2021 Intelligent Transportation Systems Master Plan Update

SPACE COAST
Transportation Planning Organization

September 2021

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ACRONYMS

AAM	Active Arterial Management
ADMS	Arterial Dynamic Message Sign
AID	Automatic Incident Detection
AMWS	Advanced Motorist Warning Systems
APCS	Automated Passenger Counter System
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ASCT	Adaptive Signal Control Technology
ATC	Advanced Transportation Controller
ATMS	Advanced Traffic Management System
ATSC	Adaptive Traffic Signal Control
ATSPM	Automated Traffic Signal Performance Measures
ATWS	Automated Truck Warning System
AVI	Automated Vehicle Identification
BSM	Basic Safety Message
C2C	Center-to-Center
CAD	Computer-Aided Dispatch
CAV	Connected and Automated Vehicle
CCTV	Closed-Circuit Television
CFR	Code of Federal Regulations
ConOps	Concept of Operations
CV	Connected Vehicle
C-V2X	Cellular Vehicle-to-Everything
DMS	Dynamic Message Sign
EOC	Emergency Operations Center
EV	Electric vehicle
EVP	Emergency Vehicle Preemption
FCC	Federal Communications Commission
FDOT	Florida Department of Transportation
FHP	Florida Highway Patrol
FHWA	Federal Highway Administration
FL511	Florida 5-1-1
FRATIS	Freight Advanced Traveler Information System
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface
HAWK	High-Advisory Crosswalk
I-95	Interstate 95
ITS	Intelligent Transportation Systems
ITSFM	ITS Facility Management
JPA	Joint Participation Agreement
KSC	Kennedy Space Center
LED	Light-Emitting Diode
LiDAR	Light Detection and Ranging
LRTP	Long-Range Transportation Pan
MIMS	Maintenance Information Management System
MLB	Orlando-Melbourne International Airport
MOU	Memorandum of Understanding
MP	Milepost
MVDS	Microwave Vehicle Detection System
NASA	National Aeronautics and Space Administration
OBU	On-Board Unit
PPD	Passive Pedestrian Detection
PSEMP	Project Systems Engineering Management Plan
PSM	Personal Safety Message
PTZ	pan-tilt-zoom
QWS	Queue Warning System
RISC	Rapid Incident Scene Clearing
RITSA	Regional Intelligent Transportation Systems Architecture
RRFB	Rapid Rectangular Flashing Beacon
RSA	Roadside Alert
RSS	Ramp Signal System
RSU	Roadside Unit
RTMC	Regional Traffic Management Center
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SCAT	Space Coast Area Transit
SCATS	Sydney Coordinated Adaptive Traffic System

SCTPO	Space Coast Transportation Planning Organization
SEMP	Systems Engineering Management Plan
SEP	Systems Engineering Plan
SIS	Strategic Intermodal System
SITSA	Statewide Intelligent Transportation System Architecture
SOG	Standards Operating Guideline
SOS	State of the System
SPAT	Signal Phase and Timing
SR	State Road
SR 528	State Road 528
TIM	Traffic Incident Management
TIM/ RISC	Traffic Incident Management/Rapid Incident Scene Clearance
TIP	Transportation Improvement Program
TMC	Traffic Management Center
TOC	Traffic Operations Center
TSMCA	Traffic Signal Maintenance and Compensation Agreement
TSMO	Transportation Systems Management and Operations
TSP	Transit Signal Priority
US	U.S. Highway
V/C	Volume-to-capacity ratio
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
VSL	Variable Speed Limit
WAN	Wide Area Network
WAP	Wireless Access Point
WWDS	Wrong Way Detection System

2021 Intelligent Transportation Systems Master Plan Update

Updated Vision, Goals, and Objectives

SPACE COAST
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Vision

The purpose of a vision statement is to provide a clear picture of what an organization aspires to be. Goals and objectives are then built to bring the organization more in line with its overall vision. In order to increase the focus on ITS and transportation technology, we recommend the following enhancement to the SPTPO ITS Vision Statement.

Previous Vision Statement: **Maximize the use of the existing Space Coast transportation system** by providing increased accessibility, reliability, and safety as part of a fully integrated multi-modal experience.

Proposed Vision Statement: **Utilize cost-effective transportation technology to increase** the accessibility, reliability, and safety of the Space Coast transportation system as part of a fully-integrated multi-modal experience.

Goals, Objectives, and Measures from Long Range Transportation Plan (LRTP)

It is important for ITS programmatic activities to be aligned with the overall goals of the agency. Because of this, we list the Space Coast TPO goals, objectives, and measures in Table 1-1, as defined for the 2045 LRTP. The following section will propose a series of ITS-specific objectives that map to the 2045 LRTP goals and objectives.

