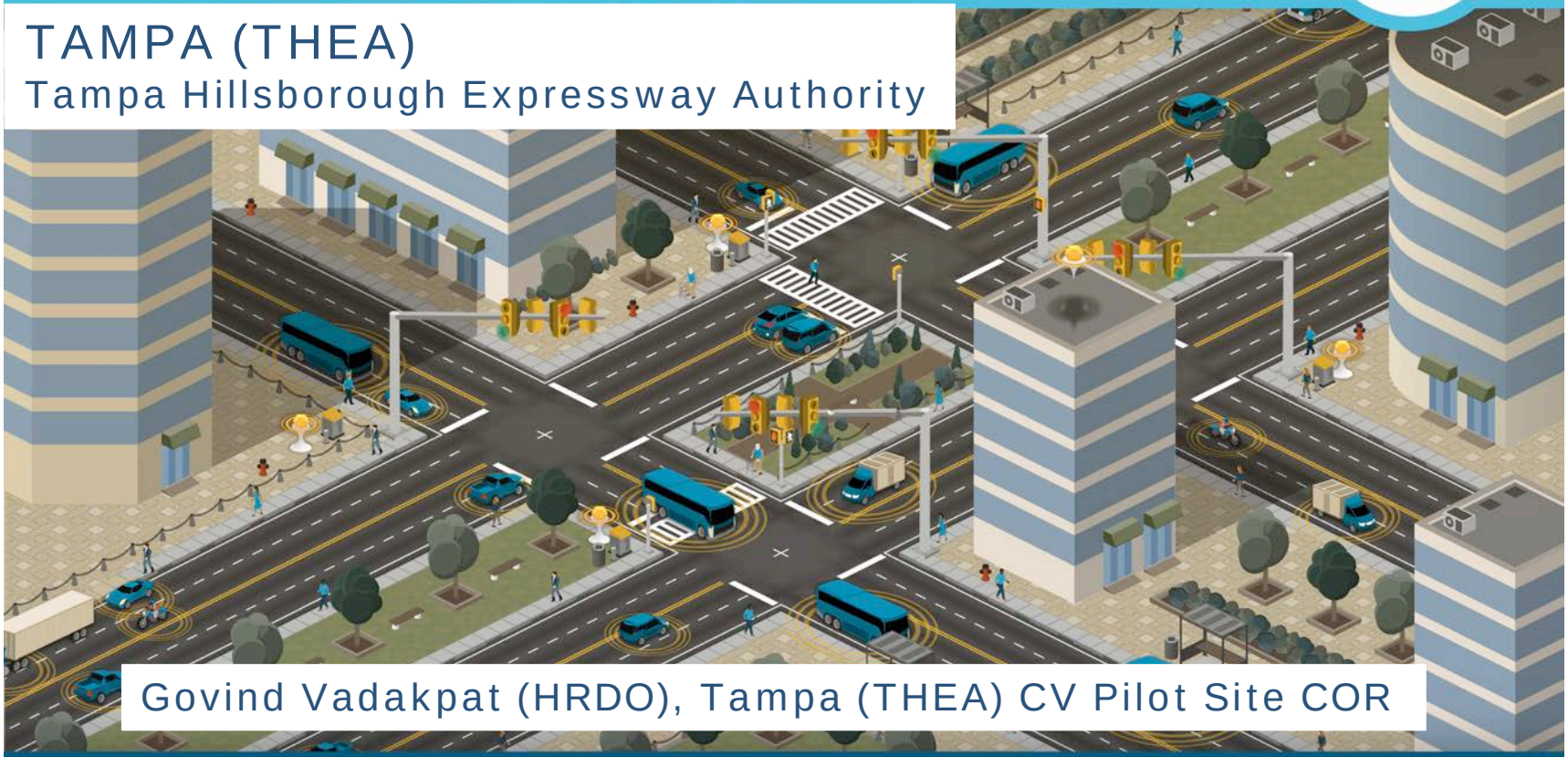
CONNECTED VEHICLE PILOT
Deployment Program

