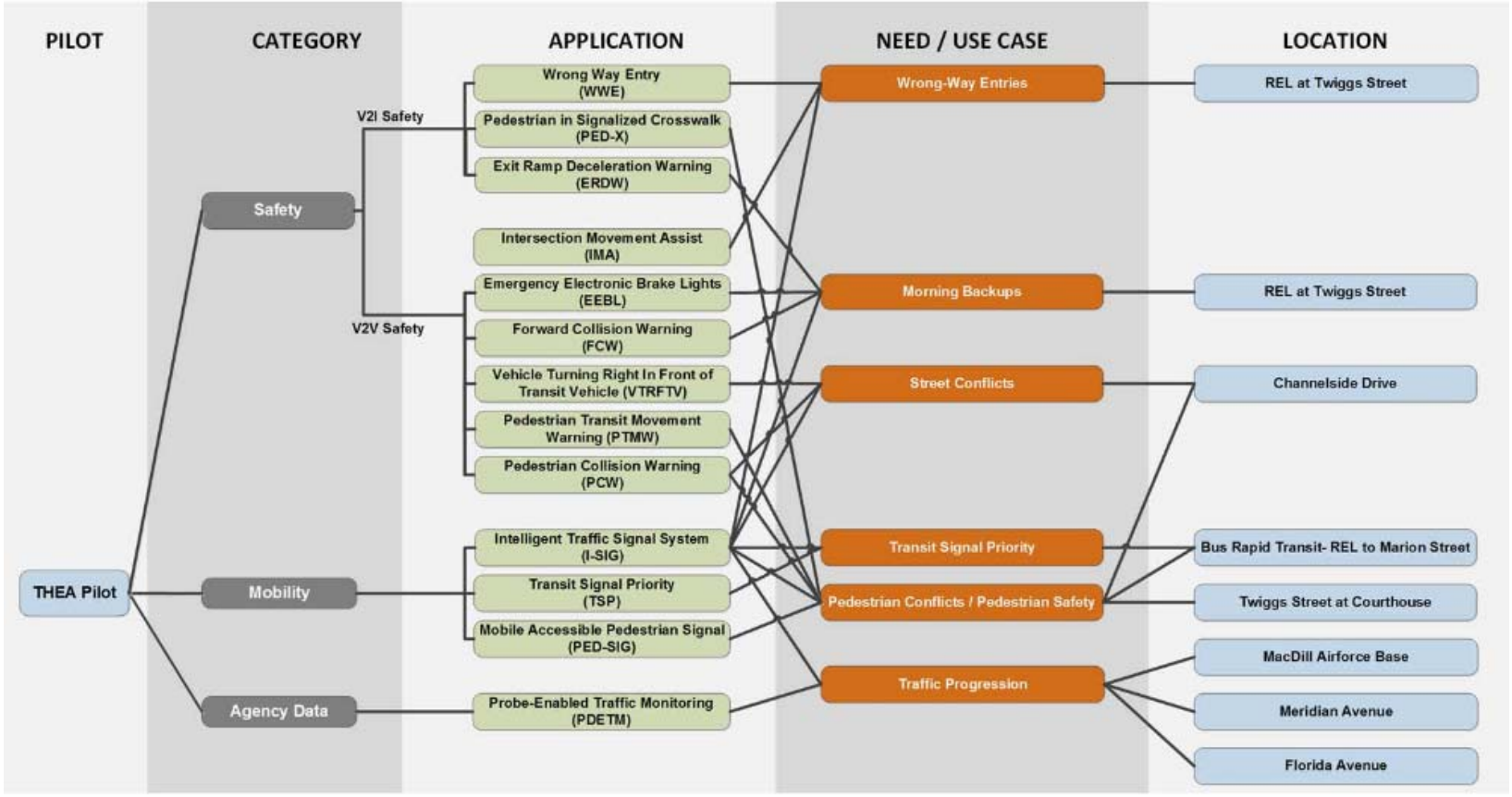
Source: https://www.its.dot.gov/factsheets/pdf/CV_SCMS.pdf

