



Next Generation Integrated Mobility:

Driving Smart Cities

www.itsworldcongress2017.org



ITS WORLD CONGRESS 2017
Montréal | OCTOBER 29 - NOVEMBER 2

Produced by



In Conjunction with



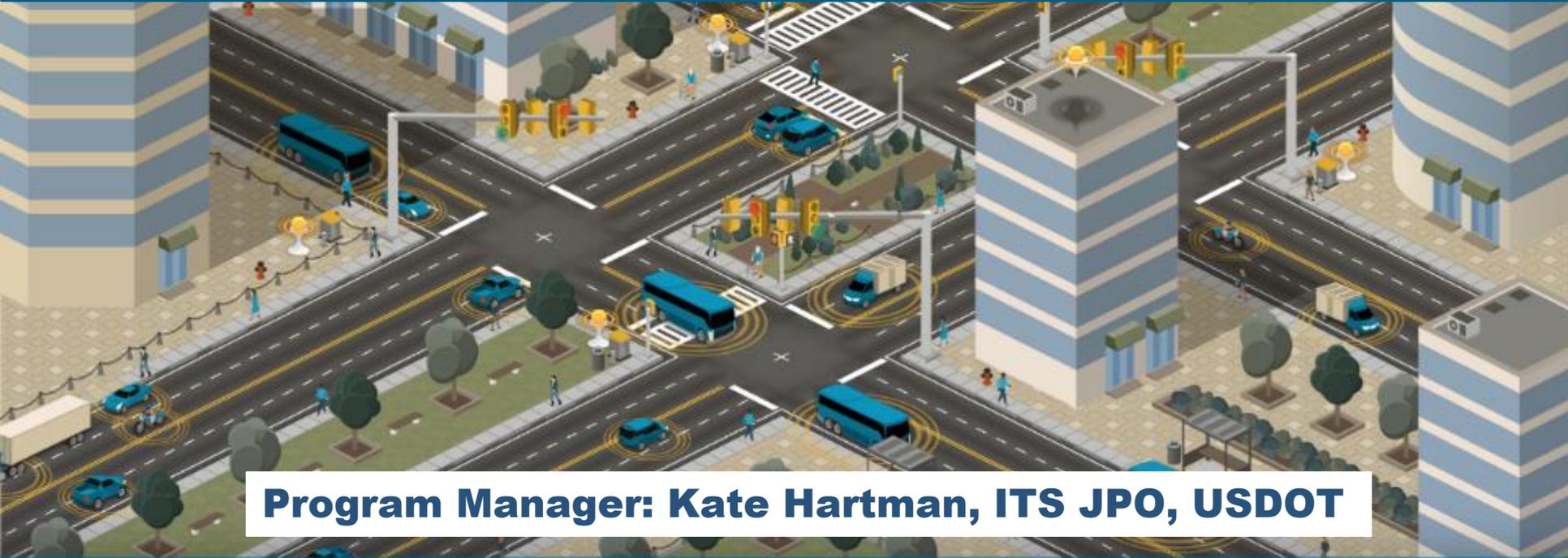
Co-organized by



CONNECTED VEHICLE PILOT Deployment Program



SESSION 1: DEPLOYMENT STATUS AND DEMONSTRATION IMPACTS



Program Manager: Kate Hartman, ITS JPO, USDOT

SESSION AGENDA



- Session Introduction and CV Pilots Overview
 - Kate Hartman, Chief, Research, Evaluation, & Management, ITSJPO, USDOT
- NYCDOT Pilot Deployment Overview
 - Mohamad Talas, Program Management Lead, New York City Department of Transportation (NYCDOT) Pilot Project
- Wyoming DOT Pilot Deployment Overview
 - Tony English, System Design Lead, Wyoming Department of Transportation (WYDOT) Pilot Project
- Tampa (THEA) Pilot Deployment Overview
 - Bob Frey, Program Management Lead, Tampa Hillsborough Expressway Authority (THEA) Pilot Project
- Q&A



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.



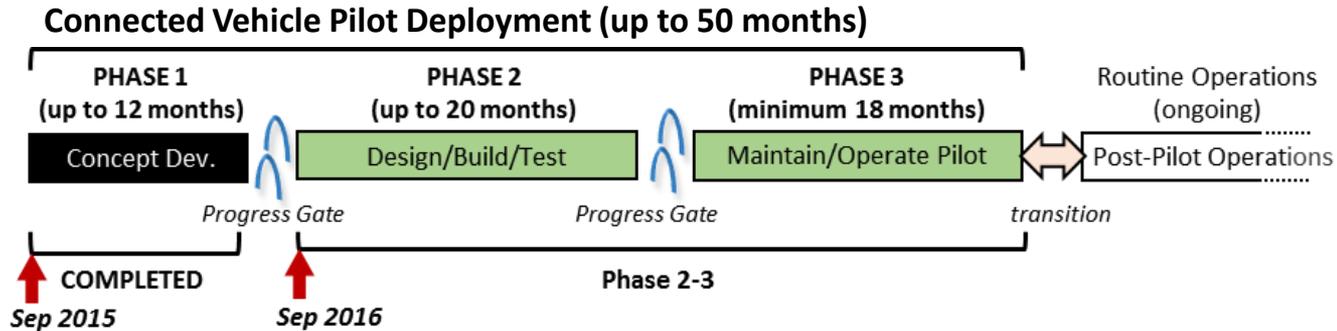
- Improve safety and mobility of travelers in New York City through connected vehicle technologies.
- Vehicle to vehicle (V2V) technology installed in up to 8,000 vehicles in Midtown Manhattan, and vehicle to infrastructure (V2I) technology installed along high-accident rate arterials in Manhattan and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



- **Phase 1: Concept Development (COMPLETE)**
 - Creates the foundational plan to enable further design and deployment
 - **Progress Gate: Is the concept ready for deployment?**
- **Phase 2: Design/Deploy/Test (CURRENT PHASE- began September 1, 2016)**
 - Detailed design and deployment followed by testing to ensure deployment functions as intended (both technically and institutionally)
 - Progress Gate: Does the system function as planned?
- **Phase 3: Maintain/Operate**
 - Focus is on assessing the performance of the deployed system
- Post Pilot Operations (CV tech integrated into operational practice)



CV PILOTS IN ITS WORLD CONGRESS



USDOT Booth #1301 (near the exhibit hall entrance) Schedule

Mon., October 30
11:00 to 18:30

Tues., October 31
09:00 to 18:30

Wed., November 1
09:00 to 18:00

Thurs., November 2
10:00 to 15:00



Pilot Program Sessions at ITS World Congress

Mon., October 30, Room 515 ABC

- **12:00 to 13:30** – SIS19: Connected Vehicle Pilot Deployment Program Session 1: Deployment Status and Demonstration Impacts
- **13:45 to 15:15** – SIS26: Connected Vehicle Pilot Deployment Program Session 2: Technical Challenges and Proposed Solutions
- **15:30 to 17:00** – SIS33: Connected Vehicle Pilot Deployment Program Session 3: Evaluating Performance and Long-Term Sustainment



Pilot Program Representative Speaker Schedule at USDOT Booth

Tues., October 31

- **Wyoming** - 14:00 to 15:00
- **Tampa** - 15:00 to 16:00
- **New York City** - 16:00 to 17:00

Wed., November 1

- **New York City** - 09:00 to 10:00
- **Tampa** - 10:00 to 11:00
- **Wyoming** - 11:00 to 12:00



ITS WORLD CONGRESS 2017

Montréal | OCTOBER 29 - NOVEMBER 2

www.itsworldcongress2017.org

Mohamad Talas

New York City Department of Transportation (NYCDOT)

NYC Pilot Deployment Overview

NYC CV Pilot Objective



VISION ZERO

“Traffic Death and Injury on City streets is not acceptable”



The NYC pilot will evaluate the **safety** benefits and challenges of implementing CV technology:

- **With a significant number of vehicles**
- **In a dense urban environment**



PROJECT IDENTIFIED USE CASES

1. Manage Speeds

- *General within the project area*
- *Work/speed zones within the project area*
- *Ramp speed – to avoid roll-over*

