

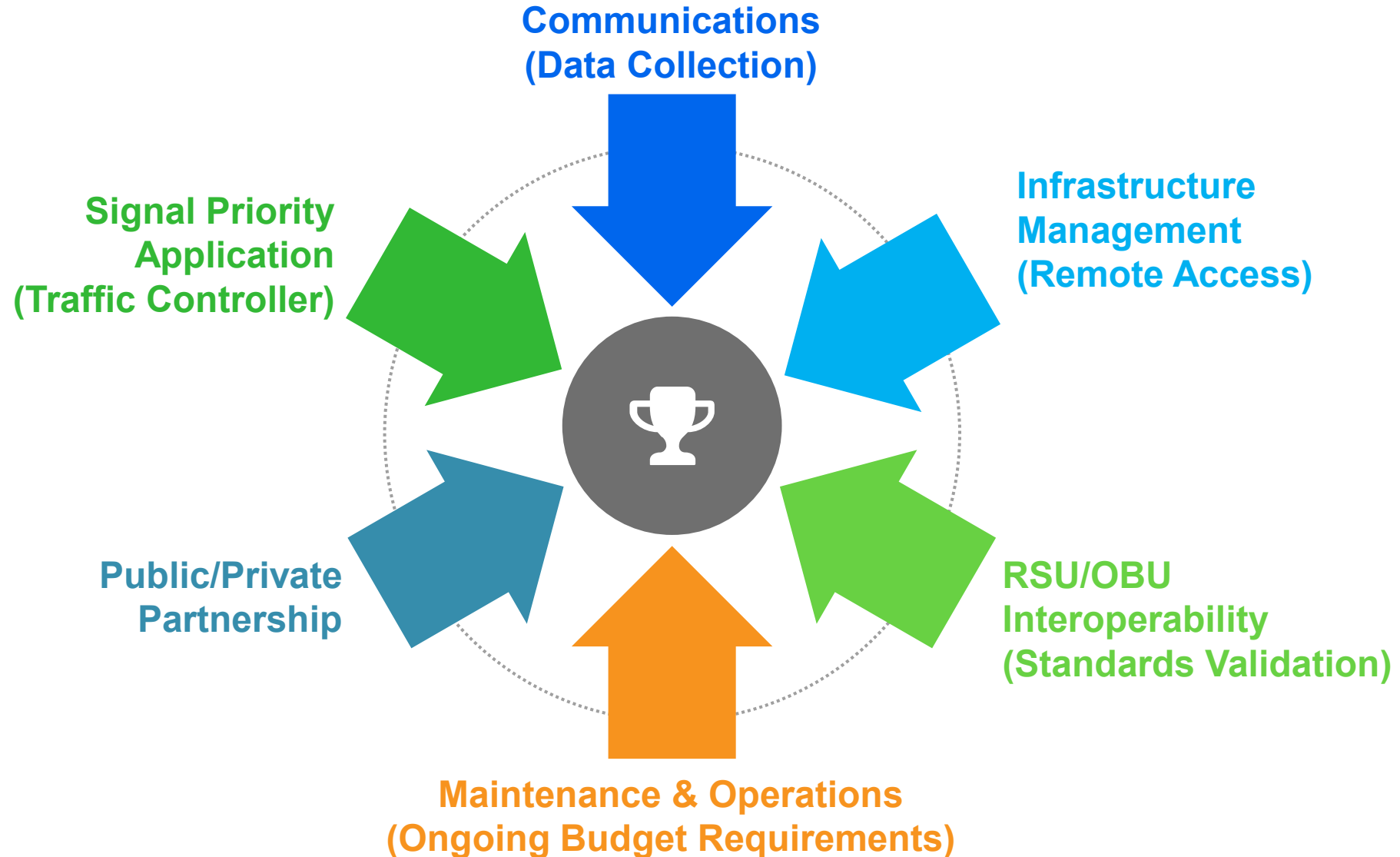
# ACES Across the Board

## Lessons Learned, with Day-One ROI

*Delivering Sustainable Mobility*

Frank Provenzano  
Senior Director, Connected Vehicle Solutions  
Iteris, Inc.  
fprovenzano@iteris.com  
Ph: 949-338-3416

# Lessons Learned, with Return on Investment...



# Successful Infrastructure Deployments – DSRC transition to LTE-V2X...



**EXCLUSIVE: 5.9 GHz Spectrum Used for Safety Related Transportation (ITS) Applications.**

# Cellular-V2X / LTE-V2X is NOT...



**Not connected  
to cellular tower**



**Not available on  
your Cellphone**



**Not 5G**

# 5.9 GHz – FCC Transition...

Unlicensed Wi-Fi					DSRC	Cellular/LTE-V2X		
5.850 GHz						5.925 GHz		
						CH 183		
						CH 181		
CH 175								
5850-5855 reserve 5 MHz	CH 172 Service 10 MHz	CH 174 Service 10 MHz	CH 176 Service 10 MHz	CH 178 Service 10 MHz	CH 180 Service 10 MHz	CH 182 Service 10 MHz	CH 184 Service 10 MHz	
	V2V/V2I BSMs	SCMS	Red Light Viol	WAVE	SCMS	Red Light Viol	Public Safety	
	SPaT/MAP	SPaT/MAP	Curve Speed	RSA	Personal Safety	Curve Speed	Signal Preemption	
	HMI	Platooning	V2 Pedestrian	BSMs	OTA Updates	V2 Pedestrian	Signal Request	
		AVs	Probe		Signal Request	Probe		

