



Connected and Automated Vehicle (CAV) Technologies Supporting Integrated Corridor Management (ICM) in Hillsborough County

FDOT District 7

Presented by

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District 7 ITS Project Manager





Presentation Outline

I. What is ICM?

II. CAV Technologies being Deployed

III. Projects Overview

- City of Tampa ATMS
- I-4 FRAME Project
- I-275 ICM

IV. Data Overview

I. What is ICM?

- **Integrated Corridor Management (ICM)** is an operational approach that proactively manages multimodal and multijurisdictional transportation systems to optimize the flow of traffic and minimize congestion.
- ICM seeks to optimize the use of existing and advanced technologies to manage traffic flow and inform travelers about different travel options.

+ **Benefits**

- Improved travel time reliability and predictability
- Increased corridor throughput and mobility
- Improved incident management
- Increased value of transportation investments

II. CAV Technologies being Deployed



RSU



Roadside Units (RSU)

- Wireless communication between the roadway infrastructure and the vehicles that are equipped with OBUs
- Communicates on the 5.9 GHz DSRC band or C-V2X to transmit and receive CV messages

OBU



On-board Units (OBU)

- Device installed on the motor vehicle to allow communication (transmitting/receiving) with other OBUs or RSUs

IVP



Integrated V2I Prototype (IVP) Hub

- A small form-factor computer
- Handles the processing of CV applications
- Allows the RSU to perform “radio” functions only
- Utilized at locations where additional edge processing is needed (i.e., passive pedestrian detection locations)



III. Projects Overview

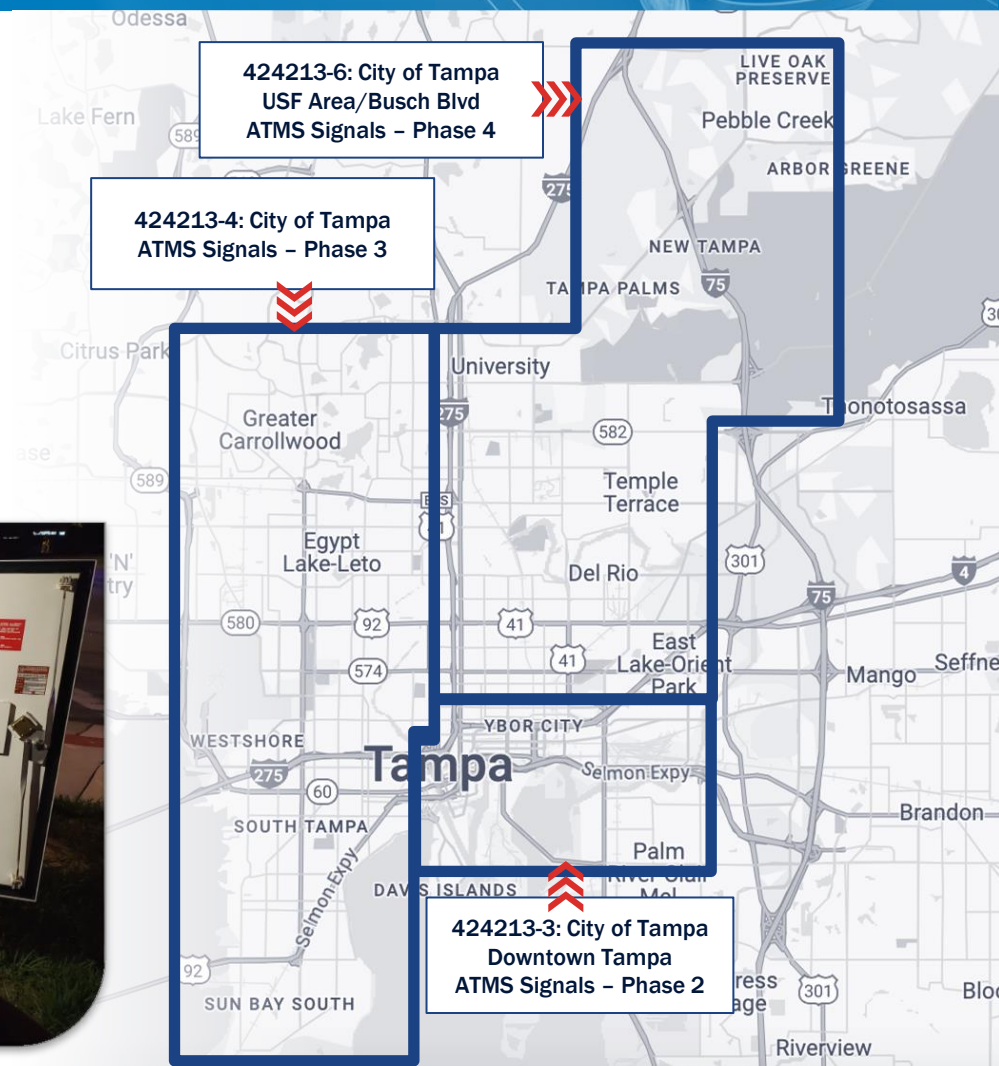
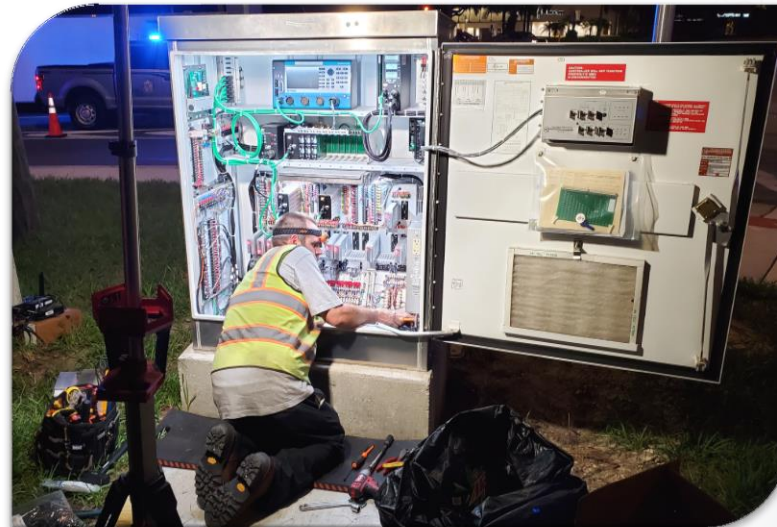
- City of Tampa ATMS
- I-4 FRAME Project
- I-275 ICM