ITS Objectives

The following six ITS project objectives are proposed to build a meaningful linkage between ITS capital projects and objectives from the LRTP. The rationale for each ITS project objective is described below. Table 1-2 shows how each ITS program objective maps to the LRTP objectives. (The LRTP objectives shaded in gray do not have a direct linkage to the ITS program objectives described on page 3.)

Table 1-1: 2045 LRTP Goals, Objectives, and Measures

Goals	Objectives	Evaluation Criteria
G-1: Improve safety and security for all users	O-1.1: Improve safety of infrastructure for motorized and non- motorized users	EC-1.1.1: Vehicular Crash frequency and severity
		EC-1.1.2: Vulnerable road user crash frequency and severity
	O-1.2: Support the Highway Safety Improvement Program	EC-1.2.1: Addresses a goal or objective of the Highway Safety Improvement Program
	O-1.3: Provide a system of bikeways, sidewalks, and shared use paths, connecting residential areas, job centers, schools, and other destinations	EC-1.3.1: Provides bicycle and pedestrian facilities to community assets (schools, parks, civic centers, etc.) (direct, indirect, none)
G-2: Improve Economic Development with a Connected Multi-Modal System	O-2.1: Promote economic development through the improved performance of multi-modal facilities providing connections to intermodal hubs and commerce centers	EC-2.1.1: Level of connection to intermodal hub (direct, indirect, none)
		EC-2.1.2: Level of connection to commerce centers (direct, indirect, none)
	O-2.2: Improve connectivity between major activity centers	EC-2.2.1: Corridor connects major activity centers (direct, indirect, none)
	O-2.3: Promote intergovernmental coordination to redevelop historic communities and concentrate development within multimodal hubs	EC-2.3.1: Project supports redevelopment/ infill
		EC-2.3.2: Project improves accessibility or connectivity to existing development
		EC-2.3.3: Project supports future land use plans
G-3: Enhance mobility and reliability of the transportation system for communities, tourism, and commerce	O-3.1: Improve mobility of people and freight by increasing the use of emerging technologies (ITS).	EC-3.1.1: Existing volume/maximum acceptable volume ratio to represent levels of congestion (high ratio ranks higher)
		EC-3.1.2: ITS applications included
	O-3.2: Enhance access to tourist destinations	EC-3.2.1: Corridor connects to a tourist destination(s) (direct, indirect, none)
	O-3.3: Improve the reliability of the transportation system through operational and incident management strategies	EC-3.3.1: Includes Transportation Systems Management and Operations (TSMO) strategies that improve reliability (high, medium, low)
	O-3.4: Enhance access to travel options in transportation disadvantaged areas	EC-3.4.1: Improves access to transit facilities
		EC-3.4.2: Provides improved bicycle and/or pedestrian facilities for a transportation disadvantaged area (direct, indirect, none)
G-4: Preserve and provide a resilient, secure transportation system through balancing social and environmental resources	O-4.1: Improve security through improvements to the capacity and efficiency of the County's evacuation routes	EC-4.1.1: Improvement to evacuation routes (direct, indirect, none)
	O-4.2: Improve air quality by lowering mobile source emissions with energy efficient vehicles and reduced vehicle miles traveled	EC-4.2.1: Supports connected or electric vehicles
		EC-4.2.2: Encourages carpooling, transit, or other ride-sharing options
	O-4.3: Improve the resiliency of the transportation system through mitigation and adaptation strategies to address sea level rise and other shocks and stressors	EC-4.3.1: Improves treatment of storm water
		EC-4.3.2: Includes adaptation strategies concerning sea level rise, flooding, and extreme weather events
	O-4.4: Integrate a "fix-it-first" mentality to keep existing infrastructure (roads, bridges, transit assets, etc.) in a state of good repair	EC-4.4.1: Supports maintenance of system

Table 1-2: ITS Project Objectives

	2045 LRTP Objectives													
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4
1. Improve traffic mobility (e.g. reduce travel time, improve travel time reliability, reduce traffic congestion)		TBD based on HSIP goal selected		■	■		■	■						
2. Increase ITS footprint on critical corridors							■				■	■		
3. Improve the ease of using multimodal transportation options				■						■		■		
4. Improve bicycle and pedestrian safety	■		■											
5. Reduce the number of automobile crashes	■													
6. Improve transportation operation strategies	■		■	■	■		■	■	■	■	■	■		■

1. **Improve traffic mobility (e.g. reduce travel time, improve travel time reliability, reduce traffic congestion):** This objective influences a number of LRTP objectives. Initiatives supporting this objective would include projects to modernize traffic signal controller equipment, execute traffic signal retiming, deploy automated traffic signal performance measures (ATSPM), and deploy advanced traffic signal timing methodologies.

2. **Increase ITS footprint on critical corridors:** This objective is a direct output of Objective 3.1, which involves improving the mobility of people and freight by increasing the use of emerging technologies like ITS. Projects supporting this objective would include installation of new fiber optic or wireless communication along corridors and deployment of ITS equipment such as cameras, dynamic message signs, Bluetooth data collection equipment, and connected vehicle roadside units.