TAMPA (THEA) PILOT DEPLOYMENT OVERVIEW

EXPANDED STAKEHOLDER IMPACT AREA

Focused Deployment Area

CV Applications to be Deployed



PARTICIPANTS


PHOTO: THEA

1,600


PHOTO: NPR

500+


PHOTO: THEA

10

PHOTO: THEA

10

MORNING BACKUPS

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)

- Forward Collision Warning (FCW)
- Emergency Electronic Brake Light (EEBL)
- End of Ramp Deceleration Warning (ERDW)
- Intelligent Signal Systems (I-SIG)

WRONG-WAY DRIVERS

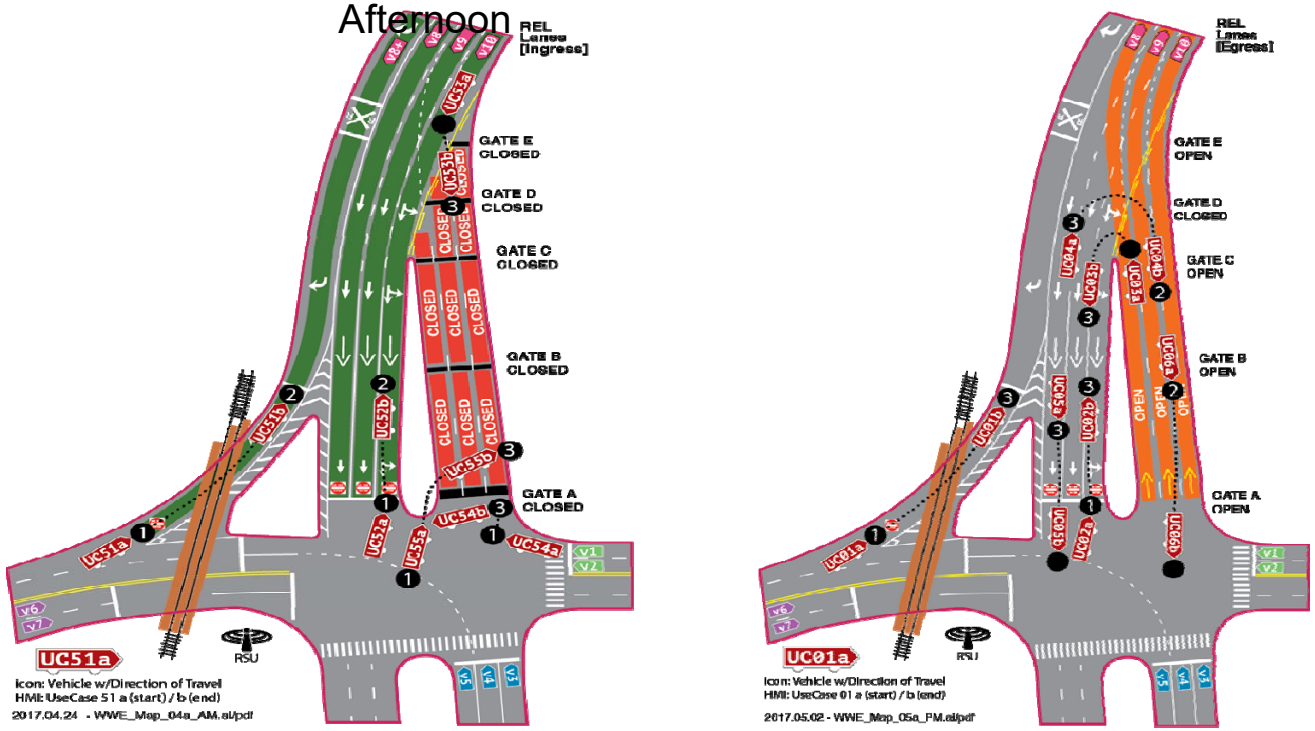
PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)