City of Tampa ATMS Overview (Design-Build)



Project Limits: City wide deployment with approximately 529 intersections

- The project includes city-wide cabinet replacements, fiber expansion, wireless communication expansion, installation of vehicle detection, CCTVs, UPS, Flood sensors, and 39 RSUs



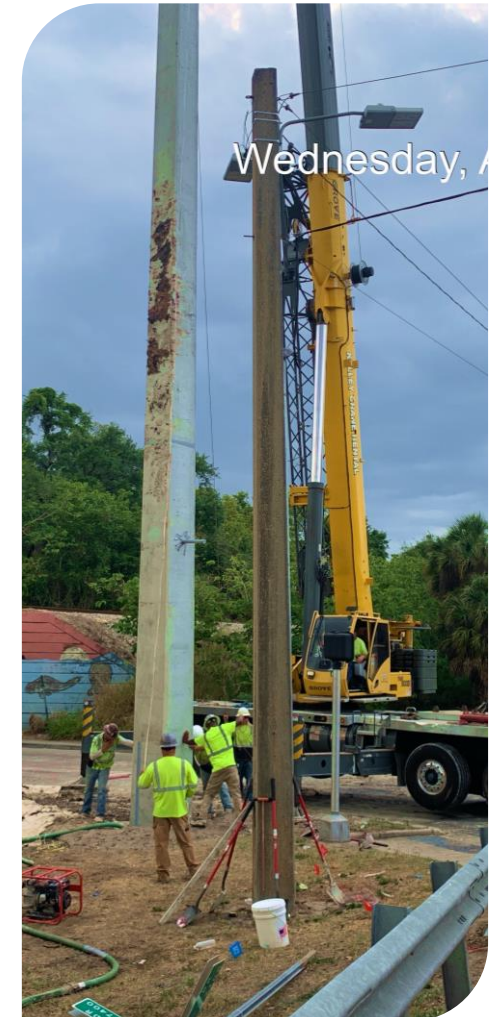
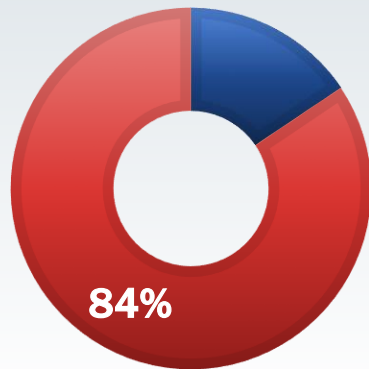
City of Tampa ATMS Project Schedule