3. **Improve the ease of using multimodal transportation options:** ITS projects that support this objective would work to make transit ridership easier and more attractive to potential riders. These projects could include arrival countdown boards at bus stops, infrastructure to support seamless payment systems, automated vehicle location (AVL) systems for buses, transit signal priority, and bus occupancy detectors.

4. **Improve bicycle and pedestrian safety:** ITS projects that support this objective would work to minimize injuries and fatalities involving bicycles and pedestrians. These projects could include deployment of connected vehicle roadside units, signalization for bike lanes, deployment of pedestrian detection, and use of rapid rectangular flashing beacons (RRFB) at midblock crosswalks.

5. **Reduce the number of automobile crashes:** ITS projects that support this objective would work to reduce the number of vehicle-to-vehicle automobile crashes. These can include projects to modernize traffic signal controllers, improve signal timing, and deploy connected vehicle roadside units for use in safety applications.

6. **Improve transportation operation strategies:** While the previous five objectives were primarily focused on deployment of technology assets, this objective emphasizes changes in business processes to raise the profile of traffic operations. Projects that support this objective could include active corridor management, incorporating automated traffic signal performance measures into the signal management workflow, and developing a traffic signal program management plan.

ITS Performance Measures

The 2045 LRTP established performance measures to quantify the success of the agency's overall goals and objectives. By their nature, ITS programs have the benefit of being data rich environments, which makes them suited for the establishment of enhanced performance measures. This section presents a number of supplemental ITS-based performance measures which can be used to track the effectiveness of ITS projects and operations initiatives. Effort was made to select outcome-based performance measures whenever possible.

1. **Travel Time and Planning Time of strategic corridors:** Travel time and planning time are widely-adopted measures for describing the performance of highways and roadways. These metrics are used to aggregate performance over a period of time (typically monthly). Median travel time (i.e. 50th percentile travel time) is normally used to describe typical travel times along a corridor. The planning time (or 95th percentile travel time) is used to describe the reliability of travel time along a corridor. When the median travel time and planning time is divided by the free flow travel time, a travel time index (TTI) and planning time index (PTI) is produced, which can be used to compare conditions between corridors of different lengths. These metrics can be obtained through various systems, including RITIS and Bluetooth data collection systems.

2. **Percent Arrivals on Green:** This metric describes the percentage of vehicles that arrive at an intersection during a green indication, which can be used as a measure of good progression. A low value for arrivals on green can indicate room for improvement in traffic signal timing in terms of promoting good progression. Improving arrivals on green can have a positive effect on corridor-level performance measures such as travel time and planning time. Percent arrivals on green is a standard component of automated traffic signal performance measures (ATSPM) for intersections with advance detection.

3. **Lane-miles of evacuation routes instrumented for ITS:** this output measure is a corollary to the "centerline miles of roadways with ITS infrastructure" which can be proposed to measure Objective 3.1. However, the modified measure proposed here could be beneficial to demonstrate readiness for Objective 4.1, which seeks to "improve security through improvements to the capacity and efficiency of the County's evacuation routes."

4. **Travel time and/or percent arrivals on green during evacuation:** This is a special-case application of ITS performance measures 1 and 2 focused on travel conditions during evacuations.

5. **Uptime of ITS equipment on strategic corridors:** This measure is a natural extension of the LRSP measure "centerline miles of roadways with ITS infrastructure." Uptime measures encourage good maintenance practices and can be used to improve operational readiness.

6. **Number of transit routes with real-time monitoring:** this output measure identifies the number of transit routes with baseline

performance data that can be leveraged for use in follow-on projects to improve rider experience, such as apps and arrival time boards at bus stops.

7. **Additional transit data (occupant count, etc.):** Additional automated transit data, such as occupant data, can be used to measure changes in ridership over time and in response to new programs and initiatives.

8. **Data from bike/ped counters:** volume and time-of-day information from bike/ped counters can be used to improve safety at intersections and improve signal timing.

9. **Pedestrian delay:** this is a standard ATSPM performance measure that records the length of time between ped button actuation and the start of the associated walk phase. Intersections with high pedestrian delay could be more prone to jaywalking, due to pedestrian impatience.

10. **User delay cost:** User delay cost (UDC) is a metric that assigns a dollar value to travel delay based on estimated volumes and value of time assumptions. UDC is a useful metric for identifying the impacts of specific traffic events along with the performance of corridors over time.

Table 1-3 presents a mapping of the proposed ITS performance measures to the existing goals, objectives, and measures established in the LRSP.