- Wrong-way Entry
- Intersection Movement Assist (IMA)
- MAP
- Signal Phasing and Timing (SPaT)

WWE: What the OBU "Sees"

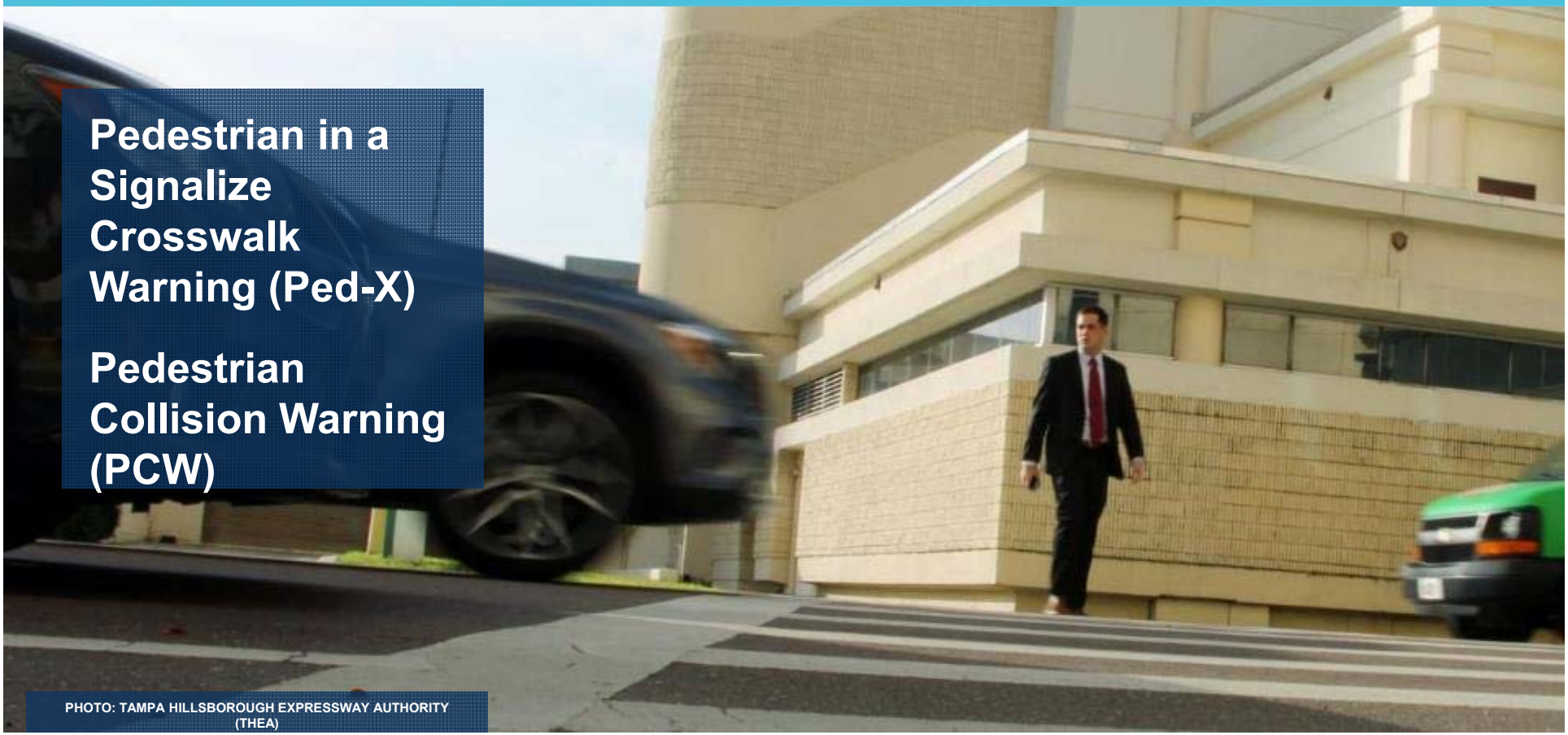
Morning

Afternoon