- Construction Letting Date: 01.31.2020
- Notice to Proceed Date: 04.30.2020
- Construction Begin Date: 04.30.2020
- Est. Construction Completion: Spring 2024



Construction Budget - \$38.35 Million

Percent Complete



I-4 FRAME Overview (Systems Manager)



Project Limits: I-4 from Tampa to Orlando and adjacent arterial roadways

- Installing CV and ITS technologies that will allow vehicles to talk to traffic signals and other vehicles, while improving traffic and alleviating traffic congestion.
- Devices being installed include RSUs, CCTV cameras, Bluetooth detectors, Blank out signs, ATC Controllers, and video and radar vehicle detection.

Project Facts

Installing Roadside Units along
72 miles of I-4

Over **275** miles of other Limited Access, State and Non-State Routes

411
Traffic Signals

I-4 FRAME Overview

Legend

Diversion Routes

- Primary Diversion Routes
- Secondary Diversion Routes
- THEA Diversion Route
- Turnpike Diversion Route

Interstate 4

- Interstate 4

FDOT District Boundaries

- District 1
- District 5
- District 7

District 1

I-4: 30 miles
Arterials: 100+ miles

Florida Turnpike Roadways: 24 miles

District 7

I-4: 25 miles
Arterials: 80 miles
SR 60 CAV: 30 Miles

Florida Turnpike Roadways: 3 miles

EXPRESSWAY THEA Roadways: 16 miles

District 5

I-4: 17 miles
Arterials: 30 miles

Florida Turnpike Roadways: 10 miles

Florida Turnpike Enterprise

Total Mileage Across All Districts

37 miles



FDOT District 7



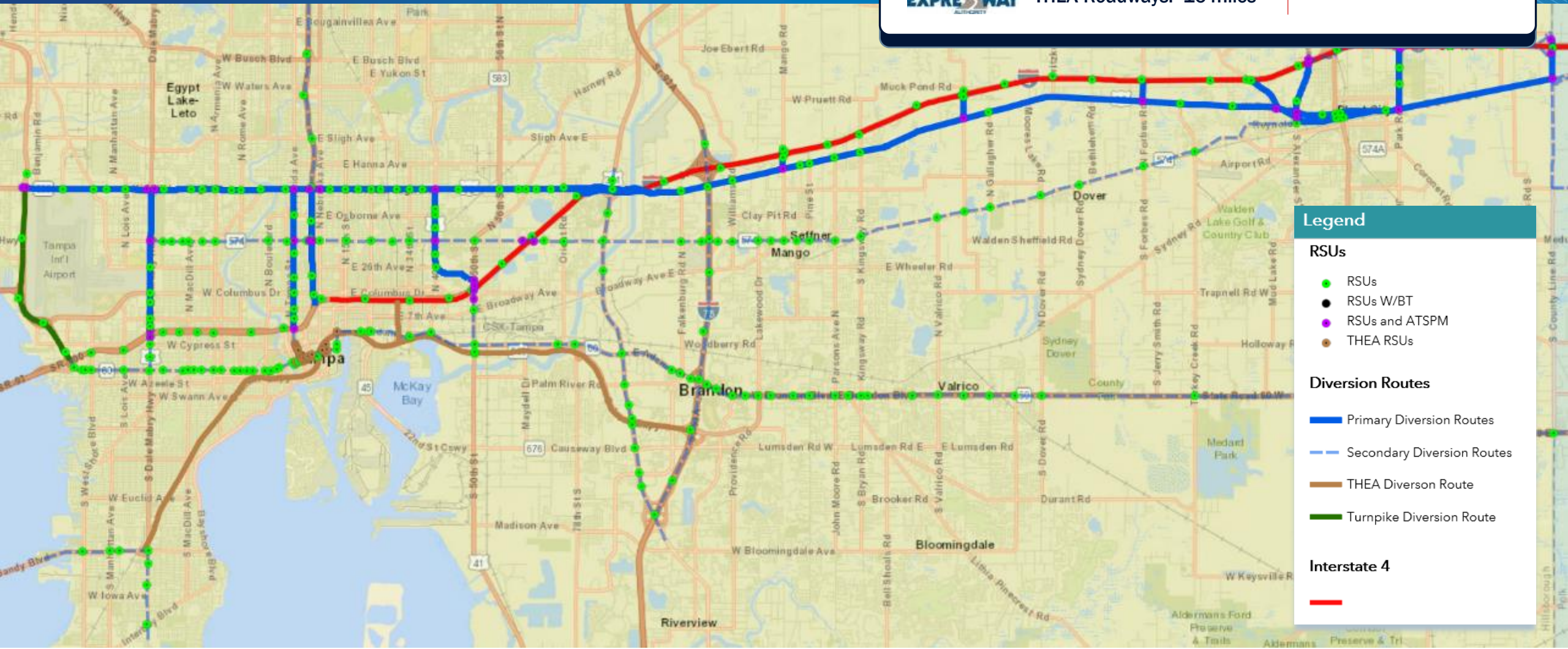
Florida Turnpike Roadways: 3 miles



THEA Roadways: 16 miles

I-4: 25 miles

Arterials: 80 miles



Legend

RSUs

- RSUs
- RSUs W/BT
- RSUs and ATSPM
- THEA RSUs

Diversion Routes

- Primary Diversion Routes
- Secondary Diversion Routes
- THEA Diversion Route
- Turnpike Diversion Route

Interstate 4

-



I-4 FRAME Project Schedule

Contract 1 - T7483

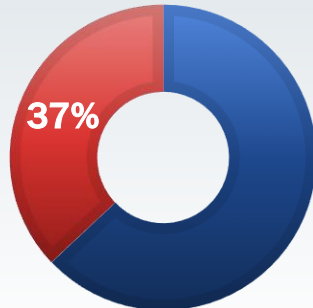
445362-2, 447012-1 (District 7)

- Construction Letting Date: 02.23.2022
- Construction Begin Date: 11.02.2022
- Est. Construction Completion: Summer 2024



Construction Budget - \$9 Million

Percent Complete



Contract 2 - E7P15

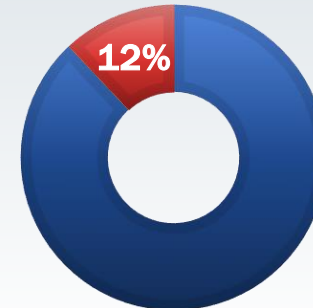
445362-3, -4, -5 (District 1, 5, Turnpike)

- Construction Letting Date: 07.13.2022
- Construction Begin Date: 03.15.2022
- Est. Construction Completion: Summer 2025