# 5.9 GHz ONLY – Transition to LTE-V2X ONLY in 2023

Unlicensed Wi-Fi					LTE-V2X		
5.850 GHz					5.925 GHz		
					CH 183		
CH 175					CH 181		
5850-5855 reserve 5 MHz	CH 172 Service 10 MHz	CH 174 Service 10 MHz	CH 176 Service 10 MHz	CH 178 Service 10 MHz	CH 180 Service 10 MHz	CH 182 Service 10 MHz	CH 184 Service 10 MHz



# Connected Vehicle Applications...

## Who gets priority, where, when & how...

# Signal Priority Based on Vehicle/User Type



**Emergency Vehicles,**  
Police, Fire, Paramedic,  
Ambulance



**Transit,** Local Bus,  
School Bus

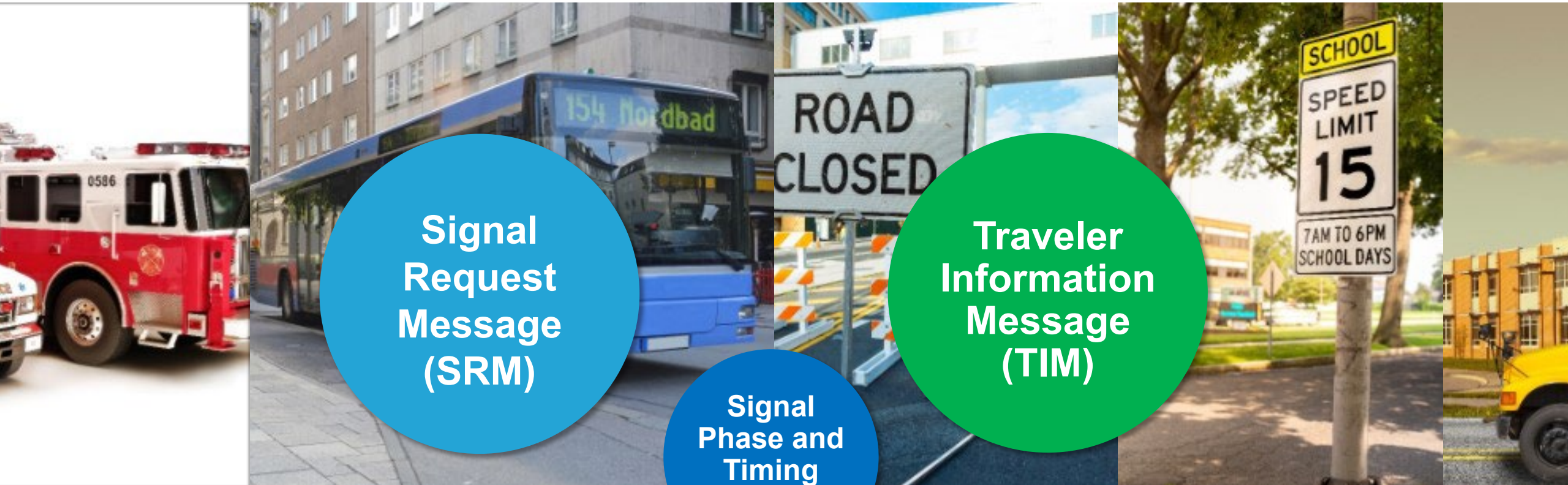


**Light Trucks, Vans,**  
Trucks, Multi-Axle,  
Trailer



**Basic Passenger**  
**Vehicles,** Motorcycles  
Equipped Travelers

Traffic Department controls who gets priority, where, when & how...



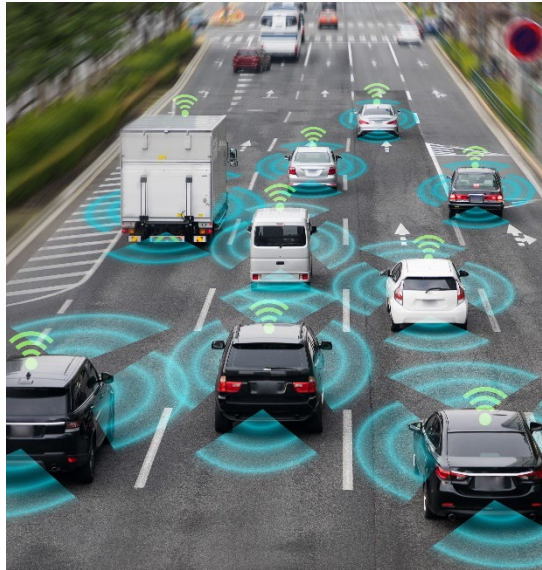
**Signal  
Request  
Message  
(SRM)**

**Signal  
Phase and  
Timing  
(SPaT)**

**Traveler  
Information  
Message  
(TIM)**

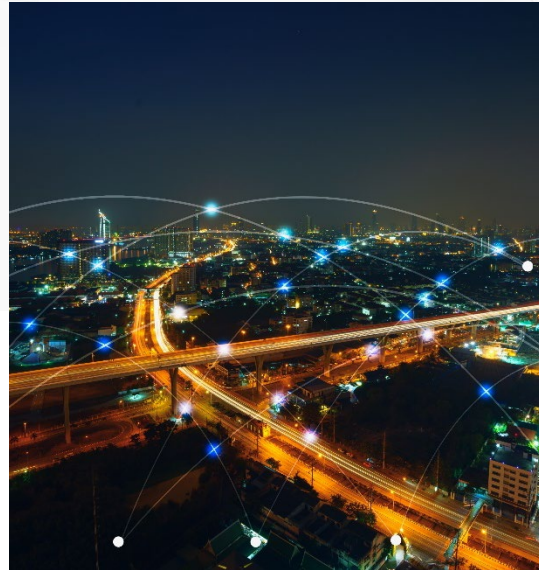
# Foundation to Build Connected Vehicle Applications