TAMPA (THEA)
Tampa Hillsborough Expressway Authority



Govind Vadakpat (HRDO), Tampa (THEA) CV Pilot Site COR

ITS Joint Program Office

OVERVIEW

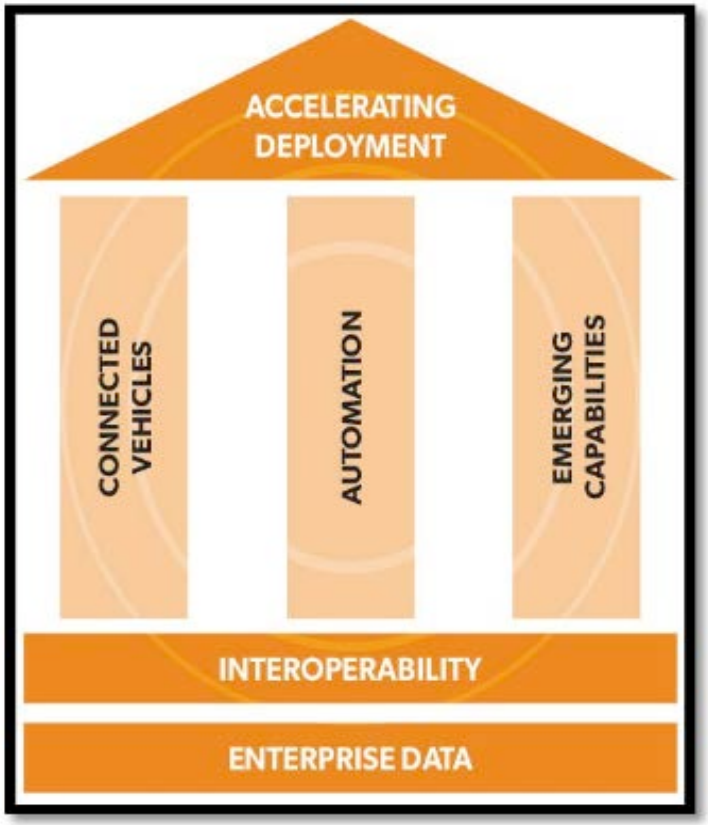
- Connected Vehicles Pilot Deployment Program Overview
  - Goals
  - Organizing Principles
  - CV Applications
  - Program Schedule and Future Milestones
  - CV Pilots Wave 1 Sites:
    - ICF/Wyoming, New York City, Tampa (THEA)
- Tampa Hillsborough Expressway Authority (THEA) CV Pilot Deployment Overview
  - Pilot Objective
  - Pilot Deployment Site: Target Areas
  - Pilot Site Needs, CV Applications and Performance Measures
  - Pilot Deployment Vision
  - Timeline and Phase 1 Deliverable Schedule
- How to Stay Connected

CV Pilot Deployment Program Within The USDOT ITS Strategic Plan

- The Connected Vehicle (CV) Pilot Deployment Program
  - Keystone effort in connected vehicle area
  - Also plays a key role in other strategic areas, including accelerating deployment, promoting interoperability, and enterprise data

- CV Pilot Deployments offer a unique opportunity related to getting CV technology to the field and making a difference in many areas, including:
  - Needs-driven planning and investment
  - Integrated performance measurement
  - Lowering barriers to deployment

USDOT ITS Strategic Plan, pg. 14



http://ntl.bts.gov/lib/54000/54400/54481/Strat_Plan_Final_Version.pdf

CV Pilot Deployment Program Goals

CV Pilot Organizing Principles

- CV Pilots are *pilot deployments*, that is, real-world environment deployments
  - The successful, deployed technologies are expected to remain as permanent operational elements

- Deployment concepts are needs-driven
  - Each site has different needs, focus and applications
    - That is, each pilot deployment will address critical problem(s)
    - The needs of each site will drive the deployment process

- Pilot deployments are expected to be both *large-scale with multiple applications*
  - *Large-scale* implies pilot deployments will have measureable impact, not a specific minimum geographic or vehicle fleet size
  - Sites will deploy *multiple applications* drawing on the products of USDOT and other connected vehicle research

CV Pilot Deployment Requirements

- Multiple connected vehicle applications must be deployed together
- Pilot deployments should leverage USDOT-sponsored research
- Pilot deployments include the capture of data from multiple sources
  - Integrated or carry-in devices for connected vehicles capable of generating an SAE J2735 Basic Safety Message (BSM)
  - Share pilot deployment data while protecting privacy and intellectual property
- Multiple forms of communications technologies are desired
  - Dedicated Short Range Communications (DSRC) 5.9 GHz utilized as one communication technology
- Well-defined, focused, quantitative performance measures
  - Support an independent evaluation effort
- Security and credentialing management system

Connected Vehicle Applications

- The USDOT has made a significant investment in foundational research and initial development of 50+ connected vehicle applications
  - Concepts of Operations
  - System Requirements
  - Prototype Design and Testing
  - Prototype Impacts Assessment
  - Analytics, Modeling and Simulation to Assess Potential Long-Term Impacts

- Not all CV Application efforts are in the same state of maturity, few are complete
  - But a large number of application development efforts across multiple programs have been completed
  - GOAL: move deployment-ready application concepts forward into integrated deployments addressing key performance concerns

CONNECTED VEHICLE APPLICATIONS

V2I Safety

- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning (Transit)

Environment

- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (light vehicle, transit, freight)
- Eco-ICM Decision Support System

Connected Vehicle Applications (Continued)

Mobility

- Advanced Traveler Information System
- Intelligent Traffic Signal System
- (I-SIG)
- Signal Priority (transit, freight)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization

Road Weather

- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

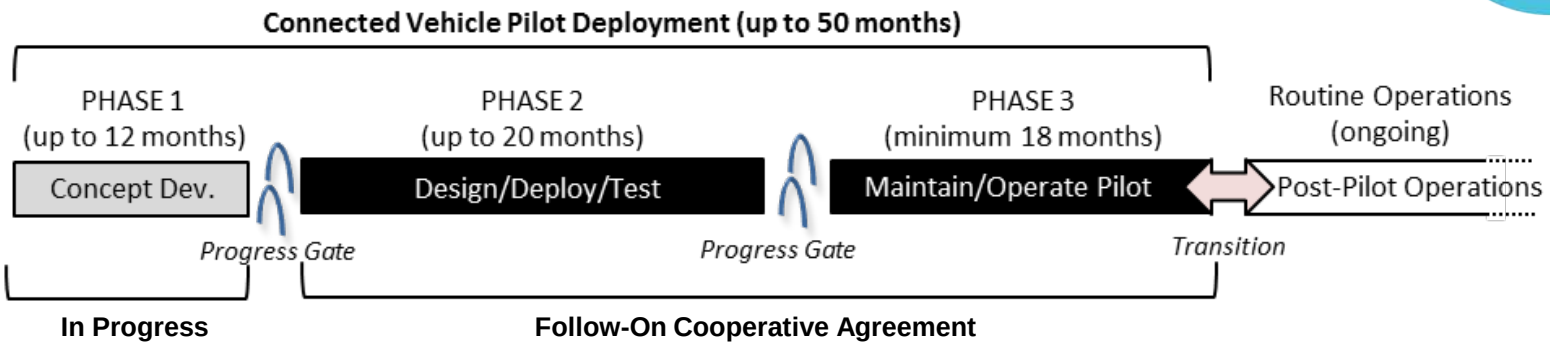
Smart Roadside

- Wireless Inspection
- Smart Truck Parking

Agency Data

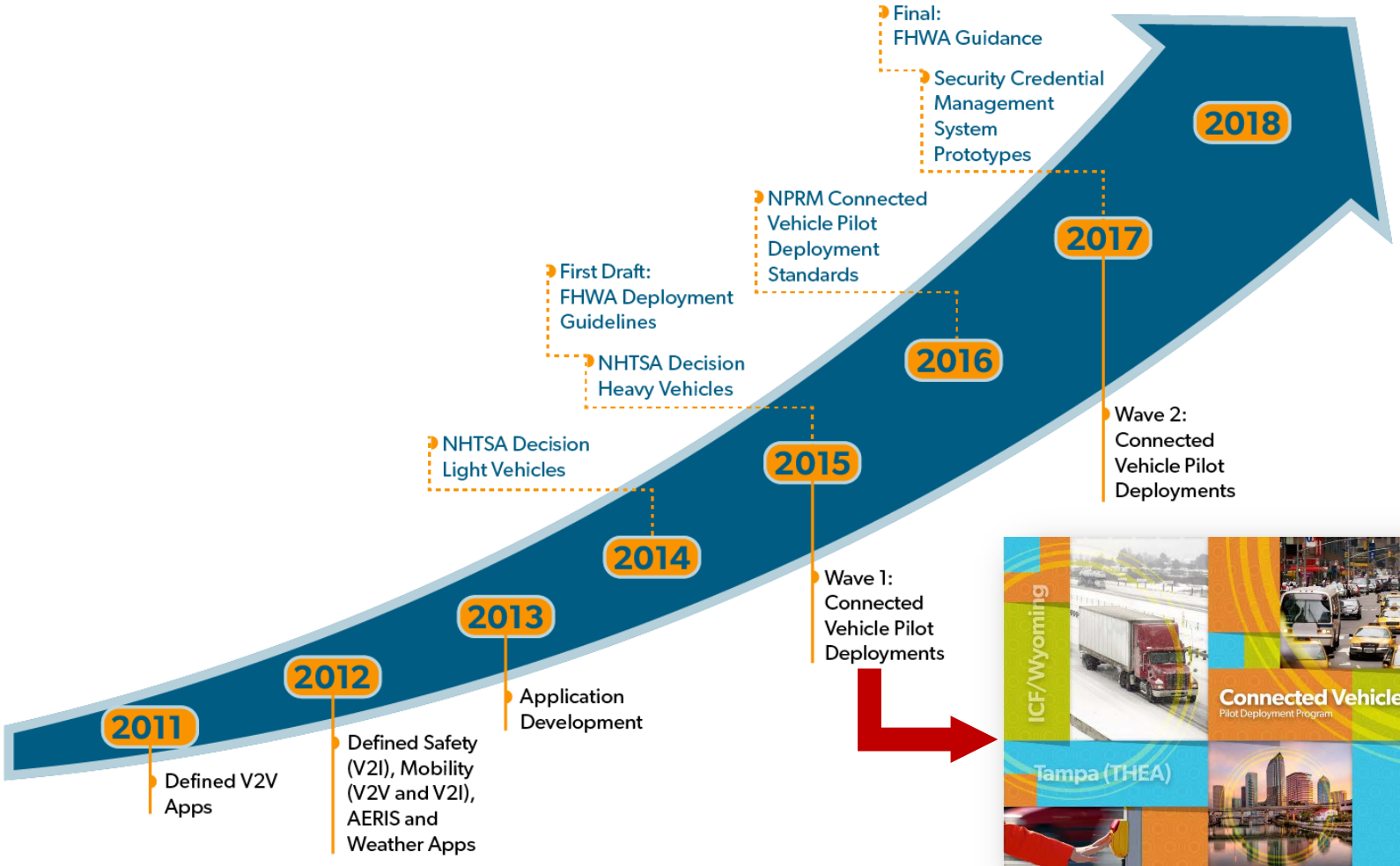
- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