Construction Budget - \$10.1 Million

Percent Complete



I-4 FRAME Construction Photos



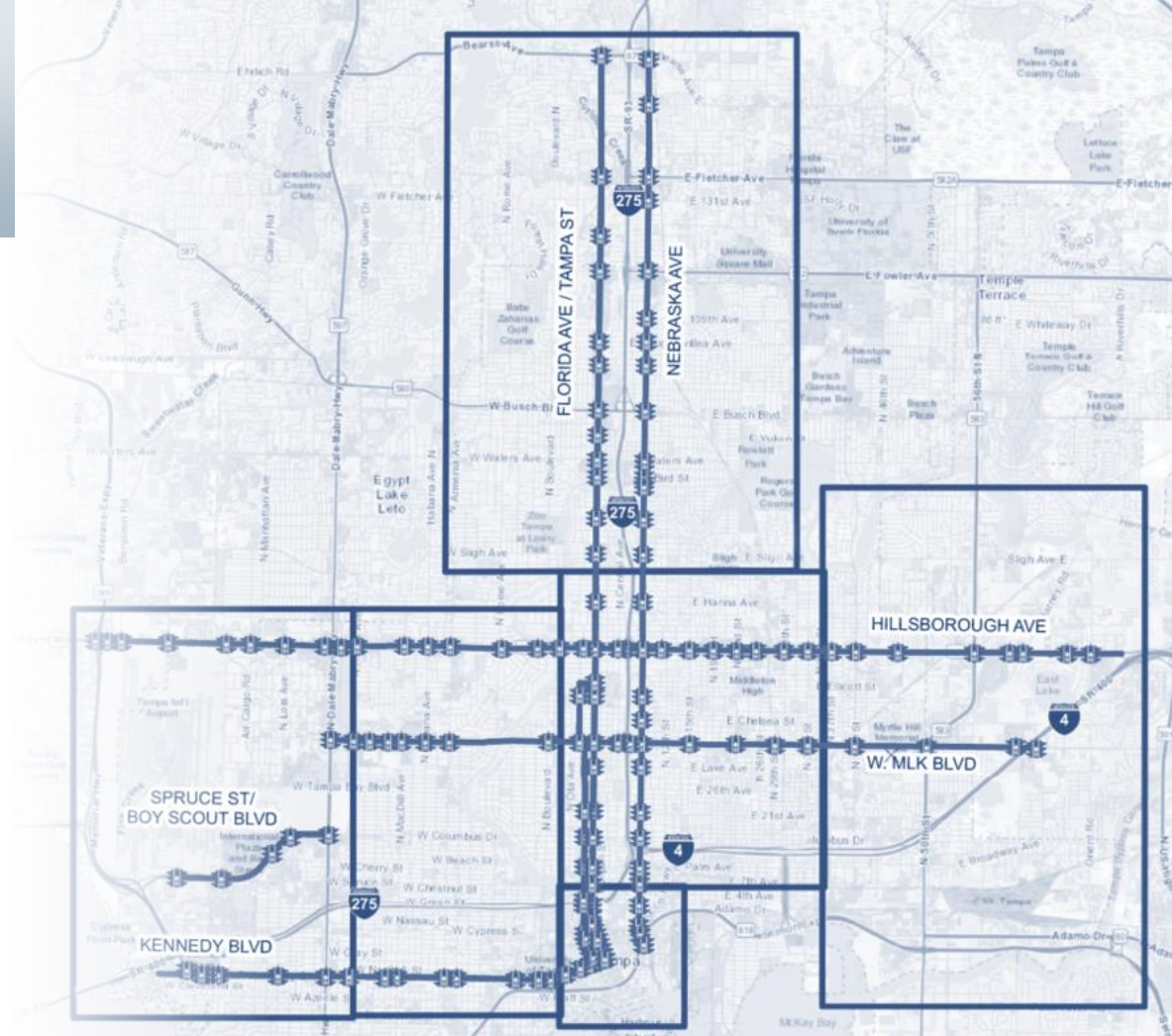
I-275 ICM Overview (Design-Build)



Project Limits: Six (6) major corridors in Hillsborough County

- SR-574/W MLK Blvd
- USB-41/SR-685/Florida Ave/Tampa St
- US-41/SR-45/Nebraska Ave
- SR-60/Kennedy Blvd
- US-92/SR-580/SR-600/Hillsborough Ave
- SR-616/Spruce Street/Boy Scout Blvd

- The project includes fiber expansion, vehicle detection, CCTVs, Bluetooth, and 33 RSUs



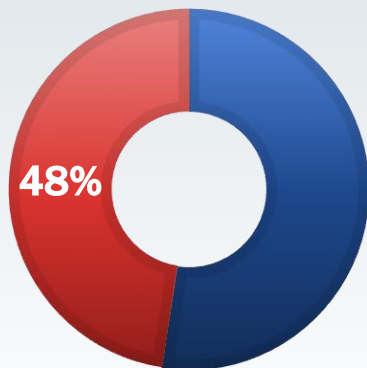
I-275 ICM Project Schedule

- Construction Letting Date: 05.27.2022
- Notice to Proceed Date: 07.28.2022
- Construction Begin Date: 03.20.2023
- Est. Construction Completion: Summer 2024