# Benefits of Using Connected Vehicle for EVP and Signal Priority



## High Accuracy, Low Latency

– No communications towers or service fees with FCC Licensed System



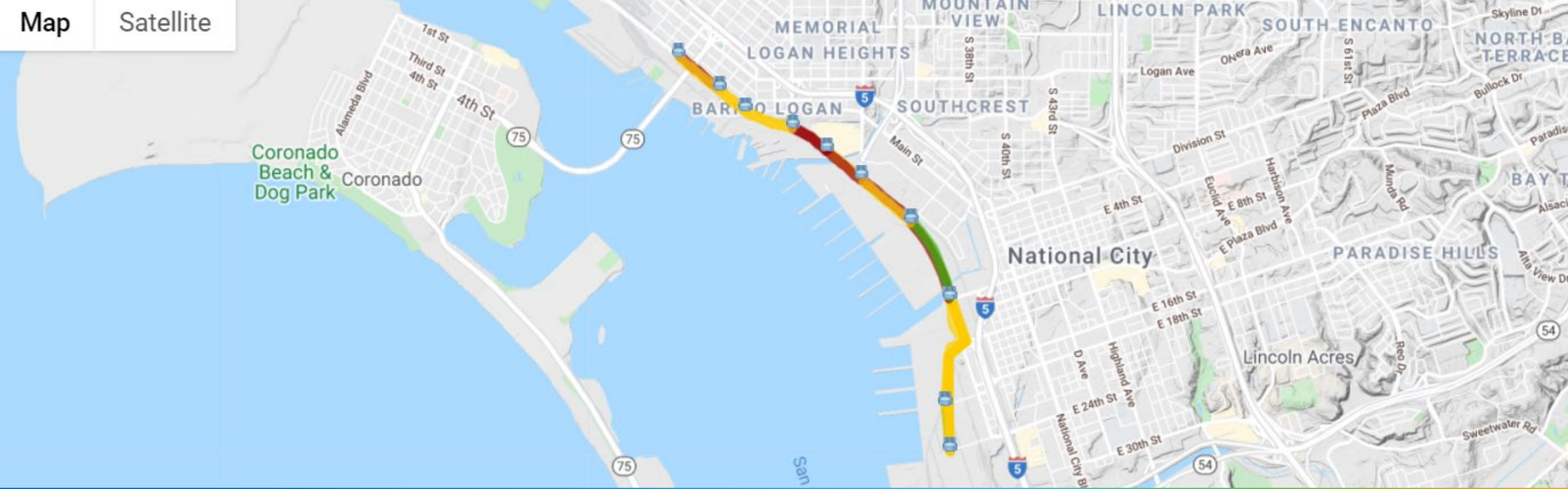
## Futureproof System

– Ready for ALL Signal Priority Applications...



## State-of-the-Art Security

– Use USDOT Security Credential Management System (SCMS)



## *The Project:* San Diego Freight Signal Priority (FSP)



### Objectives

- Manage Travel Times
- Reduce Vehicle Stops
- Reduce Carbon Emissions

### Solution

- Connected Vehicle FSP
- RSU/OBU Hardware and Software

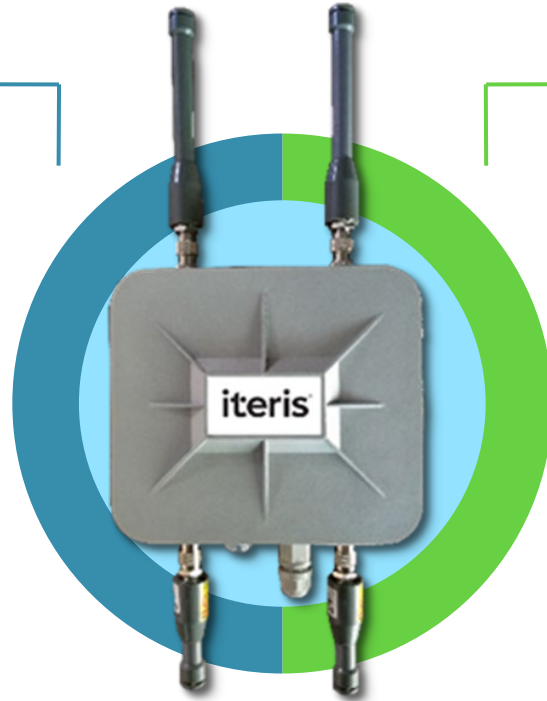
# ITS Technology Convergence

– Bluetooth Travel Time system with Connected Vehicle technology...

Bluetooth® 2.4 GHz

## BlueTOAD® Travel Time

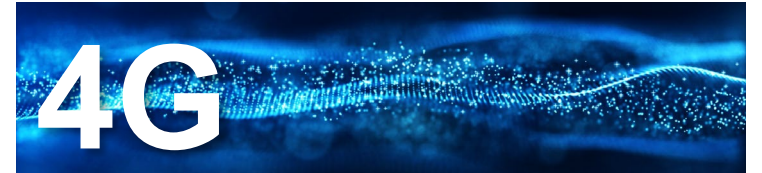
Iteris, Inc. excels in empowering organizations to harvest traffic data they produce, with the objective to build useful products and expand services.