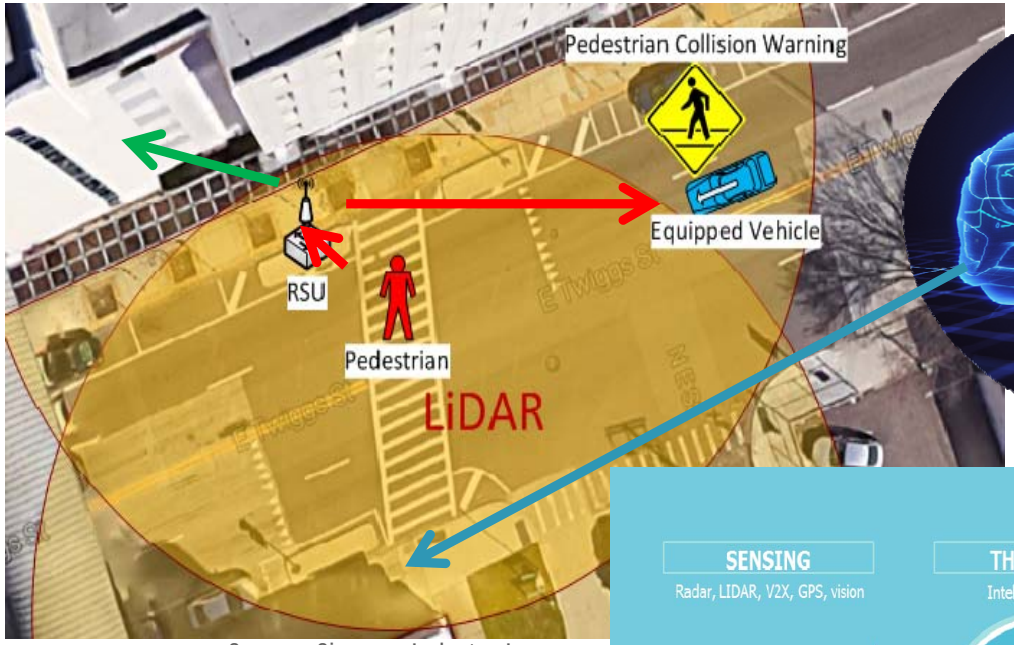


Source: Siemens Industry Inc.

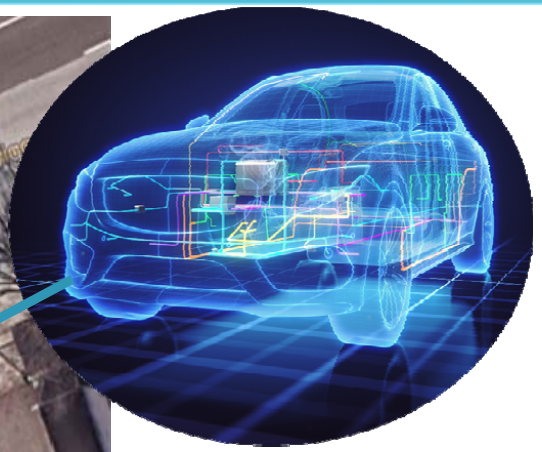
PEDESTRIAN SAFETY



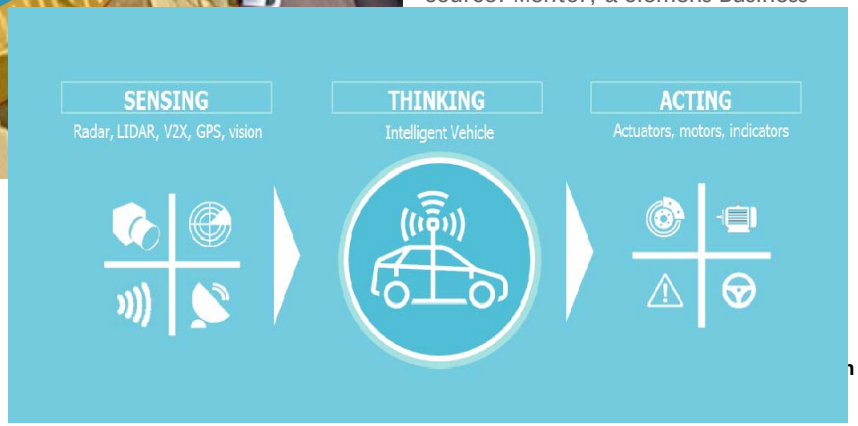
PCW: What the OBU "Sees"