CV Pilot Deployment Program Schedule: Wave 1 (Phases 1-3)



- Phase 1: Concept Development (*Current Phase*)
  - Creates the foundational plan to enable further design and deployment
  - **Progress Gate: Is the concept ready for deployment?**
- Phase 2: Design/Deploy/Test
  - 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)

MOVING FORWARD: ADDITIONAL MILESTONES

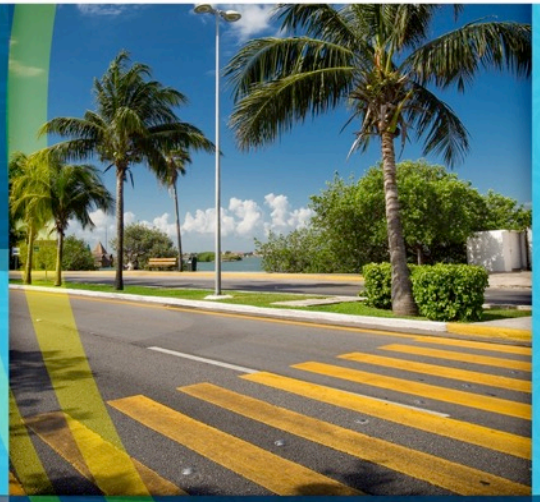


Connected Vehicle
Wave 1 Phase 1 Sites Selected

Solicitation Date: 1/30/2015

Award Date: 09/14/2015

Period of Performance: 09/14/2015 – 09/13/2016



Tampa (THEA)

Tampa Hillsborough Expressway Authority

TAMPA (THEA) PILOT DEPLOYMENT OBJECTIVE AND APPROACH

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.

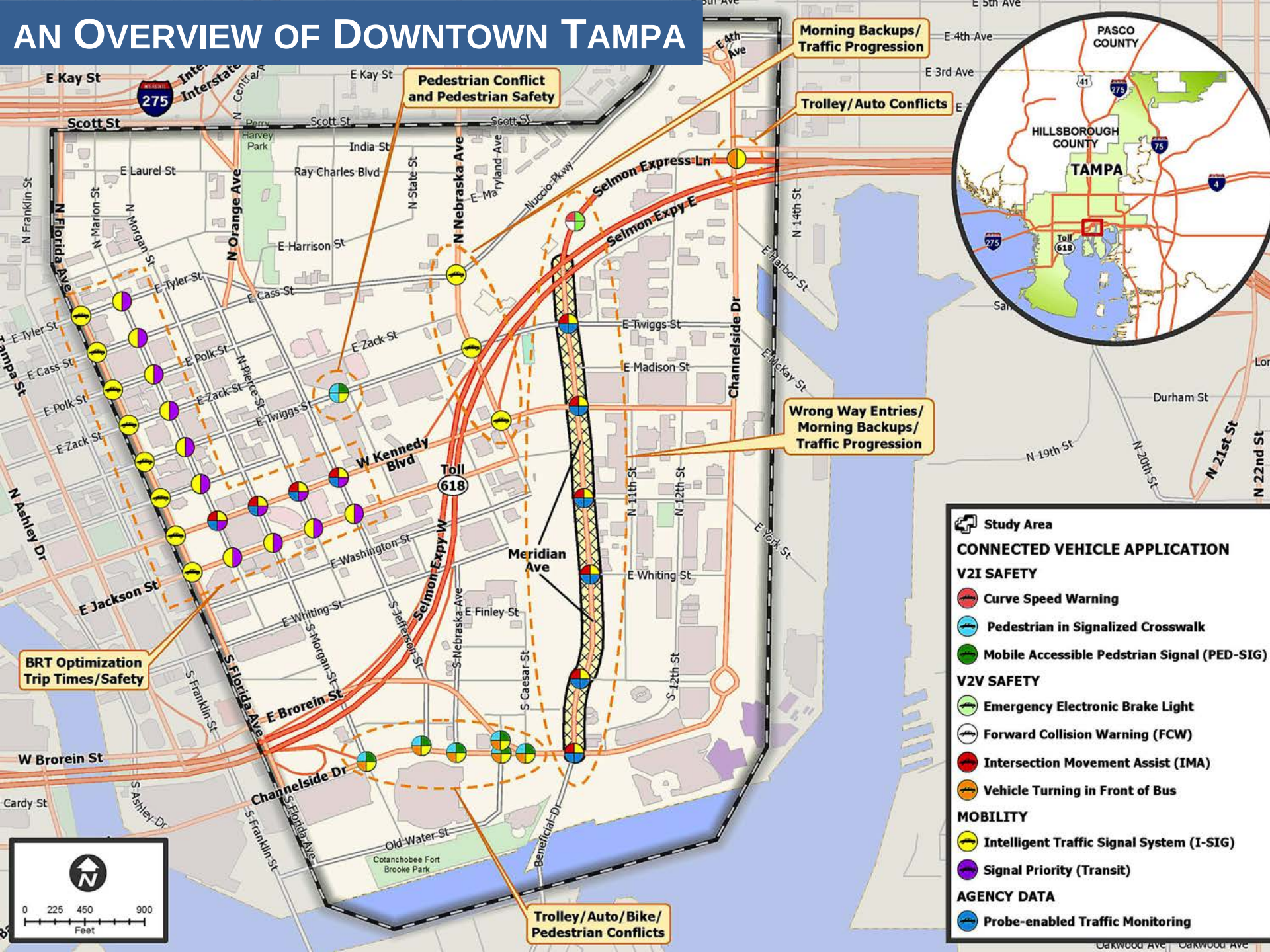
Approach:

- 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.

TAMPA (THEA) PILOT DEPLOYMENT TEAM

Project Sponsor	U.S. Department of Transportation	**ITS Joint Program Office**
Prime Consultant	Tampa Hillsborough Expressway Authority	Tampa Hillsborough Expressway Authority (THEA)
Sub Consultants	HNTB	HNTB Corporation
	SIEMENS	Siemens Industry, Inc.
	Booz | Allen | Hamilton	Booz Allen Hamilton
	CUTR Center for Urban Transportation Research	Center for Urban Transportation Research at University of South Florida
	global 5 Communications	Global-5 Communications

AN OVERVIEW OF DOWNTOWN TAMPA



Tampa (THEA) Pilot Deployment Site Needs: Morning Peak Hour Queues

Avoid Crashes due to Excessive Queues from Exit Ramp to Travel Lane

Warn Approaching Vehicles of Queue Backup in Curve

Reduce Queue Backup on Curve and Improve Signal Timing Progression

V2V Safety: FCW and EEBL

Curve Speed Warning (CSW)

Intelligent Traffic Signal System (I-SIG)

Target Area

Intersection of Twiggs Street and Meridian Avenue at Reversible Express Lanes Entrance/Exit

Performance Measures

- Congestion Impact
- Incident Rates
- Travel Time and Reliability of Travel Time
- Emission and Fuel Consumption

FCW: Forward Collision Warning | EEBL: Emergency Electronic Brake Lights

Tampa (THEA) Pilot Deployment Site Needs: Wrong-Way Entries

Improve Safety at the Entry/Exit Point

Effectively Detect Wrong Way Entries to the REL

Signal Control at Express Lane Entries

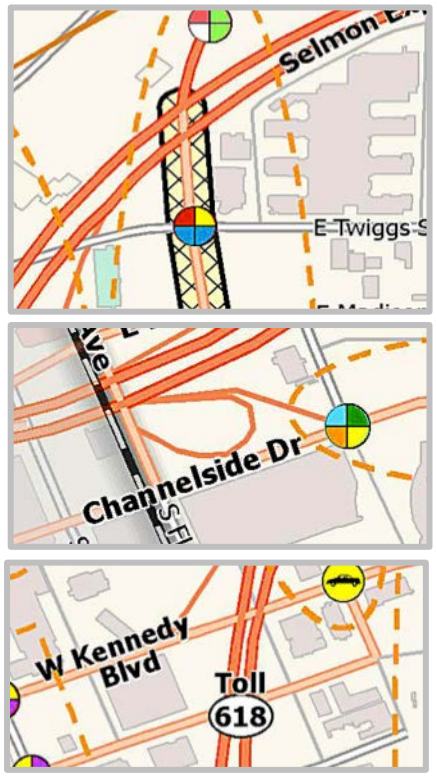
Intersection Movement Assist (IMA)

Probe Enabled Traffic Monitoring

Intelligent Traffic Signal System (I-SIG)

Performance Measures

- Congestion Impact
- Reversible Express Lane (REL) Operation
- Travel Time and Reliability of Travel Time
- Wrong Way Incidents
- Warnings Issued