2. Reduce vehicle-to-vehicle Crashes

3. Reduce Vehicle-to-Pedestrian Crashes

- *Provide assistance in navigating intersections for the visually challenged*

4. Reduce Vehicle-to-Infrastructure Crashes

5. Inform Drivers of Serious Incidents or emergency situations (e.g. blocked major arterials or evacuation)

6. Collect Mobility Data – for analysis and adaptive control

7. Manage System Operations

NYC TRAFFIC CHALLENGES

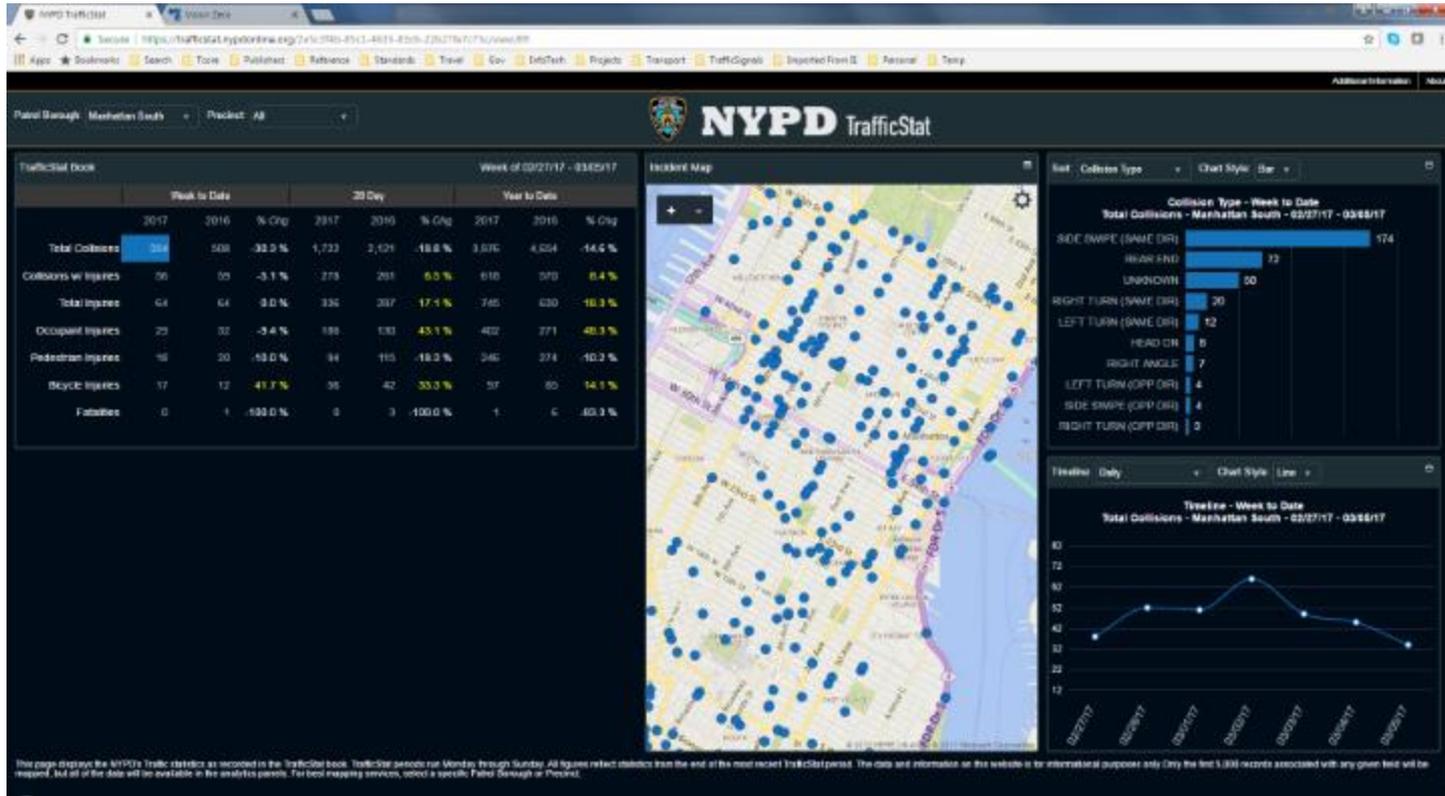


MTA BUS HITS TEENAGE GIRL TRYING TO CROSS STREET

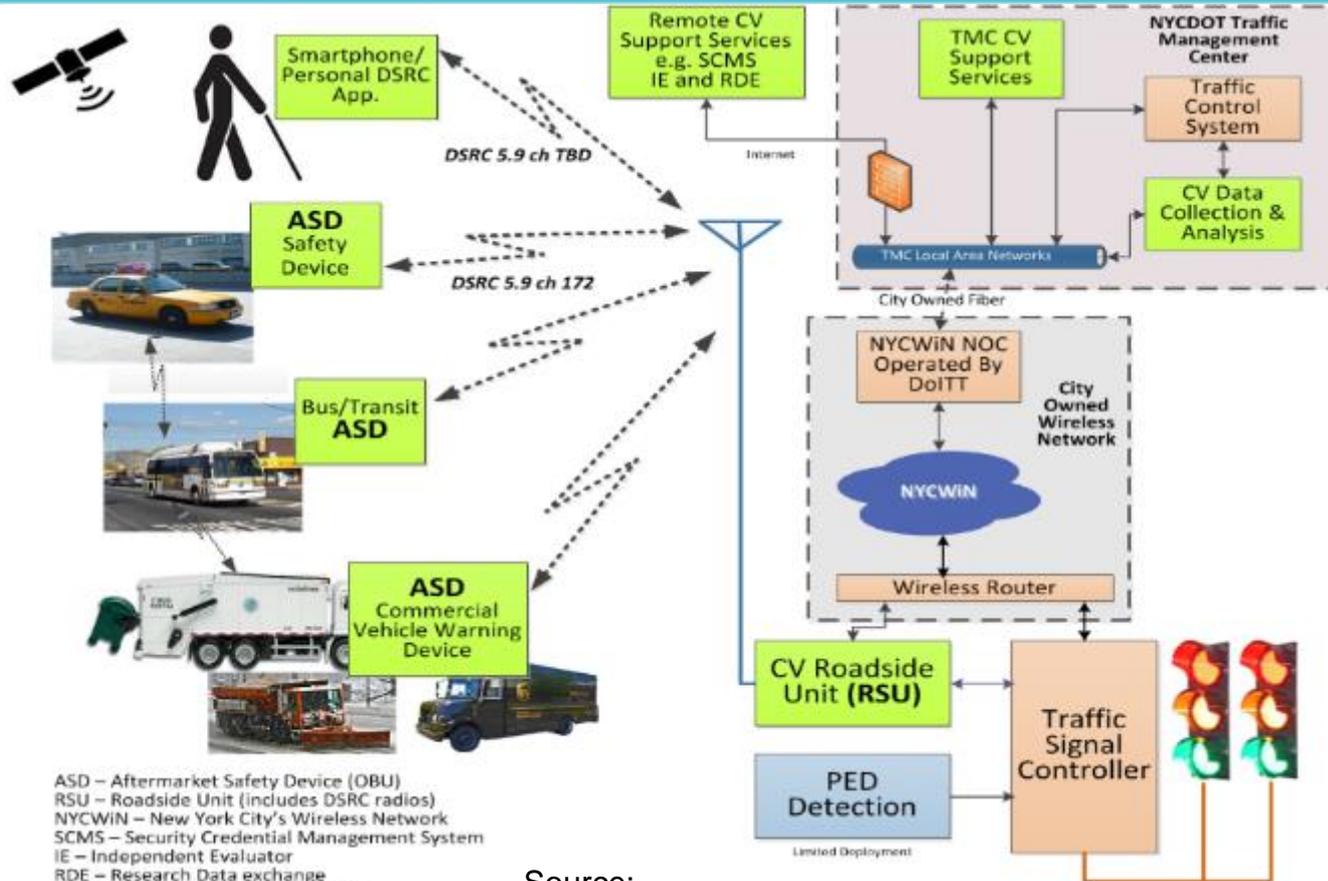
A 76-year-old Florida woman died Saturday after being struck by a taxi as she walked in a crosswalk in Manhattan, emergency officials said.