Source: Siemens Industry Inc.



Source: Mentor, a Siemens Business



- No False Positives
- No False Negatives
- CUTR: Lidar vs. PSD location service
- Use for PTMW Geo Fence settings

TRANSIT SIGNAL PRIORITY

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)

- I-SIG
- Transit Signal Priority (TSP)
- IMA
- Pedestrian Transit Movement Warning (PTMW)

STREETCAR CONFLICTS

Vehicle Turning Right in Front of Transit Vehicle (VTRFTV)

PTMW

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)

TRAFFIC PROGRESSION

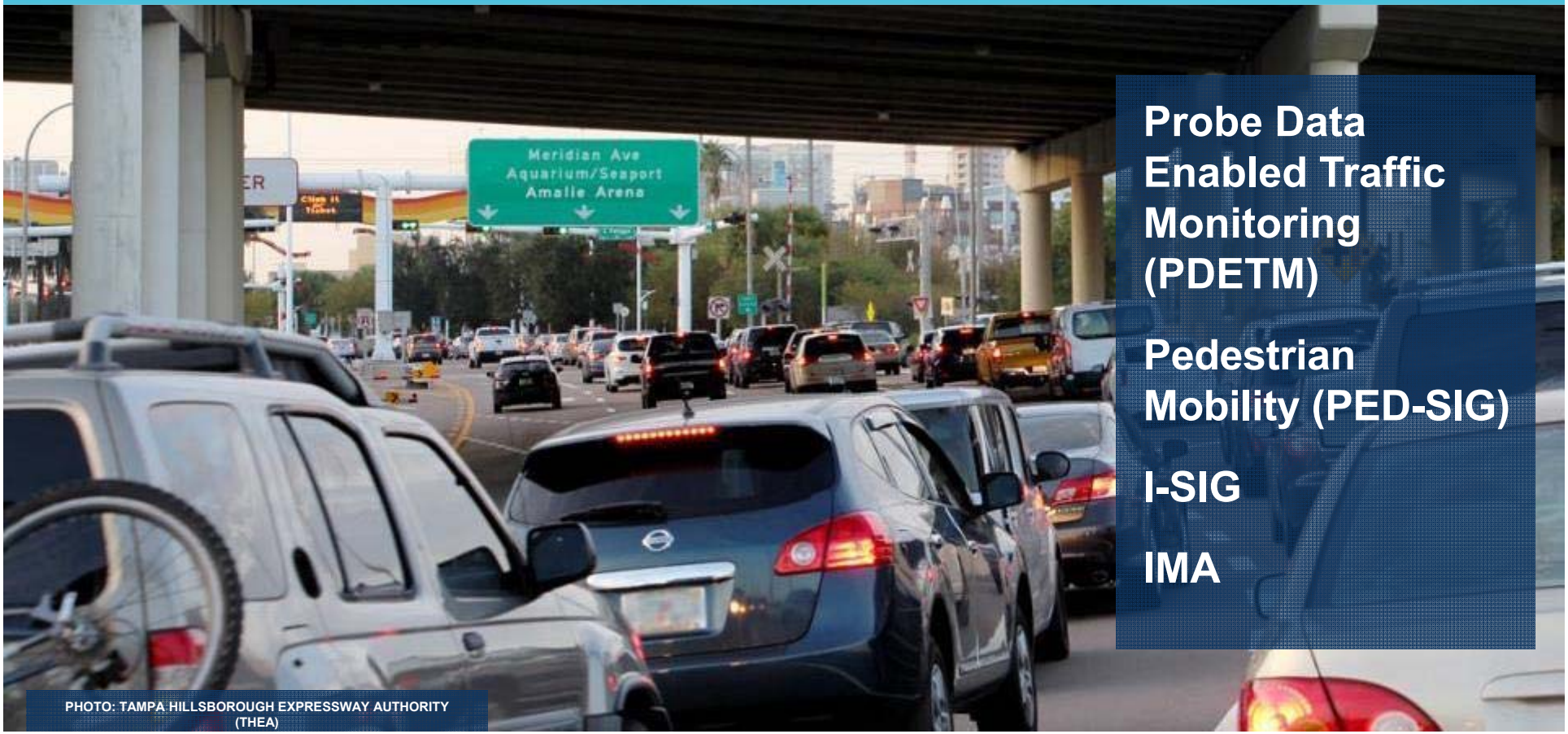
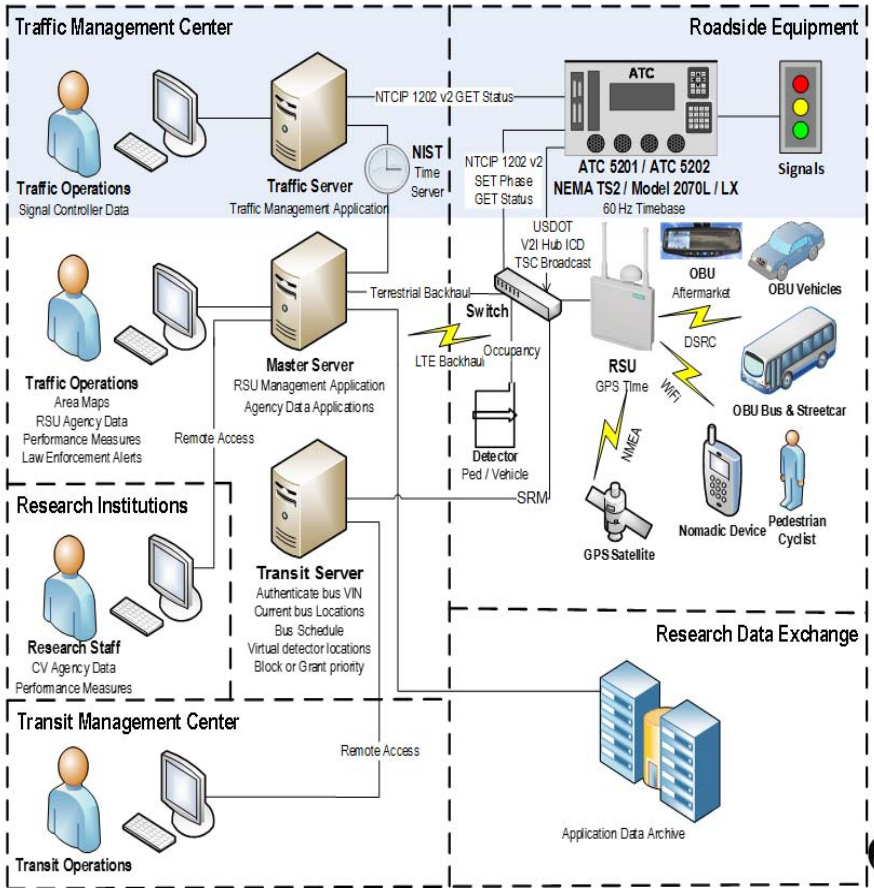


PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)

- Probe Data Enabled Traffic Monitoring (PDETM)
- Pedestrian Mobility (PED-SIG)
- I-SIG
- IMA

DEPLOYMENT CONCEPT



RSU PHOTOS

Source: Siemens

HMI PHOTOS

Mirror display uses sticker to depict location and concept of warning.
Actual image is still in development