Table 1-3: ITS Performance Measures

Goals	Objectives	Evaluation Criteria	ITS Performance Measures
G-1: Improve safety and security for all users	O-1.1: Improve safety of infrastructure for motorized and non-motorized users	EC-1.1.1: Vehicular Crash frequency and severity	Utilize data from Signal 4 Analytics
		EC-1.1.2: Vulnerable road user crash frequency and severity	Utilize data from Signal 4 Analytics; Data from bike/ped counters; ATSPM Pedestrian delay
	O-1.2: Support the Highway Safety Improvement Program	EC-1.2.1: Addresses a goal or objective of the Highway Safety Improvement Program	TBD, based on goal/objective selected
	O-1.3: Provide a system of bikeways, sidewalks, and shared use paths, connecting residential areas, job centers, schools, and other destinations	EC-1.3.1: Provides bicycle and pedestrian facilities to community assets (schools, parks, civic centers, etc.) (direct, indirect, none)	Data from bike/ped counters; ATSPM Pedestrian delay
G-2: Improve Economic Development with a Connected Multi-Modal System	O-2.1: Promote economic development through the improved performance of multi-modal facilities providing connections to intermodal hubs and commerce centers	EC-2.1.1: Level of connection to intermodal hub (direct, indirect, none)	Travel Time Index and Planning Time Index of strategic corridors (RITIS and/or Bluetooth data); % arrivals on green (ATSPM)
		EC-2.1.2: Level of connection to commerce centers (direct, indirect, none)	Travel Time Index and Planning Time Index of strategic corridors (RITIS and/or Bluetooth data); % arrivals on green (ATSPM)
	O-2.2: Improve connectivity between major activity centers	EC-2.2.1: Corridor connects major activity centers (direct, indirect, none)	Travel Time Index and Planning Time Index of strategic corridors (RITIS and/or Bluetooth data); % arrivals on green (ATSPM)
	O-2.3: Promote intergovernmental coordination to redevelop historic communities and concentrate development within multimodal hubs	EC-2.3.1: Project supports redevelopment/ infill	N/A
		EC-2.3.2: Project improves accessibility or connectivity to existing development	N/A
		EC-2.3.3: Project supports future land use plans	N/A
G-3: Enhance mobility and reliability of the transportation system for communities, tourism, and commerce	O-3.1: Improve mobility of people and freight by increasing the use of emerging technologies (ITS).	EC-3.1.1: Existing volume/maximum acceptable volume ratio to represent levels of congestion (high ratio ranks higher)	Travel Time Index and Planning Time Index of strategic corridors (RITIS and/or Bluetooth data); % arrivals on green (ATSPM); User delay cost
		EC-3.1.2: ITS applications included	Uptime of ITS equipment on strategic corridors; Lane miles of strategic corridors instrumented for ITS.
	O-3.2: Enhance access to tourist destinations	EC-3.2.1: Corridor connects to a tourist destination(s) (direct, indirect, none)	Travel Time Index and Planning Time Index of strategic corridors (RITIS and/or Bluetooth data); % arrivals on green (ATSPM)
	O-3.3: Improve the reliability of the transportation system through operational and incident management strategies	EC-3.3.1: Includes Transportation Systems Management and Operations (TSMO) strategies that improve reliability (high, medium, low)	Travel Time Index and Planning Time Index of strategic corridors (RITIS and/or Bluetooth data); % arrivals on green (ATSPM)
	O-3.4: Enhance access to travel options in transportation disadvantaged areas	EC-3.4.1: Improves access to transit facilities	On-time or occupant count data from transit system; number of transit routes with real- time monitoring
		EC-3.4.2: Provides improved bicycle and/ or pedestrian facilities for a transportation disadvantaged area (direct, indirect, none)	Data from bike/ped counters; ATSPM Pedestrian delay

Goals	Objectives	Evaluation Criteria	ITS Performance Measures
G-4: Preserve and provide a resilient, secure transportation system through balancing social and environmental resources	O-4.1: Improve security through improvements to the capacity and efficiency of the County's evacuation routes	EC-4.1.1: Improvement to evacuation routes (direct, indirect, none)	Lane miles of evacuation routes instrumented for ITS; Travel Time Index during evacuation; % arrivals on green during evacuation.
	O-4.2: Improve air quality by lowering mobile source emissions with energy efficient vehicles and reduced vehicle miles traveled	EC-4.2.1: Supports connected or electric vehicles	Number of connected vehicle roadside units deployed.
		EC-4.2.2: Encourages carpooling, transit, or other ride-sharing options	On-time or occupant count data from transit system; number of transit routes with real- time monitoring
	O-4.3: Improve the resiliency of the transportation system through mitigation and adaptation strategies to address sea level rise and other shocks and stressors	EC-4.3.1: Improves treatment of storm water	
		EC-4.3.2: Includes adaptation strategies concerning sea level rise, flooding, and extreme weather events	
	O-4.4: Integrate a "fix-it-first" mentality to keep existing infrastructure (roads, bridges, transit assets, etc.) in a state of good repair	EC-4.4.1: Supports maintenance of system	Uptime statistics of ITS devices on critical corridors.