NYC TRANSPORTATION CHALLENGES



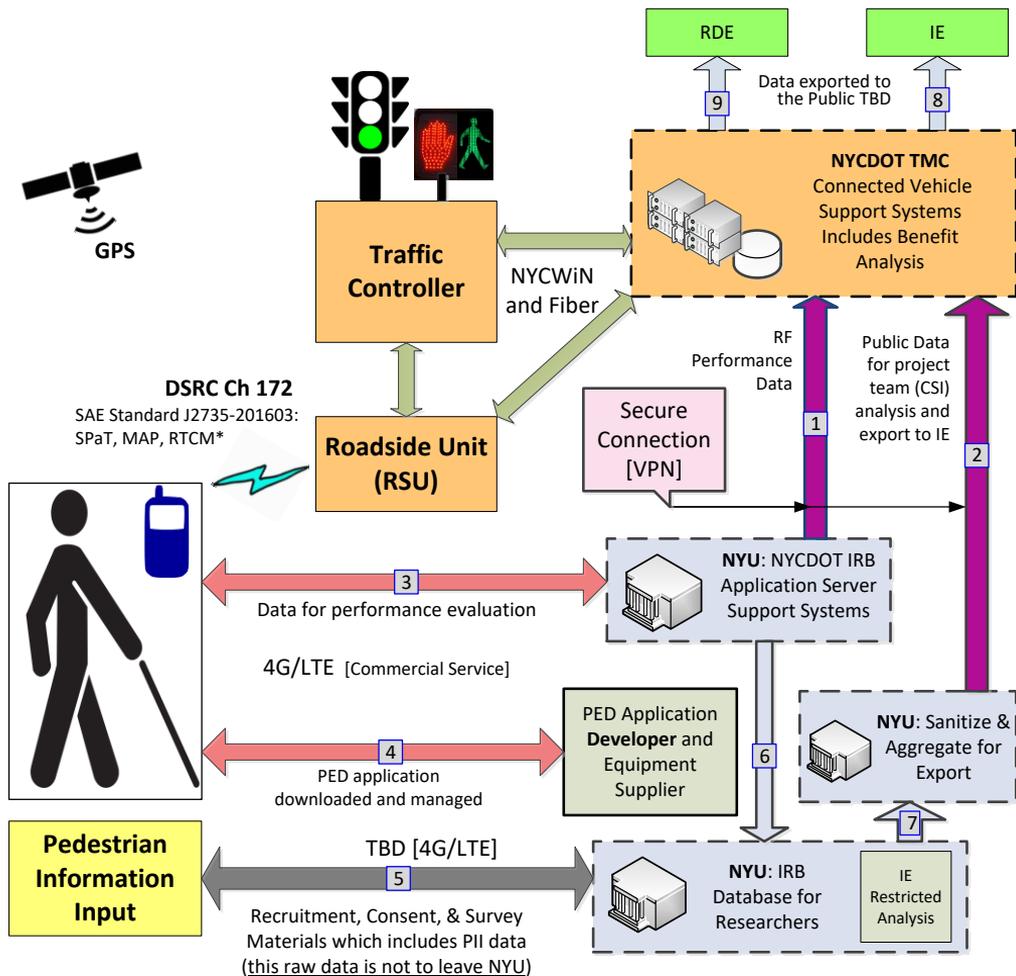
OVERALL PROJECT CONCEPT



Source:

PEDESTRIAN APPLICATION:

- Navigation Assistance for the Visually Impaired
- Working cooperatively with NYU



Visually Challenged Pedestrian Application Context Diagram

NycCvpdPEDAppContextDiag_v09-simplified.vsd

LOCATIONS (MANHATTAN, BROOKLYN)



Vehicle to Vehicle (V2V) applications work **wherever** equipped vehicles encounter one another.

Vehicle to Infrastructure (V2I) applications work where **infrastructure is installed** (highlighted streets)

The CV project leverages the City's transportation investments



CV DEPLOYMENT FLEETS – OUR STAKEHOLDERS



- Up to 8,000 **fleet vehicles** with Aftermarket Safety Devices (ASDs):
 - ~6,000 Taxis (Yellow Cabs)
 - ~ 700 MTA Buses
 - ~ 400 UPS vehicles
 - ~ 600 Sanitation & DOT vehicles

} = Revenue

- Pedestrian **PIDs** ~100 units
 - PED Detection – 10 Intersections

- Roadside Units (**RSU**)
 - ~202 Manhattan Ave
 - ~ 79 Manhattan Cross
 - ~ 28 on Flatbush Ave
 - ~ 8 on FDR
 - ~ 36 Support locations (airports, river crossings, terminal facilities)

~353 Total



Source: USDOT

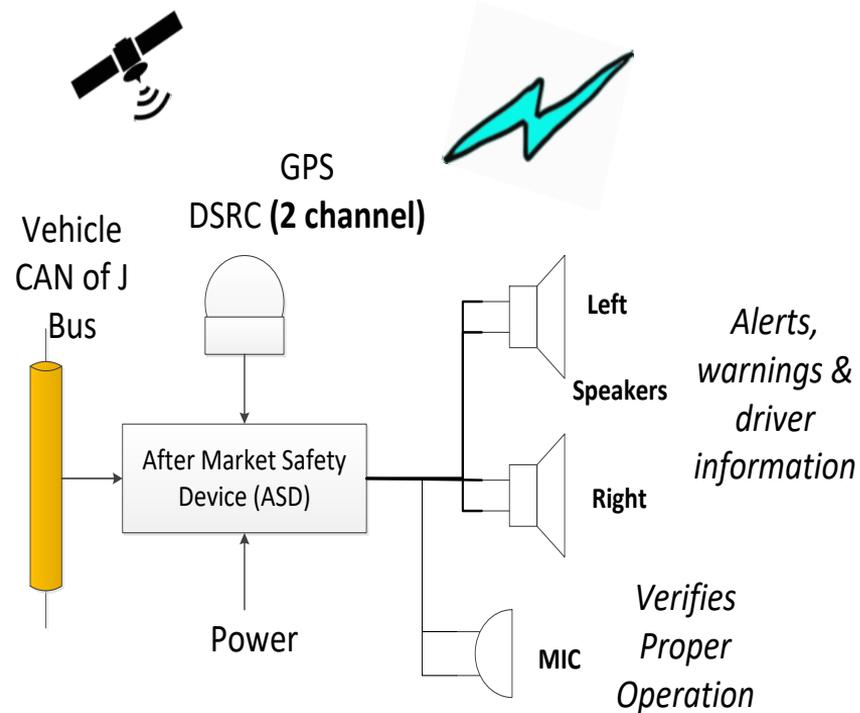
SUPPORT RSUs, INCLUDE AIRPORT TAXI HOLDING AREAS



AFTERMARKET SAFETY DEVICE



- Audio output only
 - Tones based on threat
 - Words based on situation
 - Mixture of both
- ASD includes
 - Inertial Navigation
 - GNSS Navigation
 - Connection to Vehicle data Bus
- Multi Channel DSRC support
 - Security Management Features



Source:
NYCDOT



U.S. Department of Transportation

ROADSIDE & IN-VEHICLE EQUIPMENT



Wire Shark
Antenna



ASD

Source: NYCDOT



Antenna

Source: NYCDOT

IN-VEHICLE ASD AND INSTALLATION KITS



- NYC DOT to develop installation and training procedures
- Training will include all aspects of vehicle installation and testing (extra RSUs acquired to setup installer testing)
- Installation kits will vary by each fleet.
 - Dot, TAXI, MTA, UPS, MTA
 - Buses, heavy vehicles, light vehicles
- Vendor provides on site engineering support for 6 months
- Vendor to provide up to 8 weeks of on-call engineering support





Vehicle-to-Vehicle (v2v) Safety Applications

- | | |
|---|------|
| ▪ Vehicle Turning Right in Front of Bus Warning | VTRW |
| ▪ Forward Crash Warning | FCW |
| ▪ Emergency Electronic Brake Light | EEBL |
| ▪ Blind Spot Warning | BSW |
| ▪ Lane Change Warning/Assist | LCA |
| ▪ Intersection Movement Assist | IMA |

V2V applications based on existing demonstrations and prior developments and documentation



Vehicle-to-Infrastructure (v2i) Safety Applications

- | | |
|--|-----------|
| ▪ Red Light Violation Warning | RLVW |
| ▪ Speed Compliance | SPD-COMP |
| ▪ Curve Speed Compliance | CSPD-COM |
| ▪ Speed Compliance /Work Zone | SPDCOMPWZ |
| ▪ Oversize Vehicle Compliance | OVC |
| ▫ Prohibited Facilities (Parkways) | |
| ▫ Over Height | |
| ▪ Emergency Communications and Evacuation Information
(Using the traveler information features) | EVACINFO |





Other Applications

- Mobile [[Visually Impaired](#)] Ped Signal System PED-SIG
- Pedestrian in Signalized Intersection Warning PEDINXWALK
- CV Data for Intelligent Traffic Signal System I-SIGCVDAT