Source: Brand Motion and Global 5

METRICS IDENTIFIED PMESP

Performance Pillars	*Performance Measures*	*UC1 Morning Peak Hour Queues*	*UC2 Wrong Way Entries*	*UC3 Pedestrian Safety*	*UC4 BRT Signal Priority*	*UC5 Trolley Conflicts*	*UC6 Enhanced Signal Coordination Progression*
Mobility	Travel time	✓	✓	✓			✓
	Travel time reliability	✓		✓			✓
	Queue length	✓		✓			✓
	Vehicle delay	✓	✓	✓			✓
	Throughput	✓		✓			✓
	Percent (%) arrival on green	✓			✓		✓
	Bus travel time				✓		
	Bus route travel time reliability				✓		
	Percent (%) arrival on schedule				✓		
	Signal priority: - Number of times priority is requested and granted - Number of times priority is requested and denied - Number of times priority is requested, granted and then denied due to a higher priority (i.e. EMS vehicle)				✓		
Environmental	Emissions reductions in idle	✓	✓	✓	✓		✓
	Emissions reductions in running	✓	✓	✓	✓		✓

- 6 Use Cases
- 11 CV Apps
- 40 RSUs
- 4 Evaluation "Pillars"
  - Mobility
  - Environmental
  - Safety
  - Agency Efficiency
- 3 Experimental Designs
- 22 Potential Measures

METRICS IDENTIFIED PMESP (CONTINUED)

Performance Pillars	*Performance Measures*	*UC1 Morning Peak Hour Queues*	*UC2 Wrong Way Entries*	*UC3 Pedestrian Safety*	*UC4 BRT Signal Priority*	*UC5 Trolley Conflicts*	*UC6 Enhanced Signal Coordination Progression*
Safety	Crash reduction	✓	✓	✓		✓	✓
	Crash rate	✓	✓	✓		✓	✓
	Type of conflicts / near misses	✓	✓	✓		✓	✓
	Severity of conflicts / near misses	✓		✓		✓	✓
	Percent (%) red light violation/running		✓				
	Approaching vehicle speed	✓	✓	✓			✓
	Number of wrong way entries and frequency		✓				
Agency Efficiency	Mobility improvements through the mobility pillar analysis	✓	✓	✓	✓		✓
	Safety improvements through the safety pillar analysis	✓	✓	✓		✓	✓
	Customer satisfaction through opinion survey and/or CV app feedback	✓	✓	✓	✓	✓	✓

- 6 Use Cases
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EVALUATION APPROACHES

Experimental Design	UC1 Morning Peak Hour Queues	UC2 Wrong Way Entries	UC3 Pedestrian Conflicts at Courthouse	UC4 Bus Rapid Transit Signal Priority Optimization Trip Times and Safety	UC5 TECO Line Streetcar Trolley Conflicts	UC6 Enhanced Signal Coordination and Traffic Progression
Before/ After	✓	✓	✓	✓	✓	✓
Quasi-Experiment	✓	✓	✓		✓	✓
Random Design	✓					✓

Random Design – Treatment and Control groups, random assignment, compare average treatment effect, desirable but always achievable

Quasi-Experimental – Used when random assignment not possible, selection bias reduced by using methods like propensity score matching, matching algorithm, difference in difference

Before/After – Time series analysis, no control and treatment groups, confounding factor identification, baseline data required

STAY CONNECTED

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- Jonathan Walker, NYCDOT Site AOR; Jonathan.b.Walker@dot.gov
- Govind Vadakpat, Tampa (THEA) Site AOR; G.Vadakpat@dot.gov

Visit CV Pilot and Pilot Site Websites for More Information:

- CV Pilots Program: http://www.its.dot.gov/pilots
- NYCDOT Pilot: https://www.cvp.nyc/
- Tampa (THEA): https://www.tampacvpilot.com/
- Wyoming DOT: https://wydotcvp.wyoroad.info/

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