2021 Intelligent Transportation Systems Master Plan Update

Existing Conditions

SPACE COAST
Transportation Planning Organization

Introduction

A critical first step in updating this Intelligent Transportation Systems (ITS) Master Plan for the Space Coast Transportation Planning Organization (SCTPO) is understanding and documenting existing conditions and infrastructure. This information is based on discussions with various agencies supported by the SCTPO and the State of the System (SOS) Report. Additionally, this data collection effort considers projects identified in the Cost Feasible 2045 Long Range Transportation Plan (LRTP) and the Fiscal Year (FY) 2021-2025 Transportation Improvement Program (TIP). The recommendations resulting from this work will be used to identify future ITS systems and maintenance and operations activities.

The transportation network within the Space Coast Area contains thousands of miles of roadways, including limited access highways and arterials. In addition to the general congestion that most communities deal with, attractions such as Kennedy Space Center and Port Canaveral create unique challenges for the SCTPO. ITS-related solutions can be used to resolve current and future traffic issues, particularly in constrained environments such as Brevard County.

Multiple agencies—including the Florida Department of Transportation (FDOT), SCTPO, Brevard County, and local municipalities—continually collect and analyze available data to determine the success rate of their networks and identify areas in need of improvement. By compiling information pertinent to the ITS vision, objectives, and goals from all involved agencies and municipalities, it allows the plan to take shape in a direction most beneficial to those involved.

Existing Plans and Documents

The SCTPO develops a number of plans and reports on regular intervals to both recommend new improvements and monitor progress toward adopted goals. Reports include the SOS, the LRTP, and the TIP. The following section summarizes the most current versions available and lists the projects identified in the 2045 LRTP and the FY 2021-2025 TIP. These documents identify the needs and make short- and long-term recommendations.