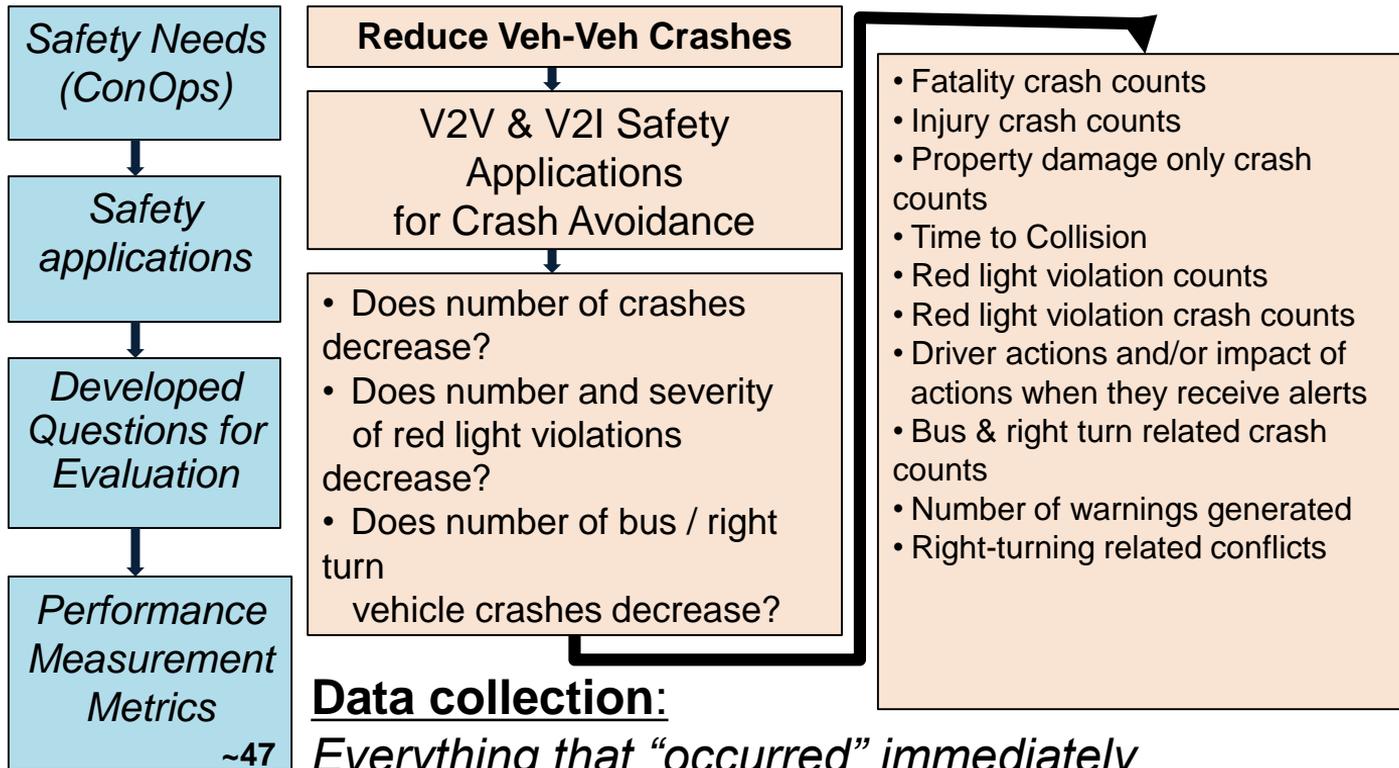
Operations, Maintenance, and Performance Analysis

- RF Monitoring RFMON
- OTA Firmware Update FRMWUPD
- Parameter Up/Down Loading PARMLD
- Traffic data collection TDC
- *Event History Recording* EVTRECORD
- *Event History Up Load* EVTCOLLECT

*To Meet USDOT
Requirements for
Benefit Analysis*

PERFORMANCE METRICS & EVALUATION METHODS

While preserving privacy

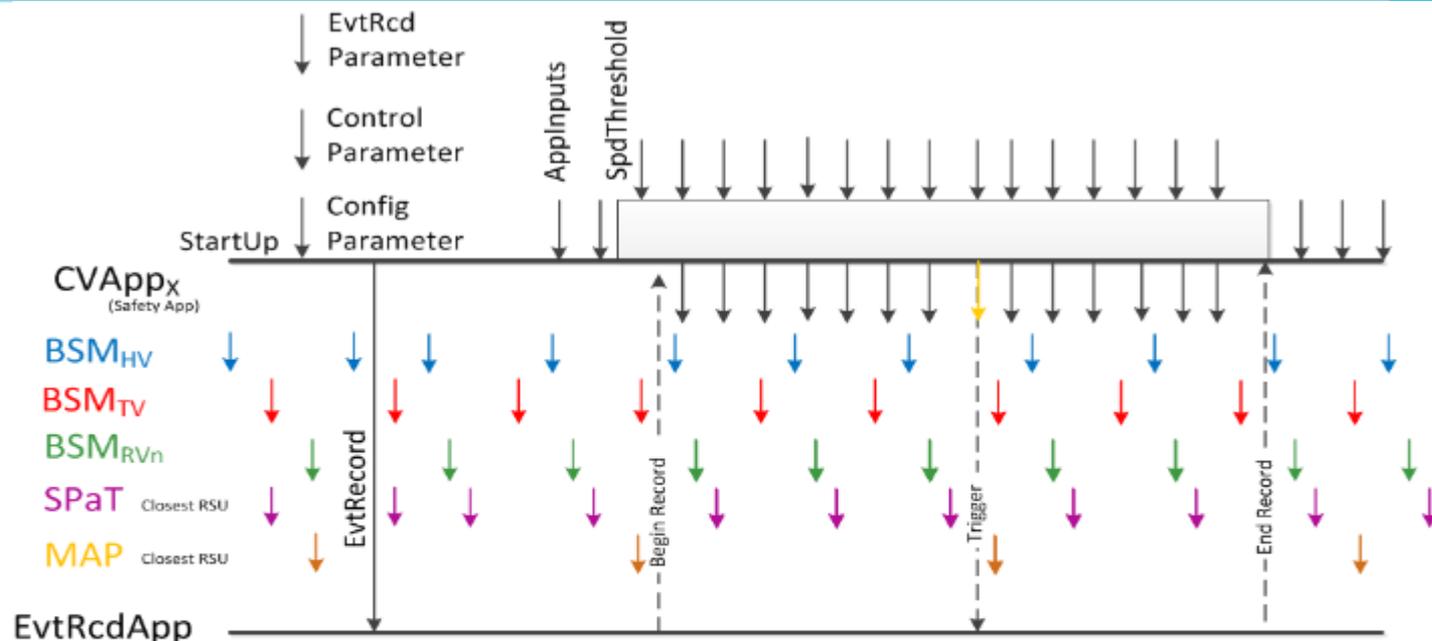


Data collection:

Everything that “occurred” immediately before and after the alert

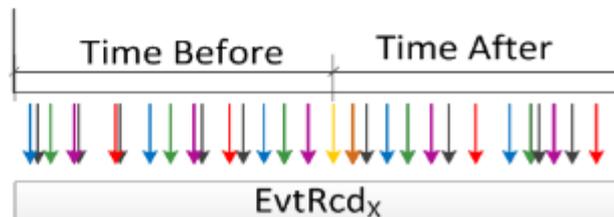


EXAMPLE OF LOGGING



HV – Host Vehicle
 TV – Target Vehicle
 RV – Remote Vehicle
 n – Vehicle 1...n

All of the data collected during T_B is transferred to the event record, and after the trigger the data is collected and added to the record until T_A expires.



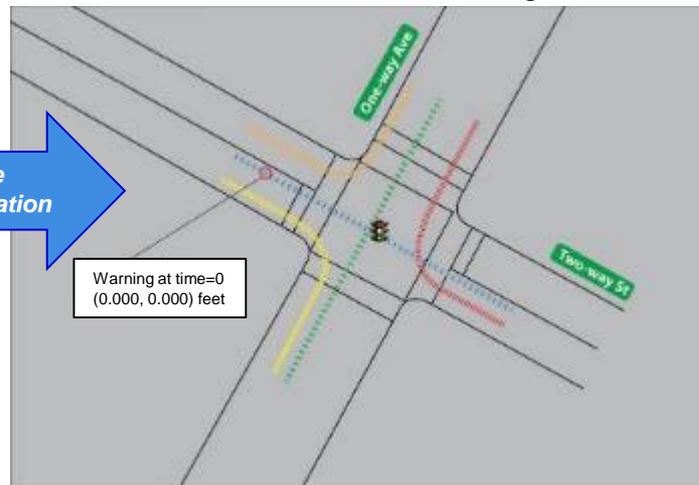
OBFUSCATION OF LOGS FOR PRIVACY



Raw ASD Action Log Data



Obfuscated ASD Action Log Data



- Obfuscation process to scrub precise time and location data
 - Relative details retained
- Non-obfuscated data will be destroyed following the obfuscation process



DEPLOYMENT APPROACH

- **Turn-key ASD and RSU equipment procurement**
 - Multiple stage delivery
 - Award to 2 ASD Bidders (~1/2 each) and 1 RSU Bidder
 - Prototypes install/test Hardware/Software/DSRC
 - Prototypes are verified in the field
 - Production units delivered
- **City field installation (RSU)**
- **Project team developing back-office software**
- **Vehicle installation**
 - City personal – City Fleets
 - CMT and Verifone
 - UPS – handles their own vehicles
- **Concept: Verify the hardware & software platform early**
 - Use OTA updates (firmware, parameters) to tune and expand the applications
The limiting factor – Installation time for 8000 vehicles!