3GPP Rel.14/15  
(5.9 GHz)

## LTE-V2X (C-V2X)

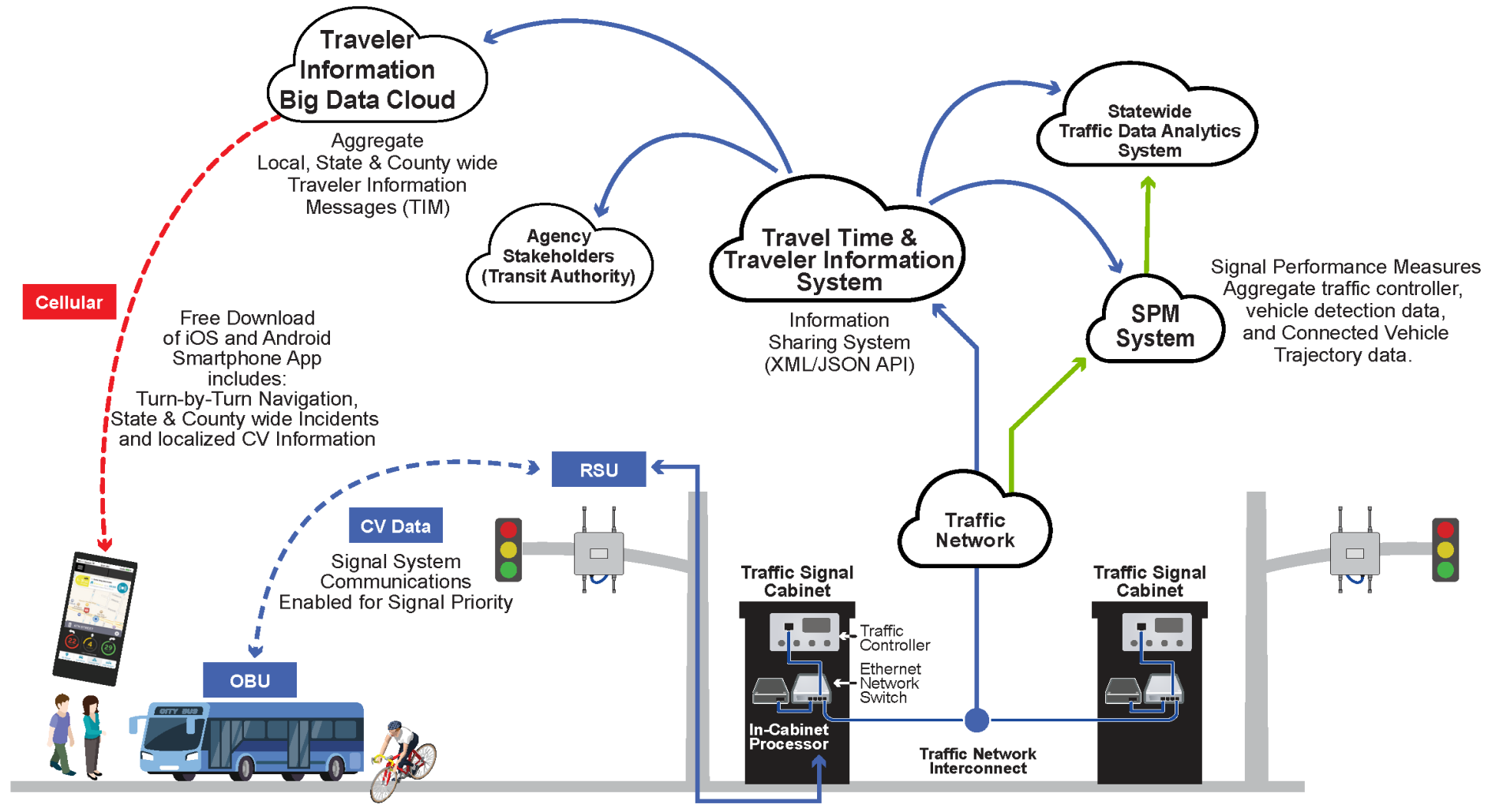
Based on proven standards developed by the USDOT – IEEE and SAE standards development for Cellular (LTE) Vehicle to Everything.



# Providing the foundation for an integrated safety and mobility strategy...

## FDOT Applications:

- Enterprise Data Cloud
- V2X Data Exchange Platform
- SunGuide (TIM)
- Florida Turnpike (API)
- RSU Monitoring System (NTCIP 1218)