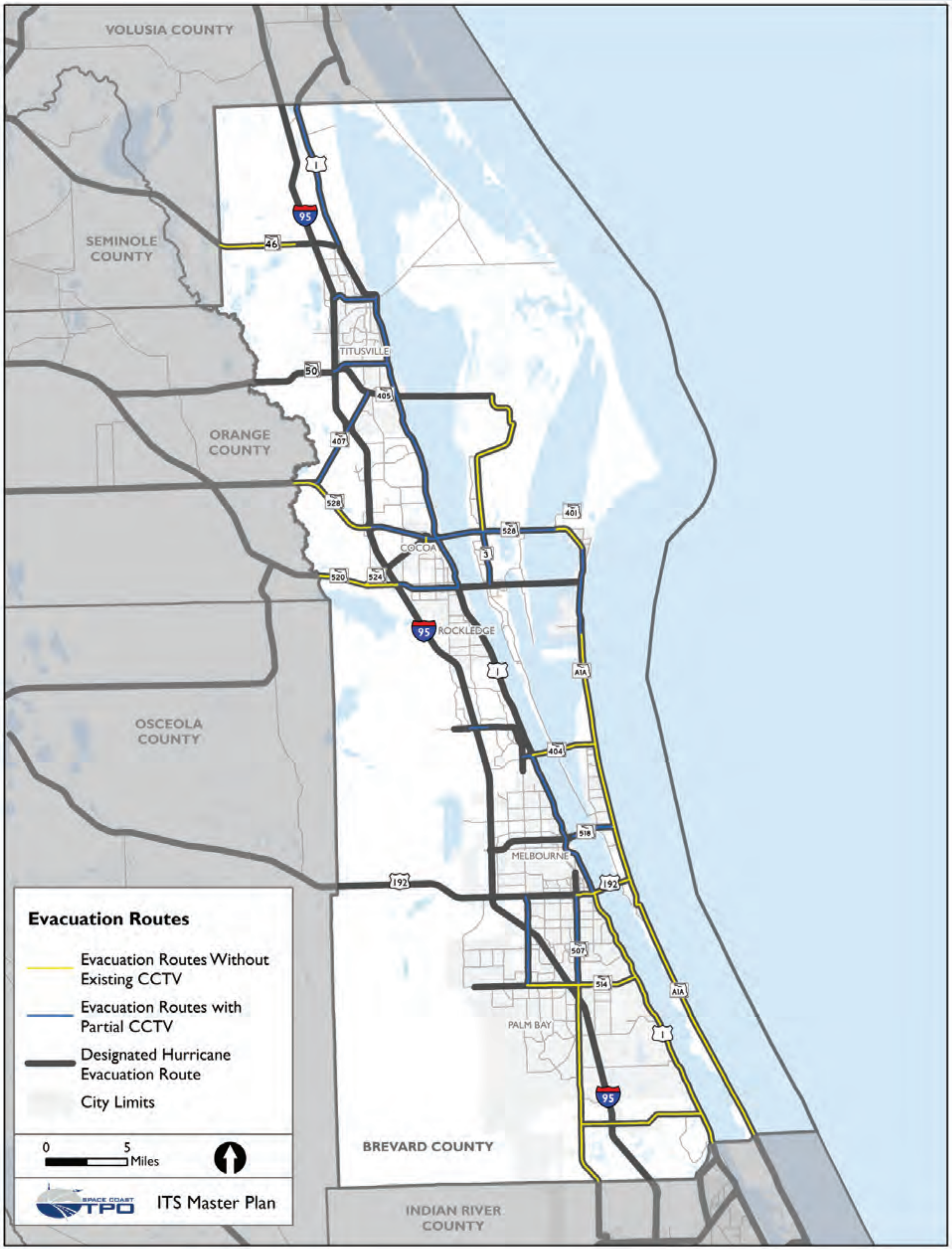
State of the System Report

The SCTPO annually evaluates the state of Brevard County's transportation system. The results are summarized in the SOS Report, which considers usage and performance trends of various transportation modes—highways, transit, seaport, airport, and space. Safety, mobility, and congestion levels are monitored. Long-term trends and possible problem locations are identified. Thus, the SOS Report provides technical guidance to the SCTPO on where and how state and federal dollars can be programmed to enhance Brevard County's transportation system. The SOS Report also measures progress toward agreed-upon goals.

Evacuation Routes

Brevard County is concerned about the ability of the County's transportation system to facilitate a safe and efficient evacuation during an emergency. Brevard County, in coordination with the State Disaster and Emergency Management Division, has designated a number of hurricane evacuation routes throughout the County. As noted in the 2018 SOS, an evacuation route was considered to be monitored if a closed-circuit television (CCTV) was located within one-quarter mile of the segment. To assess what percentage of the hurricane evacuation route network was monitored, existing CCTVs from the SCTPO's ITS Master Plan were compared to the corridors that are designated as hurricane evacuation routes. Figure 2-1 illustrates evacuation routes with partial and no CCTV coverage.

Figure 2-1: Evacuation Routes



Source: 2018 SOS

Key hurricane evacuation routes, including Babcock Street south of Malabar Road, SR A1A from Indian River County Line to just south of Cocoa Beach, and Courtenay Parkway (SR 3) from SR 528 to Space Commerce Way, do not have existing CCTVs. Key routes such as SR 528 from Interstate 95 (I-95) to SR 401, Minton Road and Babcock Street from Malabar Road to U.S. Highway (US) 192, and multiple segments along US 1 only have partial CCTV coverage. Of the 218 corridors, 61 have ITS infrastructure along their full length, 13 have only partial ITS infrastructure, and 144 do not have any existing ITS infrastructure. Table 2-1 illustrates the percent of corridor length without monitoring. Table 2-2 illustrates the top 13 corridors (as identified in the SOS) with partial existing ITS infrastructure.

Table 2-1: Percentage of Corridor Length Without Existing CCTV Monitoring

Corridor Roadway	From	To	Hurricane Evacuation Lane Miles	Percent of Corridor Length w/o Monitoring
N. Courtenay Pkwy. (SR 3)	SR 520	SR 528	13.72	91%
SR A1A	N End of One-Way Pairs	SR 520	7.94	85%
SR 528	I-95	US 1	16.85	84%
SR A1A	SR 520	N Atlantic Ave.	8.44	84%
SR 407	SR 528	SR 405	13.59	82%
SR 406 (Garden St.)	I-95	Washington Ave.	11.80	76%
US 1	SR 46	Volusia Co.	36.06	70%
SR 528	US 1	SR 401	29.52	61%
US 1	SR 405	Grace St.	20.78	59%
S. Courtenay Pkwy.	Fortenberry Rd.	SR 520	0.76	58%
US 1	Sarno Rd.	Pineda Cswy.	36.78	57%
Babcock St. (SR 507)	Malabar Rd.	Palm Bay Rd.	10.10	56%
Wickham Rd.	Murrell Rd.	Lake Andrew Dr.	3.21	56%
US 1	Peachtree St.	SR 528	12.28	49%
Minton Rd.	Palm Bay Rd.	US 192	11.99	47%
US 1	SR 528	SR 405	36.79	46%
SR 50	I-95	US 1	13.50	44%
US 1	Strawbridge Ave.	Sarno Rd.	20.83	43%
US 1 (SB Hopkins Ave.)	Garden St.	Grace St.	2.02	42%
US 1 (NB Washington Ave.)	Grace St.	Garden St.	2.42	41%
Eau Gallie Blvd. (SR 518)	Causeway	SR A1A	10.43	41%
SR 520	I-95	US 1	15.38	39%
Pineda Cswy.	I-95	US 1	13.54	37%
Minton Rd.	Malabar Rd.	Palm Bay Rd.	10.08	33%