PROJECT STATUS – 1



- Phase 1 Completed October 2016
 - Deliverables:
 - Concept of Operations
 - Security Management Operating Concept
 - Safety Management Plan
 - Performance Measurement Plan
 - System Requirements
 - Application Deployment Plan
 - Human Use Approval Summary
 - Training and Education Plan
 - Partnership Status Summary
 - Outreach Plan
 - Comprehensive Deployment Plan
 - Deployment Readiness Summary

Twelve Major Deliverables, multiple webinars, MANY meetings and reports

Published on USDOT CV Website:
<http://www.its.dot.gov/pilots/index.htm>

PROJECT STATUS 2



- Phase 2 – Ends ~ 4/30/2018
 - Completed procurement specifications for devices
 - Vendors demos of NYC CV Applications for evaluation
 - Final bids received
 - Completing negotiations and the contracting process
 - Purchased and are learning and testing samples/prototypes
 - Detailed Design is in process with reviews
 - Developing installation plans
 - Back office software is under development
 - Test plans and testing program is under development
 - Continue to work cooperatively with the other sites in support of interoperability

NYC CV PILOT NEXT STEPS 1



- Phase 2 Tasks:
 - Completing the deployment
 - Tuning the applications for NYC
 - Validating the performance measures
 - Updating Phase 1 design documents
 - Validating the data collection and Maintenance operations
- Phase 2 Performance Measures Related:
 - Evaluating the obfuscation time and location binning protocols
 - Develop the data warehouse and data handling protocols

NYC CV PILOT NEXT STEPS 2



- Phase 3 O&M
 - Collection of performance data to measure benefits
 - Collection of confounding data (for analysis)
 - Silent period operation (Before)
 - Active operation with alerts
 - Reliability evaluation
 - Ongoing operation and maintenance activities
 - Dealing with fleet turnover during operation period
 - Ongoing equipment maintenance and support



ITS WORLD CONGRESS 2017

Montréal | OCTOBER 29 - NOVEMBER 2

www.itsworldcongress2017.org

Tony English

Trihydro Corporation

Wyoming DOT Pilot Deployment Overview

Wyoming's I-80 Corridor



Heavy Freight Traffic

- Major E/W freight corridor
- Freight = over half of annual traffic

Severe Weather Conditions

- Elev. Over 6000 ft
- Heavy winds, heavy snow and fog
- Severe blowing snow and low visibility

Adverse Impacts on Trucks

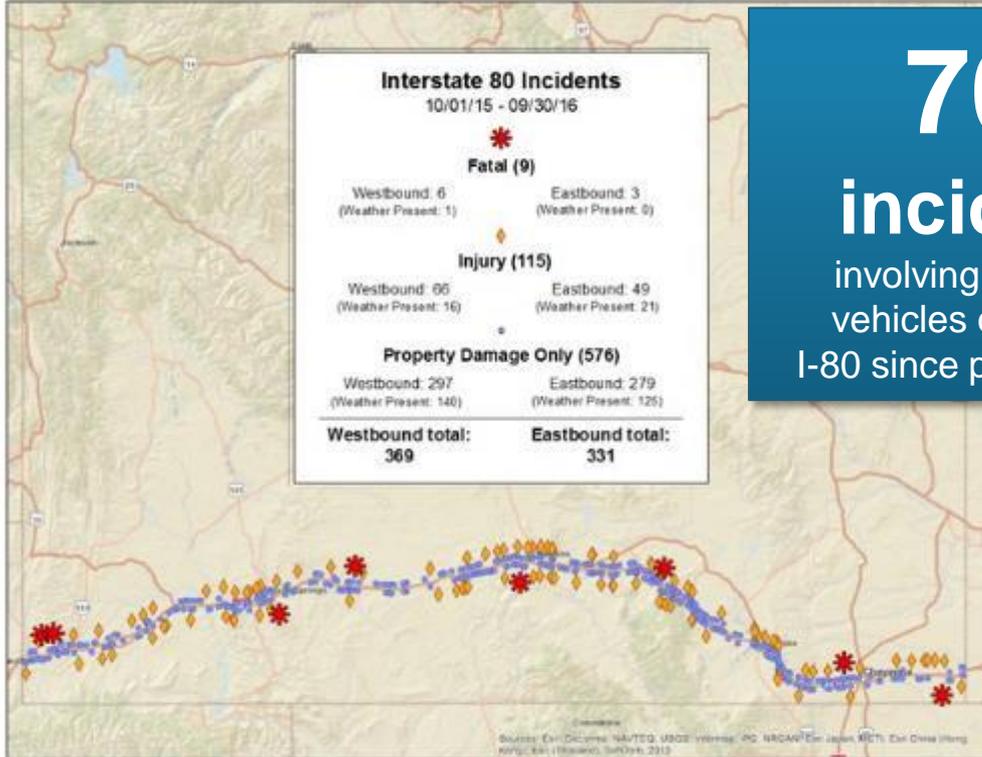
- **Higher than normal incident rates**
- **Multi-vehicle crashes**
- **Fatalities**



Source: WYDOT (Dec 17, 2015)



Scope of the problem



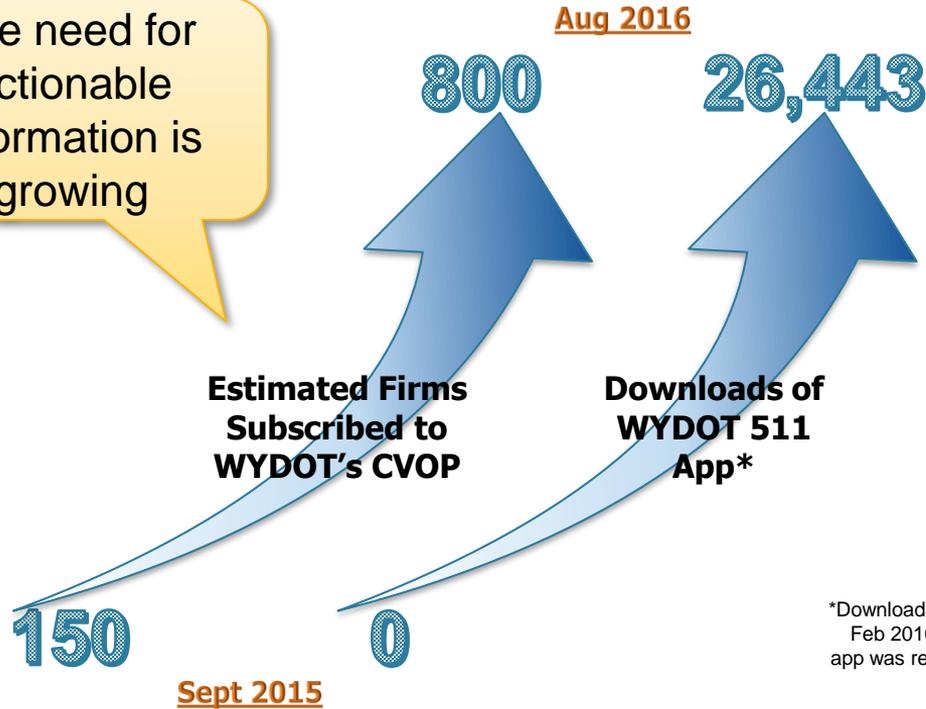
700
incidents
involving commercial
vehicles occurred on
I-80 since project kick-off

1,600+ crashes
1,923 vehicles
\$865.3M
Societal Impact

I-80 Users Need Actionable Road Weather Information



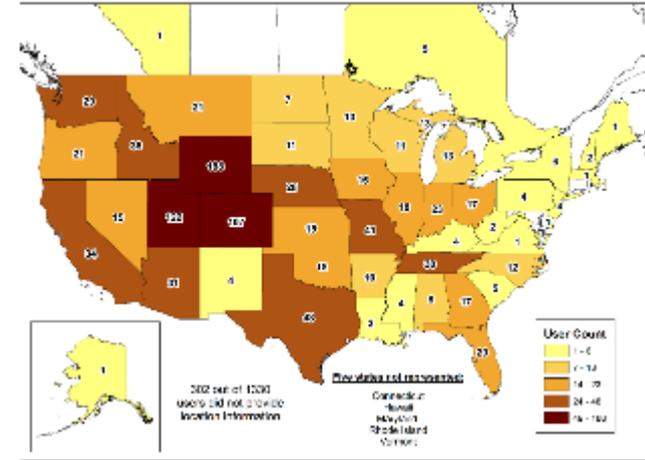
The need for actionable information is growing



*Downloads since Feb 2016 when app was released

WYDOT's Commercial Vehicle Operator Portal (CVOP)

CVOP Users by Location



Pilot Objectives



Road Weather Condition Input

1. Improve road weather condition reports received into the TMC



TMC Information Dissemination

1. Improve ability of the TMC to generate wide area alerts and advisories
2. Efficiently manage closures, restrictions and speed limits
3. Effectively disseminate and receive messages from TMC to en-route vehicles
4. Improve information to commercial vehicle fleet managers



Vehicle/Roadside Alerts & Advisories

1. Effectively transmit and receive V2V messages to reduce incidents and their severity
2. Enhance emergency notifications of a crash