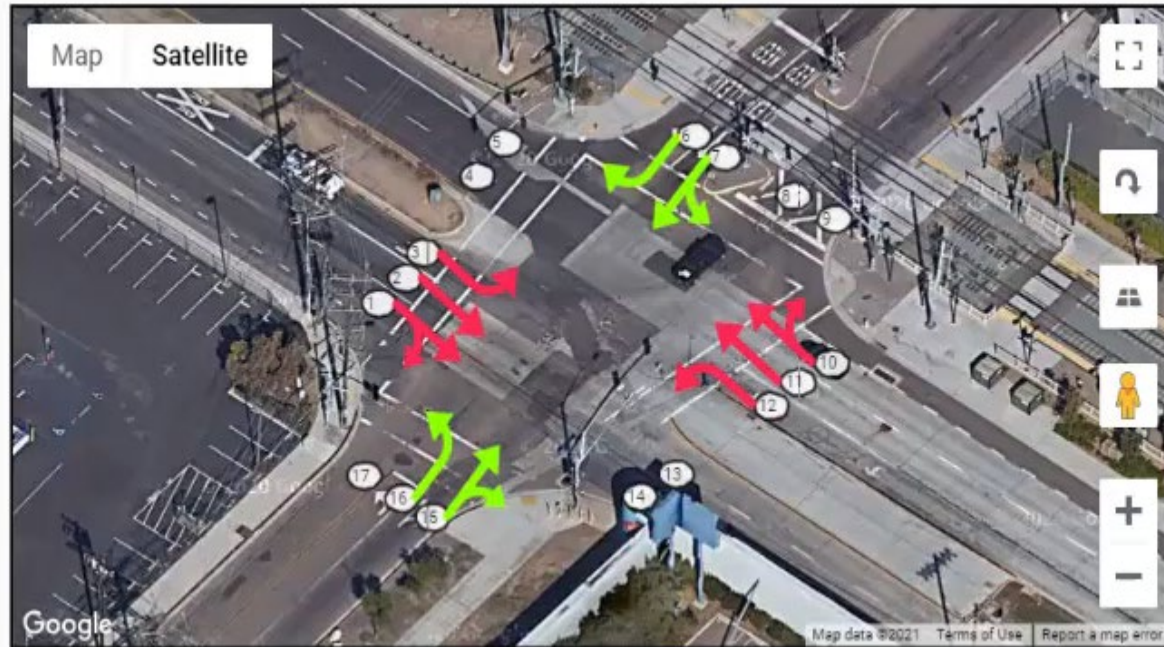




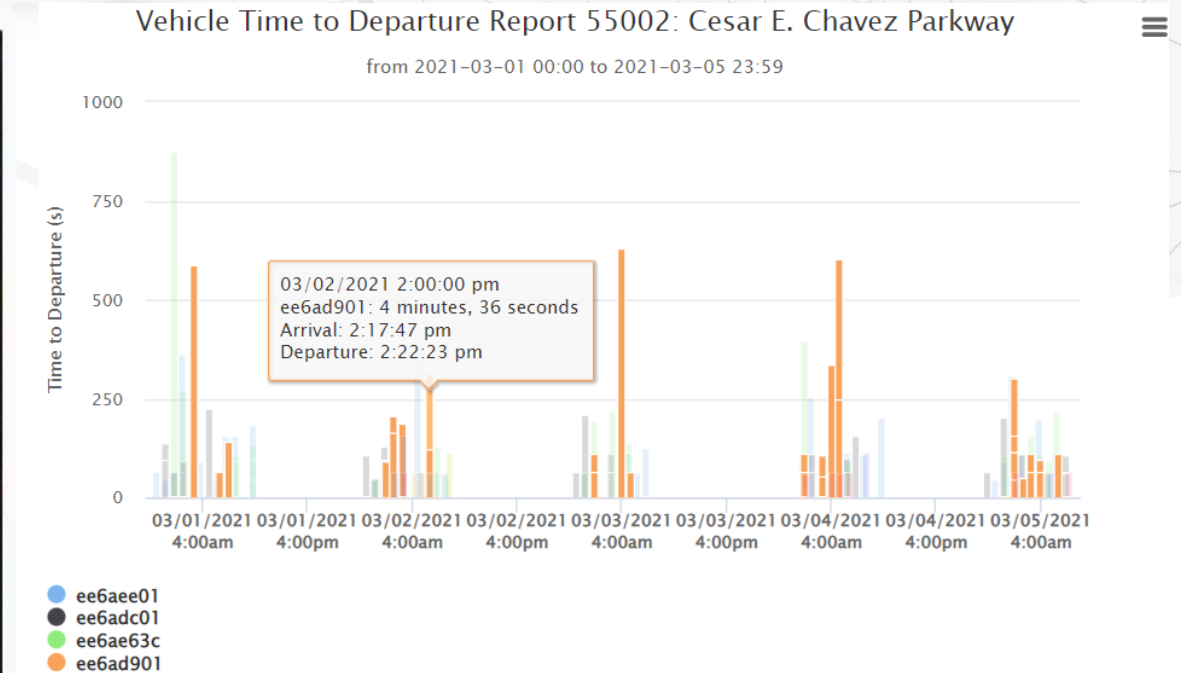
# Connected Vehicle Data Analytics

## Vehicle Trajectory Information – Basic Safety Messages (BSM)

# BlueARGUS – SPaT/MAP and Connected Vehicle Data Reports



LIVE SPaT, MAP and BSM Display



Time to Departure – Passage Time/Delay

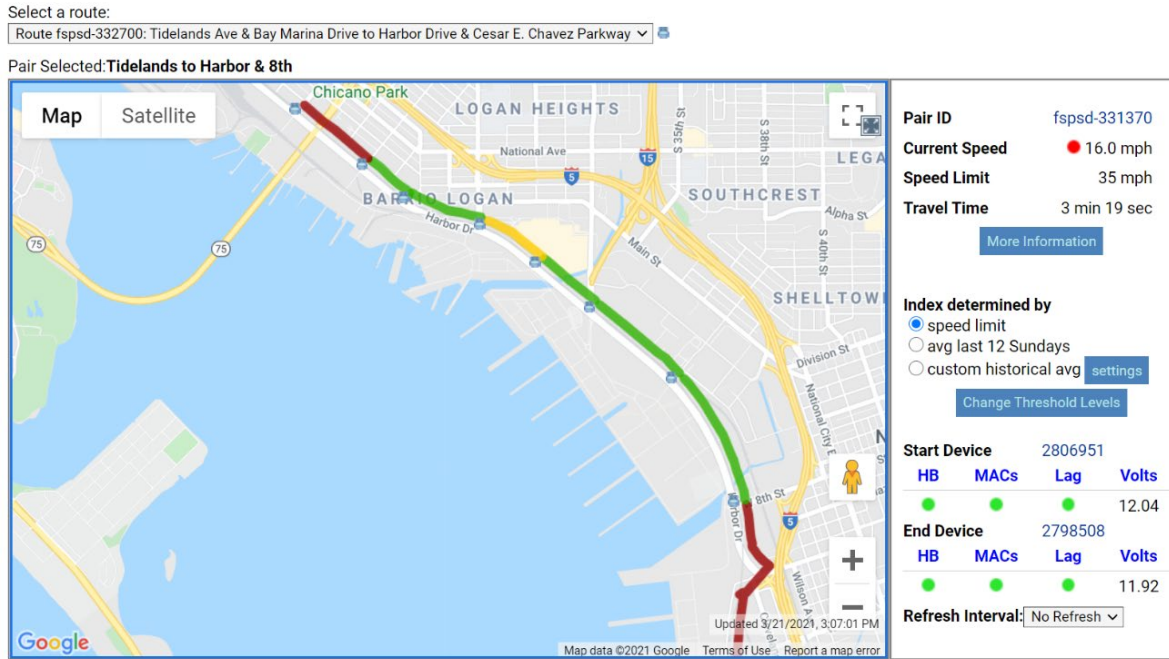