Table 2-2: Top 13 Corridors with Partial Existing ITS Infrastructure

Corridor Roadway	From	To	Corridor Length	Percent of Corridor Length without ITS
S. Courtenay Pkwy./Tropical Tr.	Pineda Cswy.	Fortenberry Rd.	11.00	95%
US 192	Osceola Co.	I-95	9.80	91%
SR A1A (NB Only)	S End of One-Way Pairs	N End of One-Way Pairs	3.06	81%
SR A1A (SB Only)	N End of One-Way Pairs	S End of One-Way Pairs	3.08	80%
Singleton Ave.	SR 405 (South St.)	SR 46	4.74	78%
US 1	SR 528	SR 405	9.20	75%
US 1	Sarno Rd.	Pineda Cswy.	6.13	68%
SR 50	I-95	US 1	3.38	44%
Cone Rd.	S Tropical Tr.	Plumosa St.	0.62	33%
Minton Rd.	Malabar Rd.	Palm Bay Rd.	2.52	33%
Plumosa St.	Cone Rd.	Merritt Ave.	1.00	30%
US 192	Babcock St.	New Haven Ave.	1.38	17%
SR 406 (Garden St.)	I-95	Washington Ave.	2.95	2%

2045 Long-Range Transportation Plan

Every five years, the SCTPO adopts a new LRTP. This plan provides a common vision for the community's future transportation needs and guides the investment of public funds in transportation facilities, addressing a timeline of 20 or more years. It includes both short- and long-term transportation strategies using multiple modes of transportation for moving people and goods. The 2045 LRTP identifies Brevard County's technology/ITS funded needs in the Cost Feasible section and includes five five-year time periods. A total of $216 million has been allocated in box funding through 2045 to cover projects identified in the ITS Master Plan, including substantial completion of the fiber network throughout the County. The LRTP identifies a number of trends, listed below, that are either ITS projects or have ITS implications. It is important to plan for future technology even as the systems are updated and improved. Ensuring the foundation is laid for the following trends will allow the SCTPO to be responsive as the technology and needs evolve. The County is also working closely with FDOT, planning for the impacts of Automated, Connected, Electric, and Shared-Use Vehicles (ACES). While the implications of these technologies are just being studied, it is anticipated that ACES scenario planning will play an increasing role in long-range plan and project development.

Mobility as a Service

The Trend: Over the past 10 years, transportation network companies (TNCs) have been able to leverage the shared economy, e-commerce, and the proliferation of smartphones to offer customer-focused, demand-responsive passenger services. New rideshare, delivery, microtransit, and micromobility services continue to evolve from this initial concept, offering mobility options using a variety of modes and price points.

The Potential Impact: Mobility as a Service (MaaS) offers the opportunity to transform how public transit may be delivered, especially to lower-density areas that are not cost-effective to serve with conventional fixed-route services. The speed with which these services can develop and deploy can disrupt traditional transportation infrastructure, especially as it relates to parking and curb management strategies.

How Can We Plan for It? MaaS providers (both those currently operating along and outside of the Space Coast) should be actively engaged as stakeholders in the planning process to understand their business model and its potential impact on local and regional transportation infrastructure. Special attention should be paid to how curb management and ITS strategies can evolve to leverage MaaS-generated data to create better real-time mobility management solutions.

Cooperative Intelligent Transportation Systems

The Trend: Vehicle-to-Everything (V2X) technologies are making it possible for fleets of vehicles to collaborate among themselves to optimize the travel times and reliability of passenger and delivery services. Convergences in revenue systems (tolls, transit fares, and parking) are making it possible to cross-subsidize modes of travel, giving agencies and transportation providers better ways of incentivizing optimal travel behavior. At the same time, crowdsourced traveler information and private navigation apps are providing the traveling public with route alternatives that, while faster, may select paths that include signals and facilities not optimized for higher volumes of traffic.

The Potential Impact: Transportation agencies that are able to integrate V2X technologies into their transportation infrastructure will be better able to engage with travelers, inform their travel decisions, and improve the overall safety and efficiency of the transportation network. Transportation agencies that are able to interface with the ITS solutions of private fleets (e.g., rideshares, delivery services, freight systems) will be able to have greater flexibility in how they plan, deliver, and manage new mobility solutions.

How Can We Plan for It? The planning process should regularly assess how to integrate V2X-based solutions into the planning, deployment, and operation of the transportation system. Pilot deployments within the Space Coast should be encouraged to learn about the specific impacts of these technologies on the local transportation environment. The regional ITS architecture should consider interfaces with the data generated by both public and private fleets of connected vehicles and services.

Connected Travelers

The Trend: Travelers are already taking advantage of mobile devices, crowdsourced information, and existing MaaS applications to make local, regional, and international trip-making decisions. The expansion of V2X, MaaS, and other Smart City technologies can be expected to enable entirely new business models catered to optimizing individual travel choices.