Outcomes

1. Improve speed adherence and reduce speed variation
2. Reduce vehicle crashes





Pilot Elements



CV Environment

75 Roadside Units on I-80
400 Vehicles with DSRC
Connectivity



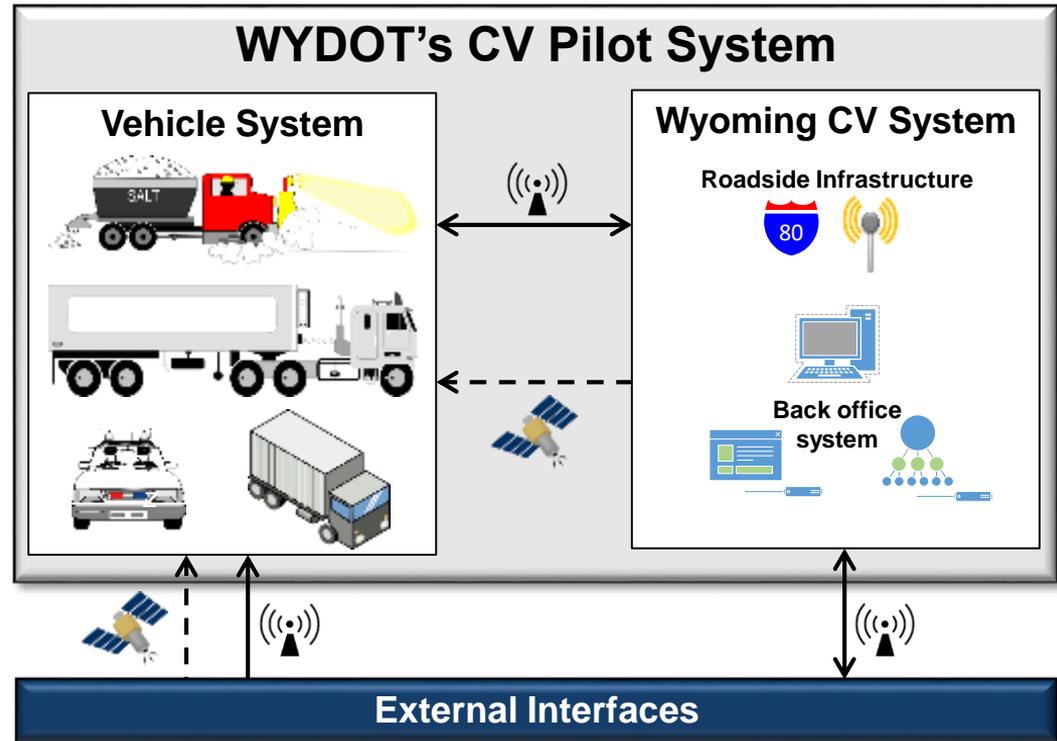
V2V Applications

Forward Collision Warning
Distress Notification



V2I Applications

Situational Awareness
Spot Weather
Work Zone Warning





All vehicles that are part of the vehicle system will have:

- Ability to share information via DSRC with connected devices (vehicles and RSUs)
- Ability to broadcast Basic Safety Message Part I
- Ability to receive Traveler Information Messages (TIM)
- Human-Machine Interface (HMI) to communicate alerts and advisories to driver



Vehicle Sub-Systems

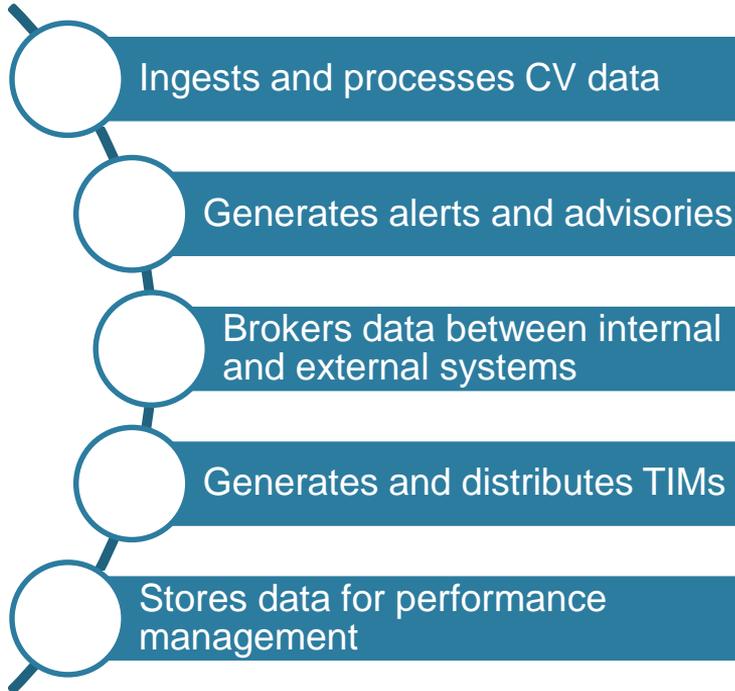
1. WYDOT Fleets
2. Integrated Trucks
3. Retrofit Vehicles
4. Basic Vehicles

On-board Vehicle Technologies

- OBU with DSRC only
- OBU with DSRC and Satellite Receiver
- Human Machine Interface
- CAN Bus Integration (selected vehicles)
- Environmental Sensors (selected vehicles)



System Overview – Wyoming CV System



Wyoming CV Pilot System

External Interfaces

- US DOT Interfaces (e.g. SCMS)
- WYDOT Interfaces (e.g. ATMS and ATIS Systems at the TMC)
- Weather

CV Subsystems

- Roadside Units
- Operational Data Environment
- Pikalert® System
- WYDOT Data Broker
- WYDOT Data Warehouse



CV Applications



On-Board Applications

- Applications available to equipped vehicles



TMC Operations Applications

- Support for WYDOT Traveler Information and Traffic Management





On-Board Applications

The pilot will develop five on-board applications that will provide key information to the drivers of equipped vehicles.

- Forward Collision Warning (FCW)**
- Infrastructure-to-Vehicle (I2V) Situational Awareness (SA)**
- Work Zone Warning (WZW)**
- Spot Weather Impact Warning (SWIW)**
- Distress Notification (DN)**



TMC Operations Applications



CV Data will support several TMC functions for traffic management and traveler information on I-80. All these applications will be enabled by external interfaces to the existing TMC Systems from the Wyoming CV System

Support Variable Speed Limit, Closures, Restriction Management

Support Wyoming Traveler Information (WTI) Updates

Support Commercial Vehicle Operators Portal Updates

Support Third-Party Interface



Performance Measures



Road Weather Condition Input

Improve road weather condition reports received into the TMC

TMC Information Dissemination

Improve ability of the TMC to generate alerts and advisories

Efficiently disseminate broad area traveler information

Effectively disseminate and receive I2V or V2I alert/advisory messages from TMC

Improve information to commercial vehicle fleet managers

Vehicle/Roadside Alerts & Advisories

Effectively transmit and receive V2V messages

Automate emergency notifications of a crash

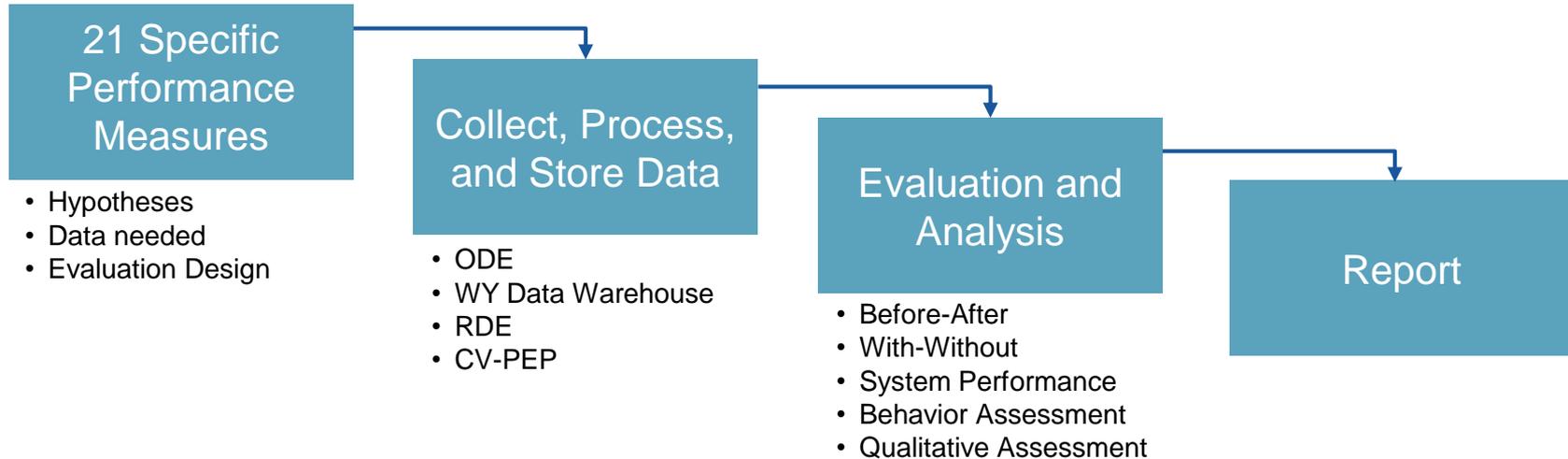
Outcomes

Improve speed adherence and reduce speed variation

Reduce vehicle crashes



TRACKING PERFORMANCE MEASURES





Project Status



Current Status



Final System Design	In-progress; draft submitted to U.S. DOT
Acquisition and Installation Planning	Final Comprehensive Acquisition Plan submitted to U.S. DOT; Draft Comprehensive Installation Plan submitted to U.S. DOT
Ongoing Equipment Bench Testing	4 OBUs are up and running, 4 RSUs are running (52 more to install), Android HMI up and running. Targeting 92-95 snowplows and 50 with Weather Cloud sensors. Targeting 33 Lear Sharkfin on 33 Highway Patrol Vehicles
Integration of CV Pilot Elements with TMC	Progress on TMDD Interface, participant tracking application, 511 app updates, location for the 75 RSUs identified, Pikalert® instance activate
Operational Readiness Demonstration	November 15-16, 2016 in Cheyenne, WY