Target Area

Entry/Exit Points Along Selmon and Reversible Express Lanes (REL)

Tampa (THEA) Pilot Deployment Site Needs: Pedestrian Safety

Improve Pedestrian Safety at Mid-Block Crossing Locations

Provide Pedestrian Crossing Signal Timing

Target Area

Midblock of Twiggs Street at Hillsborough County Courthouse

Pedestrian in Signalized Crosswalk Warning

Mobile Accessible Pedestrian Signal (PED I-SIG) and I-SIG

Performance Measures

- Application Acceptance
- Transit/ Auto/Pedestrian Conflicts
- Pedestrian Behavior (e.g., Jaywalking behavior)

Tampa (THEA) Pilot Deployment Site Needs: Bus Rapid Transit/Transit Operations

Improve Signal Timing Progression

Improve Bus On-schedule Performance

Intelligent Traffic Signal System (I-SIG)

Transit Signal Priority (TSP)

Target Area

Express Route through Downtown City Streets to Marion Street Transit Station

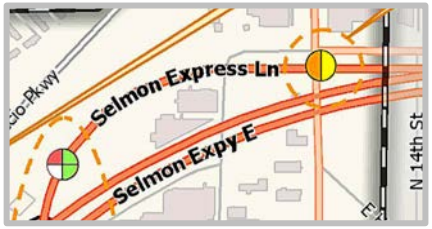
Performance Measures

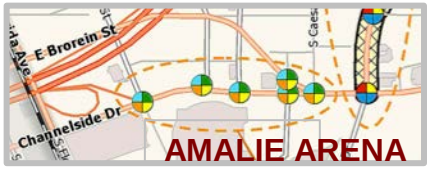
- Transit Ridership
- Travel Time and Reliability of Travel Time
- Bus Headway / On-Schedule Performance
- Bus Tailpipe Emissions
- Fuel Consumption

Tampa (THEA) Pilot Deployment Site Needs: Street Cars/Vehicles Conflicts

Avoid Potential Vehicle Conflicts

Improve Signal Timing for Special Events





Vehicle Turning Right in Front of Bus Warning

Intelligent Traffic Signal System (I-SIG)

Target Area

- Adamo Drive (SR 60)/ Channelside Drive
- Amalie Arena/Channelside Drive Area

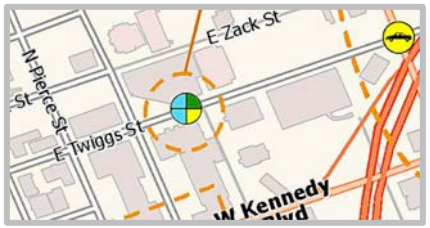
Performance Measures

- Transit/ Auto Conflicts
- Travel Time and Reliability of Travel Time
- Incident Rates
- Streetcar Headway / On-Schedule Performance

Tampa (THEA) Pilot Deployment Site Needs: Signal Coordination and Progression

Effectively Monitor Peak Queuing and Congestion

Improve Traffic Progression



Probe Enabled Traffic Monitoring

Intelligent Traffic Signal System (I-SIG)