Construction Budget - \$29.2 Million

Percent Complete



Integration Activities – Systems Manager

- I-4 FRAME has configured roughly 251 out of 544 RSUs between the two contracts.
- I-4 FRAME has configured 600+ ITS devices (CCTVs, Switches, web relays, RPMUs, Bluetooth Devices, wireless modems, etc.). Anticipating an additional 800+ devices to be configured for contract 2.
- City of Tampa ATMS has configured 1100+ devices.



A wireframe illustration of a car driving on a road, set against a blue background with motion blur lines.

IV. Data Overview

- ATSPM Data
- Data being Transmitted and Received
- High-Level Architecture
- Data for Operations and Planning
- Connected Vehicles Applications
- Decision Support System for ICM

Automated Signal Performance Measures (ATSPM) Data

ATSPM Data being gathered:

- Signal Phasing and Timing (SPaT)
- Traffic Volumes
- Queue Lengths
- Travel Times
- Delay (approach, pedestrian, preemption)
- Split Failures
- Yellow/Red Actuations



Data Frequency
~every $1/10^{\text{th}}$
Second



Data Volume
~10MB per signal,
per day

Data being Transmitted and Received

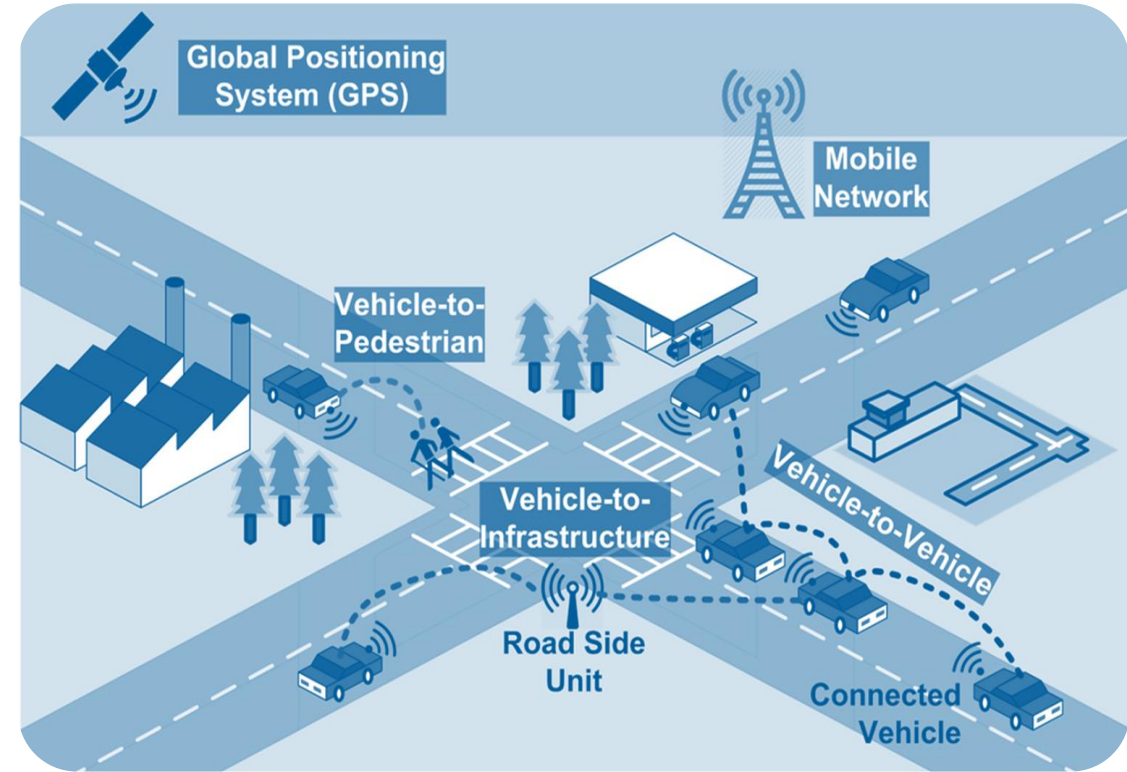
Connected Vehicles

RSUs

- Receiving basic safety messages (BSMs) from OBUs
- Transmitting Traveler Information Messages (TIM) to OBUs
- Transmit Signal Phasing and Timing (SPaT) information to OBUs