Next Steps and Activities

Site Interoperability Demo

System Operations and Maintenance starting May 2018
for 18 months

Post-Pilot Transition Planning

Support for performance measurement and evaluation
(throughout)

Standards support (throughout)

Stakeholder outreach (throughout)





ITS WORLD CONGRESS 2017

Montréal | OCTOBER 29 - NOVEMBER 2

www.itsworldcongress2017.org

Bob Frey

Tampa Hillsborough Expressway Authority

Tampa (THEA) Pilot Deployment Overview

TAMPA (THEA) PILOT DEPLOYMENT OVERVIEW



TAMPA (THEA) PILOT DEPLOYMENT OVERVIEW



Participants



1,600



500+



10



10



Morning Backup



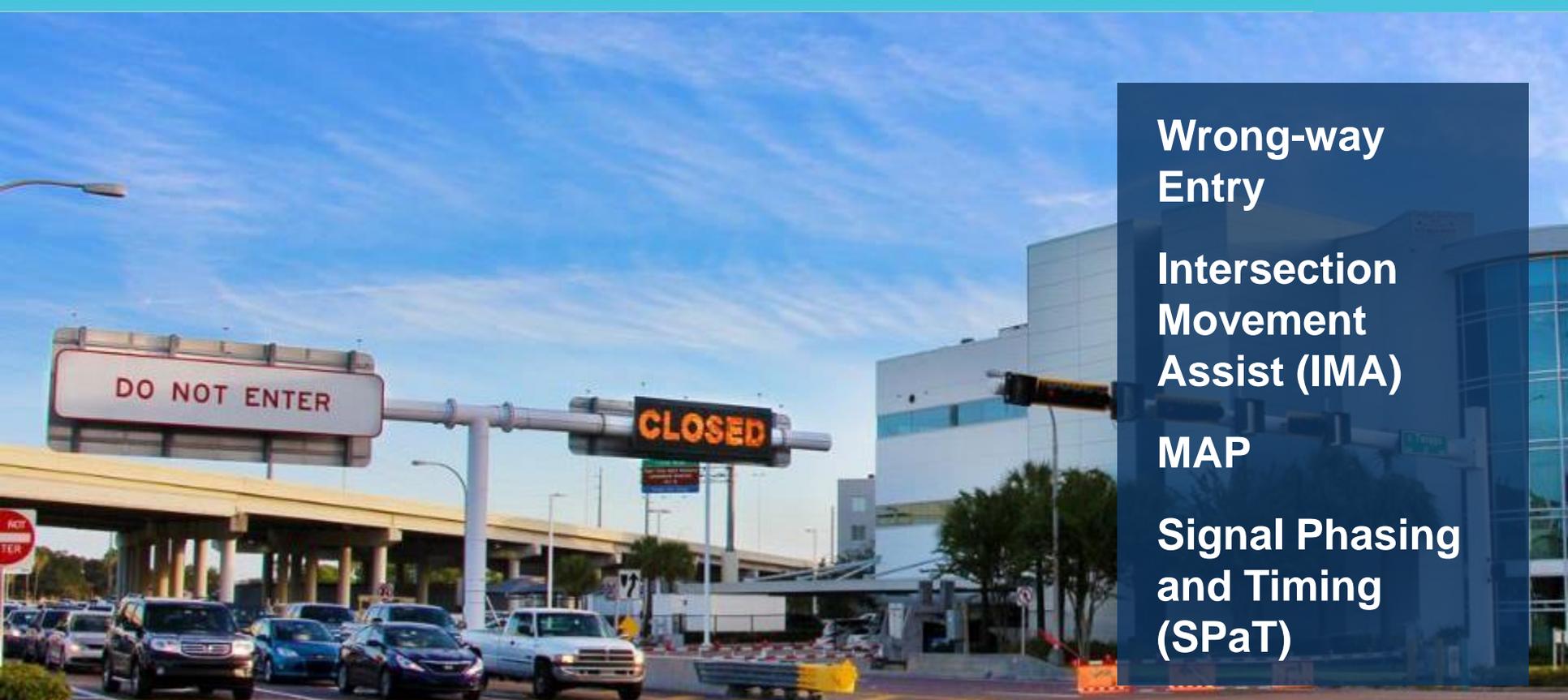
**Forward Collision
Warning (FCW)**

**Emergency
Electronic Brake
Light (EEBL)**

**End of Ramp
Deceleration
Warning (ERDW)**

**Intelligent Signal
Systems (I-SIG)**

Wrong-Way Drivers



**Wrong-way
Entry**

**Intersection
Movement
Assist (IMA)**

MAP

**Signal Phasing
and Timing
(SPaT)**

Pedestrian Safety



**Pedestrian in a
Signalize
Crosswalk
Warning (Ped-X)**

**Pedestrian
Collision Warning
(PCW)**



Transit Signal Priority



I-SIG

**Transit Signal
Priority (TSP)**

IMA

**Pedestrian
Transit
Movement
Warning
(PTMW)**

Streetcar Conflicts

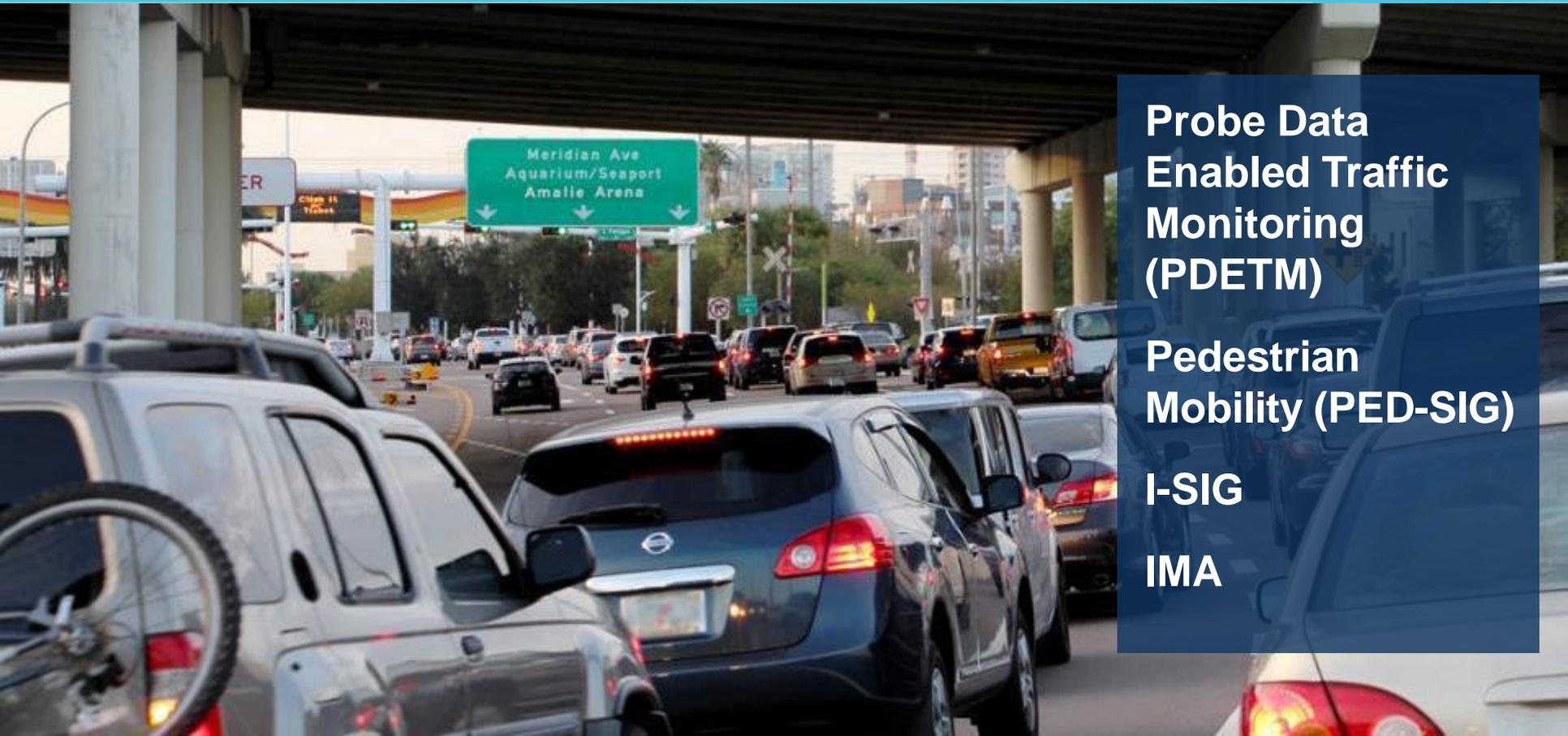


Vehicle Turning
Right in Front of
Transit Vehicle
(VTRFTV)