**CV Data shared with ATMS and/or SPM systems...**



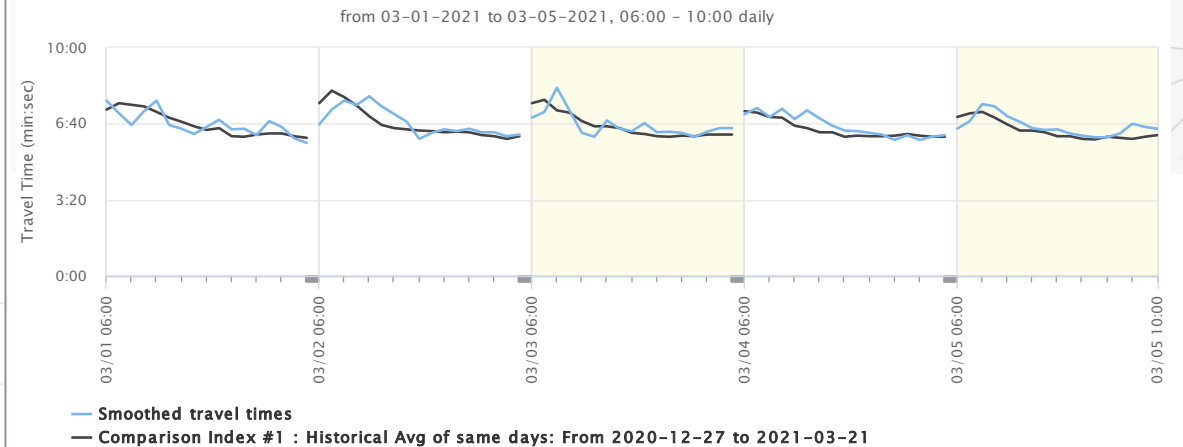
# Travel Time Data Analytics

BlueTOAD: Bluetooth Travel-Time Origin And Destination

# Manage Traditional Real Time and Historical ITS Data



Smoothed (15 min) for Route 336226: Harbor Drive & 8th Street to Harbor Drive & Cesar E. Chavez Parkway



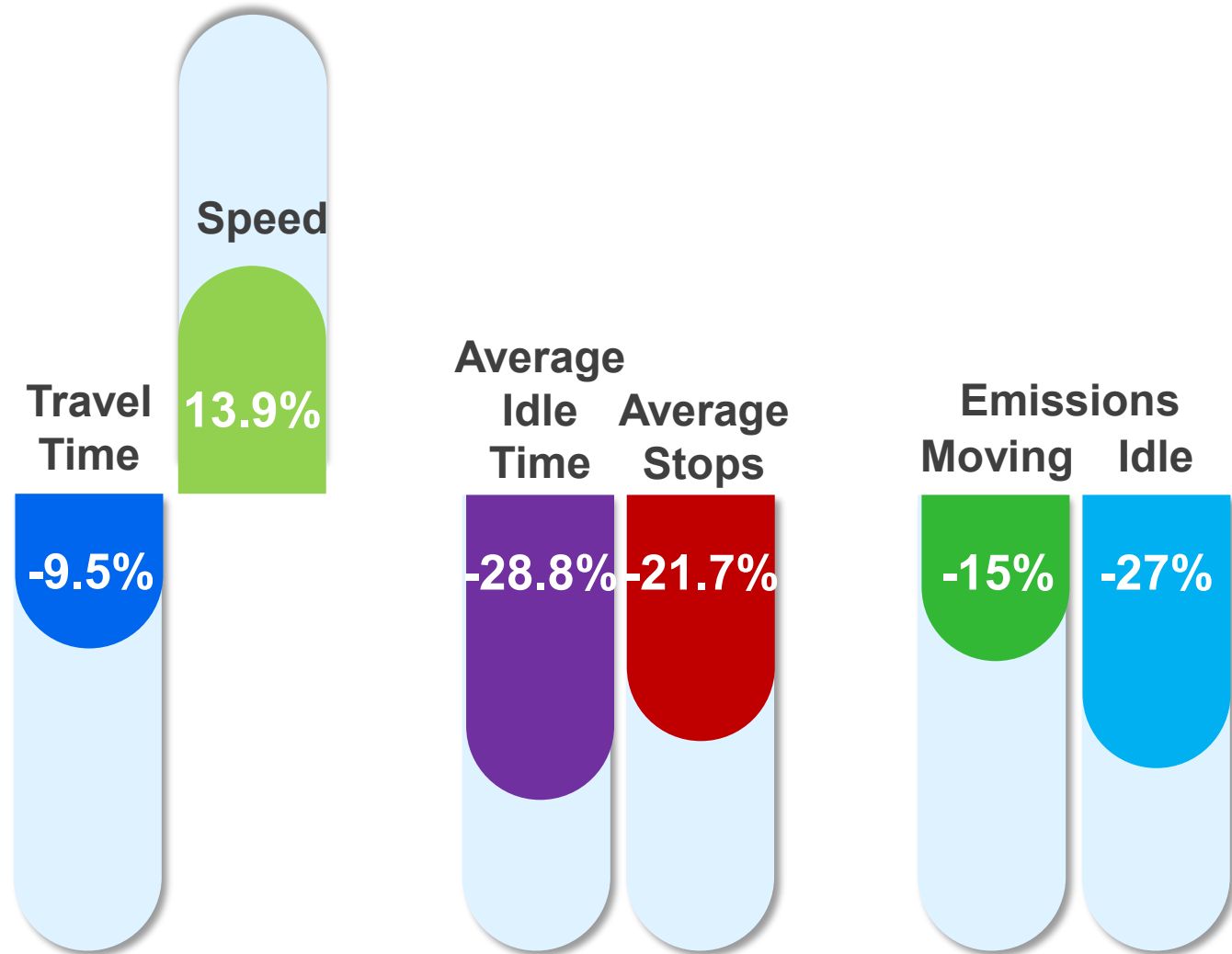
Real Time Travel Time – Interactive Speed Maps