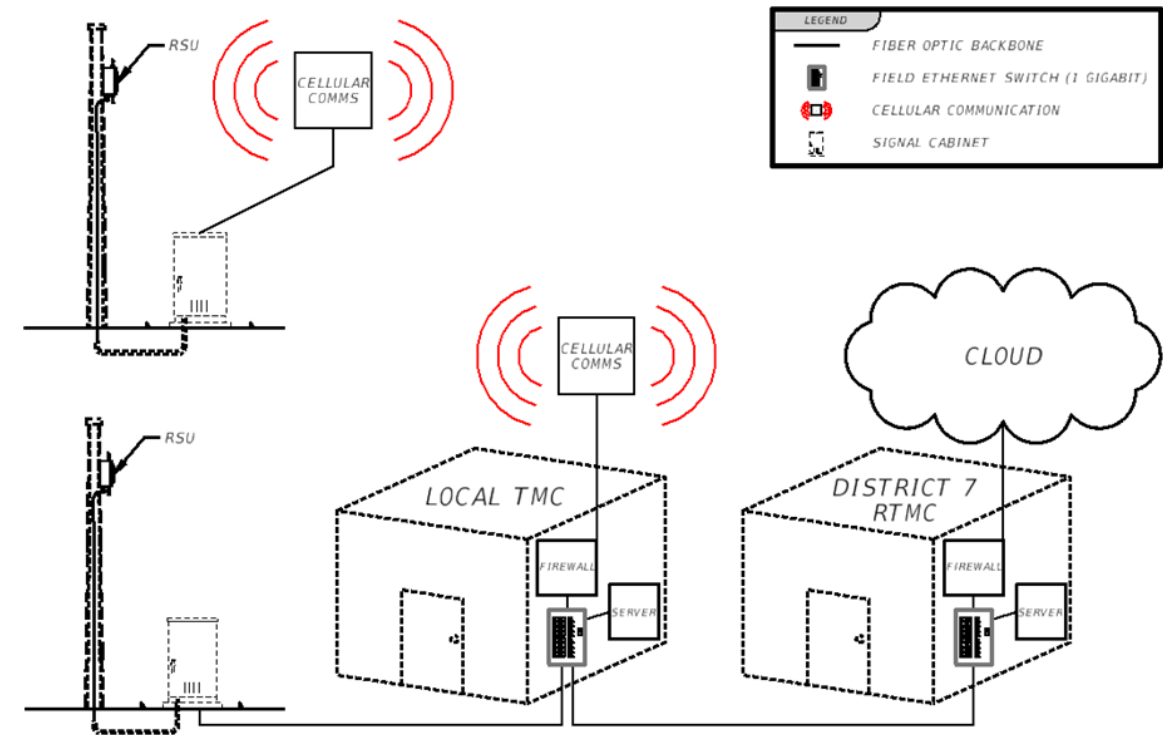
OBUs

- Initially will transmit BSM with position, speed, heading, and location information
- In future, additional information such as brake status, acceleration status, windshield wiper status, etc. can be gathered as systems progress



High-Level Architecture

- Data will flow from field device to local agency TMC to FDOT District 7 RTMC.
- CV Data will also be pushed to FDOT Central Office V2X Data Exchange Platform (V2X DEP).
- Data aggregation location and storage is currently still being determined based on the statewide V2X DEP Project development.
- The local agencies can have a client of SunGuide or some other CV application within their respective TMCs, to assist with viewing the CV data in order to make informed decisions on response plans.



High-Level Architecture of Data Flows between the Local Agency TMC and FDOT.