PTMW



Traffic Progression



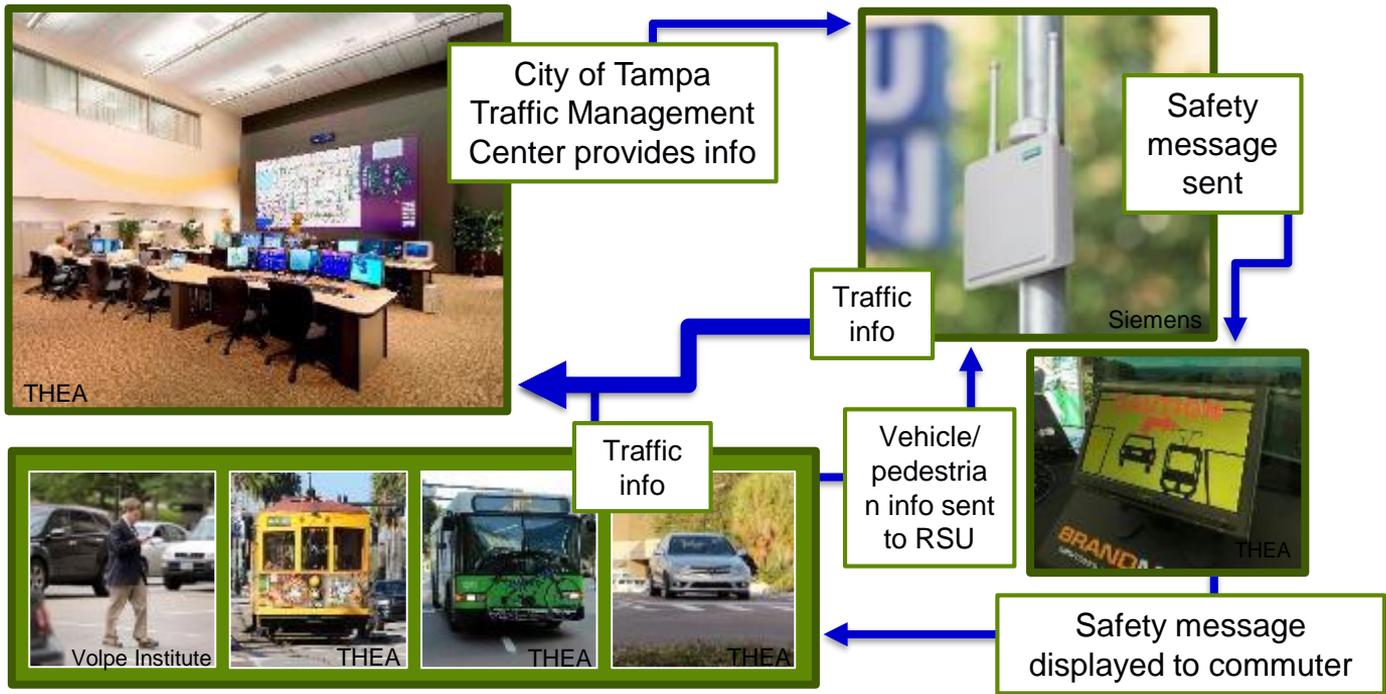
**Probe Data
Enabled Traffic
Monitoring
(PDETM)**

**Pedestrian
Mobility (PED-SIG)**

I-SIG

IMA

Information Flow



RSU Photos



Source: Siemens

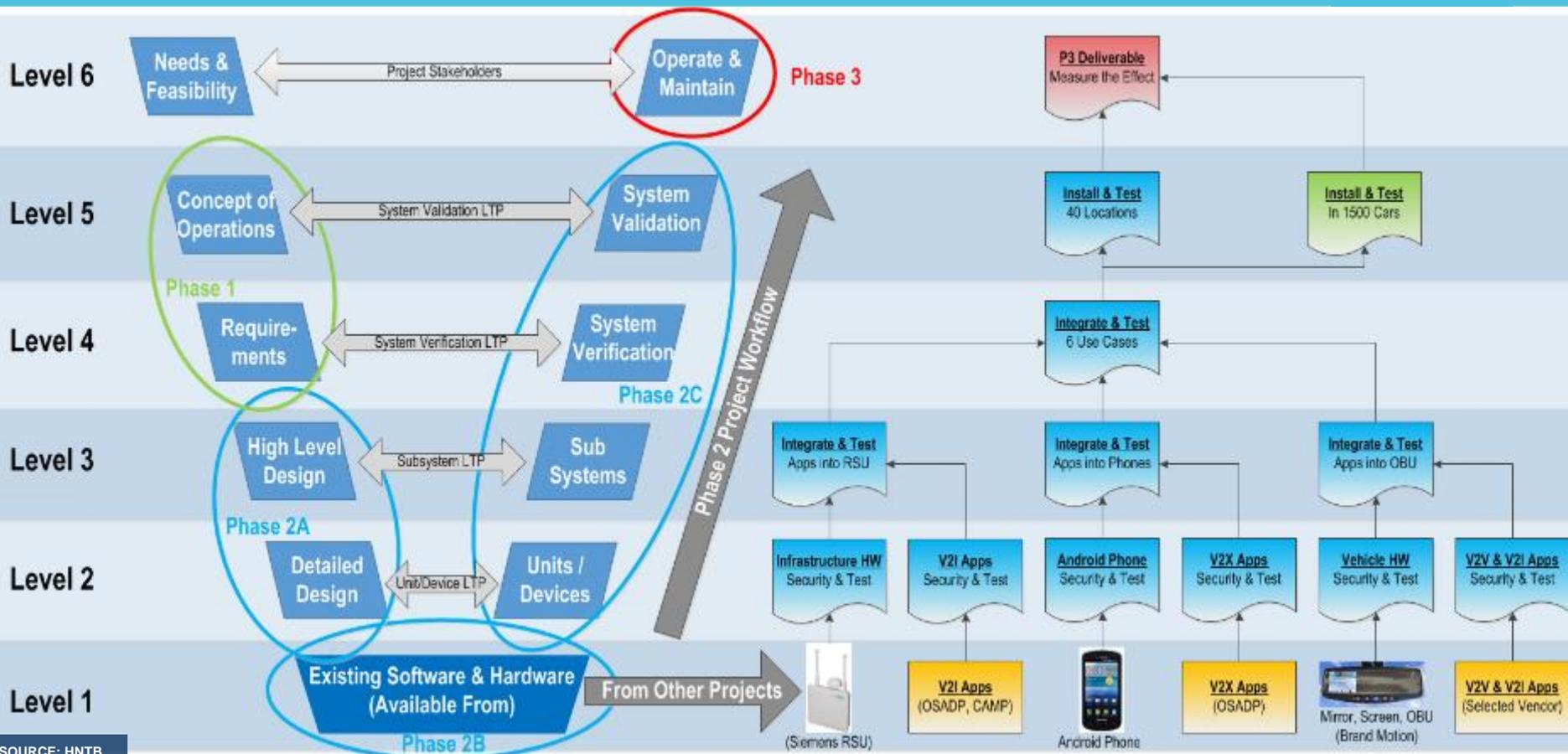


Mirror display uses sticker to depict location and concept of warning.
Actual image is still in development

Benefits



Status





ITS WORLD CONGRESS 2017

Montréal | OCTOBER 29 - NOVEMBER 2

www.itsworldcongress2017.org

Kate Hartman

ITS Joint Program Office, USDOT

Questions and Answers

STAY CONNECTED



Stay with Us to Learn More about Technical and Evaluation Aspects

- 1:45 – 3:15 PM
 - Session 2 - Technical Challenges and Proposed Solutions
- 3:30 – 5:00 PM
 - Session 3 - Evaluating Performance and Long-Term Sustainment

Visit USDOT Exhibition Booth

- USDOT Booth #1301
- Talk to the Pilot Site Representatives
 - October 31, 2017, 2:00 PM – 5:00 PM
 - November 1, 2017, 9:00 AM – 12:00 PM

Contact for CV Pilots Program/Site AORs:

- Kate Hartman, Program Manager, Wyoming DOT 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

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/>