Origin/Destination, Before & After Studies

Travel Time Data shared with Advanced Traffic Management Systems (ATMS) and Signal Performance Measures (SPM) systems...

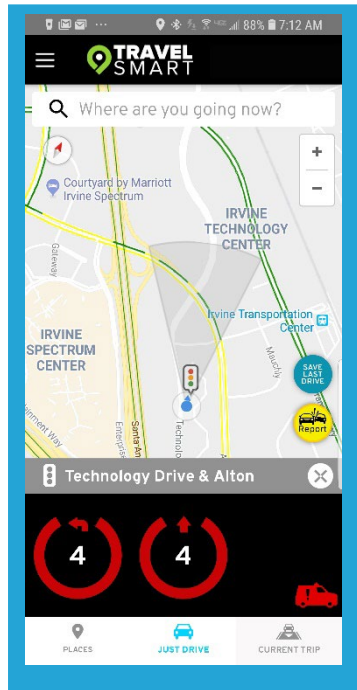
*“Performance results show the (Connected Vehicle) FSP system provides substantial benefits...”*

STC Traffic, Carlsbad, CA



*Trucker participation interest increased as word spread of the improved travel times and reduced stops.*

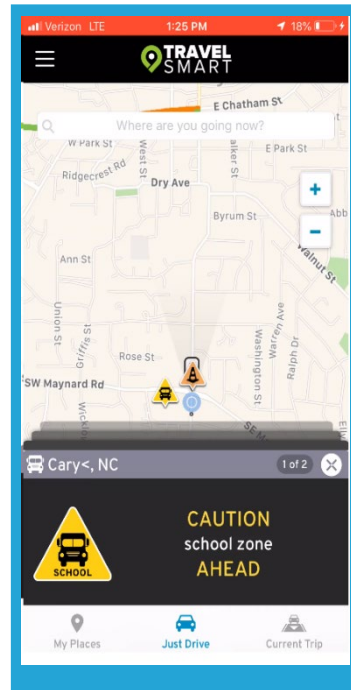
# Combine Smartphone App with Connected Vehicle Notifications



**I2X  
Information**



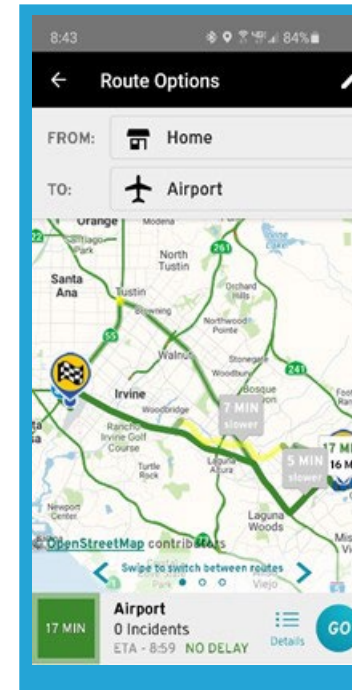
**EV Alerts  
Signal Status**



**Localized  
TIM**



**School Zone  
Construction  
Zone  
Notifications**



**Navigation**



***Trucker participation interest increased with mobile device application!***



iteris® V2X Connect™

Used for Agency install signoffs, project management, and technical support...