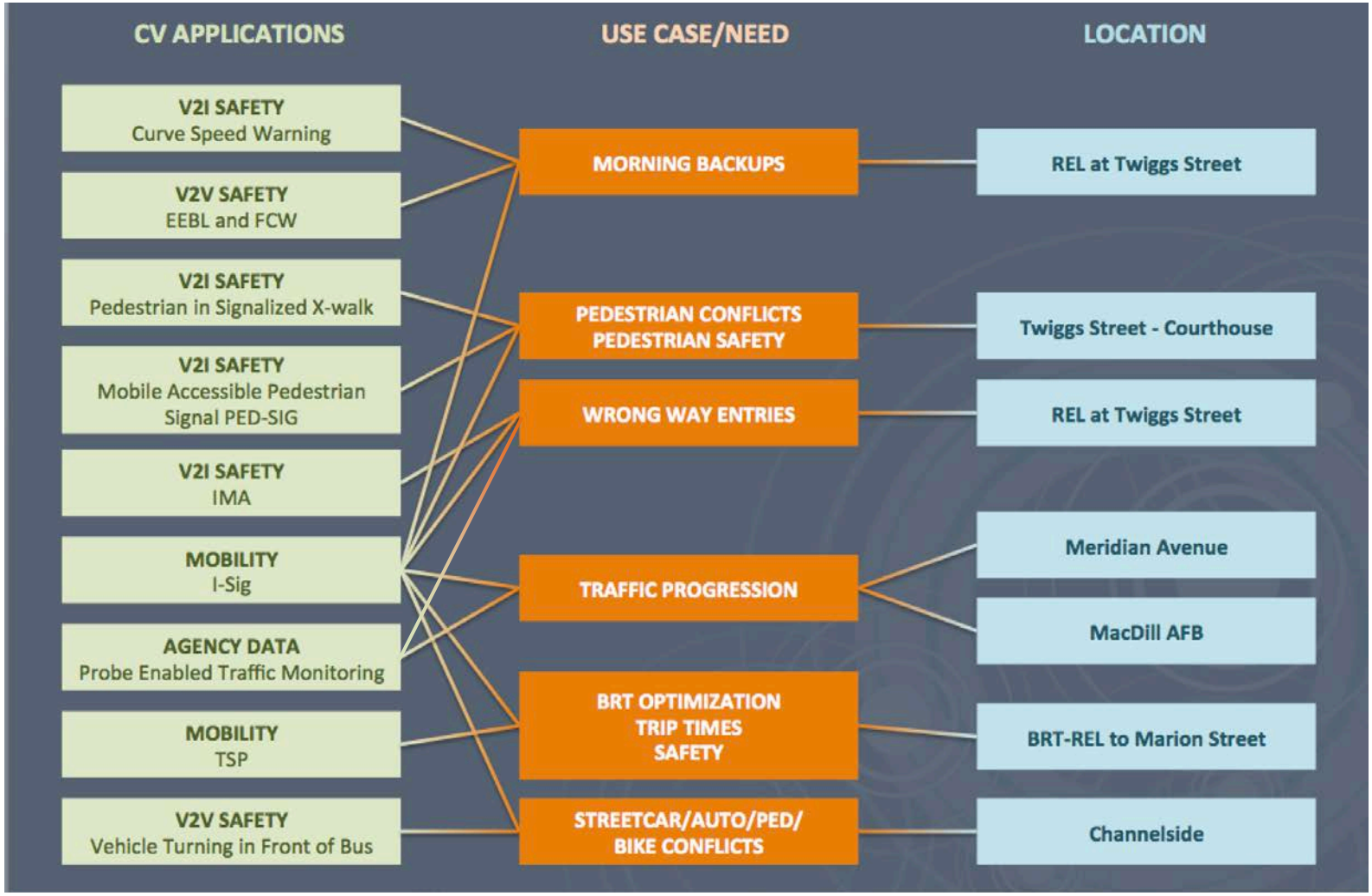
Target Area

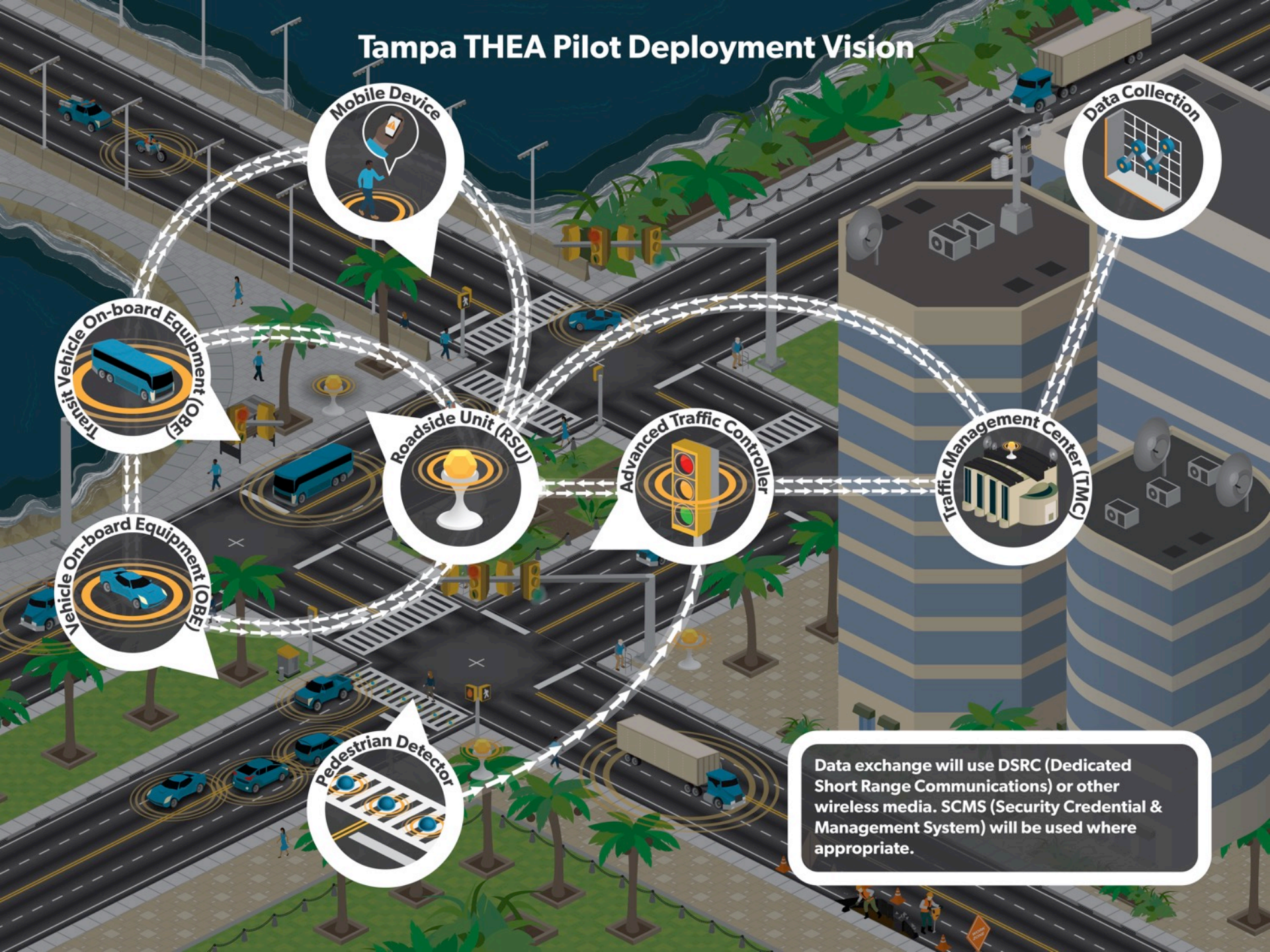
- Along Twiggs Street from Selmon to Marion Street
- Along Meridian Avenue from REL to Channelside Drive