Data for Operations and Planning



ATSPM Data will be accessible at the local TMC and RTMC

- Local agencies can utilize this data to optimize signal timing
- Ability to monitor and remotely manage signal timing plans in real time
- RTMC has access for after hour assistance or per SOPs/SOGs agreed upon
- TMC and RTMC will be able to run reports as needed for transportation planning needs

CV Data will be accessible at the local TMC, RTMC, and V2X DEP

- Local agencies to have client of SunGuide in order to access CV data
- Ability to monitor and remotely manage response plans based on CV data received
- RTMC and TMC will operate based on SOPs/SOGs
- TMC and RTMC will be able to run reports as needed for transportation planning needs
- V2X DEP will disseminate real-time CV data to OEMs

Connected Vehicle Applications

Freeway

TM08 – Traffic Incident Management System

- Broadcasts traffic incident management information from incident detection, maintenance and construction management, and emergency management centers via the RSUs.

TM12 – Dynamic Roadway Warning

- Broadcasts information on back-of-queues, roadway hazards, road weather conditions, road surface conditions, and obstacles or animals on the road.

TM17 – Speed Warning and Enforcement

- Broadcasts information to warn drivers of reduced speed recommendations based on the roadway conditions ahead.

TM25 – Wrong Way Vehicle Detection and Warning

- Broadcasts TIM to oncoming drivers of a wrong way driver.

VS07 – Road Weather Motorist Alert and Warning

- The RTMC will receive data generated by the traffic detectors, CCTV cameras, road weather information systems (RWIS), and other weather dissemination sources.

VS08 – Queue Warning

- Broadcasts information to warn motorists of back-of-queue in order to minimize or prevent rear-end or other secondary collisions.

VS09 – Reduced Speed Zone Warning/Lane-Closure

- Broadcasts information on reduced speed zones that include (but are not be limited to) construction/work zones, school zones, and pedestrian crossing areas).

MC06 – Work Zone Management

- Broadcasts information to motorists in areas where maintenance, construction, and utility work are ongoing.

PS07 – Incident Scene Safety Monitoring

- Broadcasts information to alert drivers of incident zone operations.



OBU Penetration is CRITICAL for success!

Connected Vehicle Applications

Arterial

TM04 – Connected Vehicle Traffic Signal System

- Use CV data to determine whether signal timings for an intersection or group of intersections should be adjusted to improve traffic flow, including allowing platoon flow.

TM14 – Advanced Railroad Grade Crossing

- Broadcasts alerts to drivers approaching an at-grade railroad crossing if a train is approaching based on data collected from detection devices.

PT09 – Transit Signal Priority

- Use CV data to improve the operating performance of the transit vehicles by reducing the time spent stopped at a red light.
- This would be deployed along a couple strategic corridors after coordination with transit agency. OBU purchasing by Transit Authority would be required.

PS03 – Emergency Vehicle Preemption

- Use CV data to improve the operating performance of the emergency vehicles by facilitating the movement of public safety vehicles through the intersection.

VS12 – Pedestrian and Cyclist Safety

- Integrates traffic, pedestrian, and cyclist information from roadside or intersection detectors and new forms of data from wirelessly connected, non-motorized traveler-carried mobile devices to request right-of-way or to inform non-motorized travelers when to cross and how to remain aligned with the crosswalk or pathway based on real-time Signal Phase and Timing (SPaT) and MAP information.

VS13 – Intersection Warning and Collision Avoidance

- If the vehicle determines that proceeding through the intersection is unsafe, a warning is provided to the driver and/or collision avoidance actions are taken, depending on the automation level of the vehicle.

CV006 – Freight Signal Priority

- Use CV data to reduce stops and delays for increased travel time reliability for freight traffic, and for enhancing safety at intersections.
- This would be deployed along select corridors, mainly SR 60.



OBU Penetration is CRITICAL for success!

Decision Support System (DSS) for ICM



A Decision Support System (DSS):

- Monitors real-time data to assess current transportation network conditions
- Recommends preapproved strategies and response plans when events occur
- Analyzes and predicts response plan benefits
- Evaluates response plan results



District 7 is looking into options for a fully functional DSS that will focus on making decisions that benefit the corridor as a whole, versus the individual networks/jurisdictions.



Open Discussion