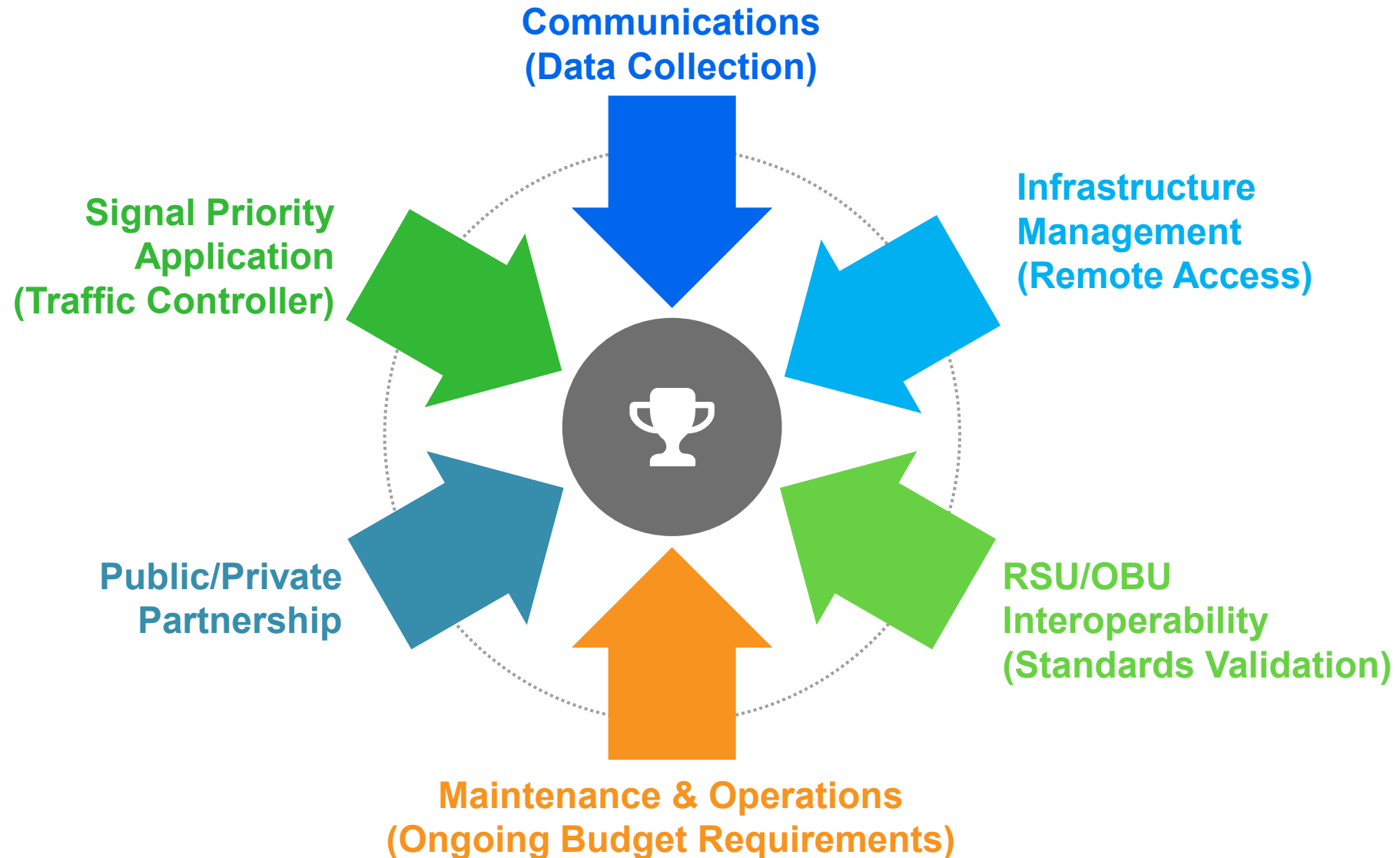
Connected Vehicle data/application validation:

- Signal Priority & Preemption Implementation and Monitoring
- Traveler Information Messages
  - Construction Zone Alerts
  - Vehicle Incident Notifications
- Pedestrian Safety Messages
- Speed Limit Warnings
- Wrong Way Vehicle Alerts

The screenshot displays the iteris V2X Connect software interface. At the top, there's a navigation bar with 'Overview', 'MAP & SPAT', 'Data Stream', and 'Settings' options. The main interface is divided into several sections:

- BSM (Basic Safety Message):** Shows GPS Accuracy (7.13 ft), Latitude (33.9626169), Longitude (-84.2199402), and Elevation (940.33 ft).
- HEADING:** South West.
- SPEED:** 0 MPH, with a SPEED LIMIT of 35 MPH.
- MAP:** A map view showing the vehicle's location and lane information (Map ID 0, Lane 2).
- SPAT (Signal Priority and Preemption):** A central panel showing 'MY SIGNALS' (Signal Group 6, Lane(s) 1, 2, 8, 9, 17s Time left, Permissive Movement Allowed) and 'OTHER SIGNALS' (Signal Group 2, 8, 10, 12, with various Lane(s) and Time left indicators).
- TIM (Traffic Information Message):** Lists traffic messages such as 'observe speed limits, slower traffic keep right' (R4-3) and 'no parking, loading zone' (R7-6).
- SRM & SSM (Signal Request Message & Signal Status Message):** Shows 'Granted' (SSM) and 'Fire' (SRM) for Lane 1.
- PSM (Pedestrian Status Message):** Lists pedestrian status with Speed and Heading (e.g., 1.745 MPH North).

# In Summary – all ITS parts work in harmony...



An aerial view of a city street intersection, overlaid with a blue semi-transparent layer. A network diagram with white nodes and connecting lines is superimposed on the street scene. The text "Thank You. Questions/Comments?" is centered in white.

Thank You.  
Questions/Comments?

Frank Provenzano  
[fprovenzano@iteris.com](mailto:fprovenzano@iteris.com)  
949-338-3416