Performance Measures

- City Traffic Management Center (TMC) Operation Enhancements
- Transit Agency Scheduling
- Travel Time and Reliability of Travel Time
- Fuel Consumption

Tampa (THEA) Pilot Deployment Site Needs: Issues and Applications Relationship




Tampa THEA Pilot Deployment Vision
Mobile Device
Data Collection
Transit Vehicle On-board Equipment (OBE)
Roadside Unit (RSU)
Advanced Traffic Controller
Traffic Management Center (TMC)
Vehicle On-board Equipment (OBE)
Pedestrian Detector
Data exchange will use DSRC (Dedicated Short Range Communications) or other wireless media. SCMS (Security Credential & Management System) will be used where appropriate.

TIMELINE - TAMPA (THEA)

Task	Sep 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016
Task 1 – Program Mgt.													
Task 2 – Concept of Operations						●							
Task 3 – Security Concept													
Task 4 – Safety Plan													
Task 5 – Performance Measurement										●			
Task 6 – System Requirements													
Task 7 – App Planning													
Task 8 – Human Use Approval													
Task 9 – Training Plan													
Task 10 – Partnership													
Task 11 – Outreach Plan													
Task 12 – Deployment Plan												●	
Task 13 – Readiness Summary													

● Public Webinar

CV Pilots Phase 1 Deliverable Schedule

Task Name	Deliverables	Due Date
Task 1: Project Management	Kickoff Briefing to USDOT	10/1/2015
	Program Management Plan (Final)	10/26/2015
Task 2: Concept of Operations (ConOps)	Stakeholder ConOps Review Panel Roster (Final)	11/23/2015
	ConOps (Final)	1/18/2016
	ConOps Webinar (Public)	2/8/2016
Task 3: Security Management Concept	Security Management Operating Concept (Final)	3/14/2016
Task 4: Safety Plan	Safety Management Plan (Final)	3/14/2016
Task 5: Performance Measurement	Performance Measurement Plan (Final)	5/16/2016
	Performance Plan Measurement Webinar(Public)	6/6/2016
Task 6: System Requirements (SyRs)	Stakeholder SyRs Review Panel Roster (Final)	3/21/2016
	SyRs (Final)	5/16/2016
Task 7: Application Planning	Application Deployment Plan (Final)	6/6/2016
Task 8: Human Use Approval	Human Use Approval Summary (Final)	7/18/2016
Task 9: Training Plan	Training and Education Plan (Final)	8/1/2016
Task 10: Partnership	Partnership Status Summary (Final)	8/1/2016
Task 11:Outreach Plan	Outreach Plan (Final)	7/18/2016
Task 12: Deployment Plan	Comprehensive Deployment Plan (Final)	8/1/2016
	Deployment Plan Webinar (Public)	8/22/2016
Task 13: Readiness Summary	Deployment Readiness Briefing to USDOT	8/22/2016
	Deployment Readiness Summary (Final)	9/12/2016

STAY CONNECTED

- **Join us for the *Getting Ready for Deployment* Series**
  - Discover more about the Wave 1 CV Pilot Sites
  - Learn the Essential Steps to CV Deployment
  - Engage in Technical Discussion

Website: http://www.its.dot.gov/pilots

Twitter: @ITSJPODirector

Facebook: https://www.facebook.com/DOTRITA

Contact for CV Pilots THEA
Govind Vadakpat, THEA Site COR
G.Vadakpat@dot.gov

Contact for CV Pilots Program:
Kate Hartman, Program Manager
Kate.hartman@dot.gov