The Potential Impact: As the ecosystem of interconnected vehicles, devices, and services expands, travelers and citizens will have higher expectations for the speed, agility, and reliability of local transportation services. Regions that engage in larger national (and international) transportation ecosystems will become more attractive to visitors, residents, and employers.

How Can We Plan for It? As part of stakeholder outreach, it would be appropriate to engage with citizens and visitors in market research to understand what services they use and what channels of communication they use to plan their trips. This could inform how Space Coast stakeholders engage with private transportation interests, and how ITS infrastructure may need to evolve to interface with onboard systems and personal devices.

Automated Transportation Systems

The Trend: While privately owned vehicles with Advanced Driving Systems (ADS, formerly referred to as autonomous vehicles) may not see large scale deployments in the near future, low-speed automated shuttles, automated freight systems (including trucking and small-scale delivery drones), and aerial drone systems are seeing larger pilot programs rolled out in Florida and across the United States. It is likely that fleets of these vehicles will become more common over the next 10 years.

The Potential Impact: Automated freight systems offer the opportunity to improve the efficiency of the freight network; however, it is possible that automated delivery services may pose new localized congestion issues on the sidewalks, curbs, and roadways upon which they operate. Similarly, fleets equipped with ADS may be able to operate on narrower lane widths more safely than human-operated vehicles, reducing construction costs and improving the efficiency of the transportation system. That being said, V2X infrastructure may be needed to manage the interfaces between human-operated vehicles and automated transportation systems, especially in early stages of ADS deployments.

How Can We Plan for It? The planning process should regularly assess the readiness of the SCTPO for automated systems from a technology, infrastructure, and policy perspective. Pilot deployments within the Space Coast should be encouraged to learn about the specific impacts of these technologies on the local transportation environment.

Urban Aerial Mobility

The Trend: Trends in automated systems, battery technologies, and aerial drones are making it possible to transport passengers and goods over longer distances. The Federal Aviation Administration (FAA) has recently released its first Concept of Operations for Urban Aerial Mobility (UAM) Corridors that would allow higher volumes of aerial traffic in urbanized areas.

The Potential Impact: UAM may be able to relieve congestion from local streets by allowing passenger and freight services to bypass the road network entirely. UAM corridors would require new systems and facilities to allow urban aerial vehicles to travel and land safely.

How Can We Plan for It? Scenario planning may be developed to include the impacts of UAM adoption on the local transportation network. Engagement with potential UAM users (delivery companies, rideshares) would help to clarify the impacts of these vehicles and their supporting infrastructure on long-range planning. Corridor Demand Balancing (CDB) may be required to understand the infrastructure necessary to support different volumes of aerial traffic within the Space Coast.

Electric Vehicles (EV)

The Trend: Advances in battery technologies are making electric and hybrid vehicles more affordable to consumers, while an increasing number of public and private fleet operators are adopting electric vehicles. Recent experiments with electric-powered aircraft (including aerial drones and fixed-wing aircraft) may make these modes more viable options for new passenger and delivery services in urbanized areas in the future.

The Potential Impact: While electric vehicles offer the opportunity to reduce vehicle emissions, they do create new demands for charging infrastructure. The location, availability, and affordability of this infrastructure will affect the adoption rates of these vehicles along the Space Coast.

How Can We Plan for It? Scenario planning may be developed to include the impacts of different rates of EV adoption. Engagement with utility companies and EV manufacturers would help to clarify the impacts of these vehicles and their supporting infrastructure on long-range planning. Benchmarking the effectiveness of EVs (range, time necessary to charge) would help to understand the potential right-of-way and facility impacts of new charging infrastructure for land-based and aerial electric vehicles.

Converged Security (Cyber and Physical)

The Trend: As the operating technology behind traffic systems becomes more advanced and more intertwined with both the Internet of Things (IoT) and public and private information technology (IT), there is a need to look at the security of transportation infrastructure from both a physical security and a cybersecurity perspective.

The Potential Impact: A converged security approach will allow the Space Coast to deploy resilient transportation systems that embrace new technologies and interconnected systems while minimizing the threats posed by "black hats"—private and state-sponsored actors who may try to hack or disrupt Space Coast transportation networks.

How Can We Plan for It? Consider additional coordination between transportation planning, IT infrastructure planning, and security stakeholders. Converged security issues also should be addressed in resiliency planning moving forward.

Digital Infrastructure

The Trend: As transportation systems become more sophisticated and more connected, they are generating new data needs that were not previously anticipated in the IT plans of local agencies. V2X technologies, automated transportation systems, and new MaaS models are all anticipated to generate massive amounts of data, much of which could offer new insights into how transportation networks are planned, delivered, operated, and maintained.

The Potential Impact: New data sets from public and private transportation sources can create new opportunities in the Space Coast economy; however, the impacts of these data on the digital infrastructure of local agencies (including data storage, security requirements, and transmission) need to be taken into account. The challenges of sharing data between multiple public and private partners also needs to be considered to support desired outcomes of the LRTP.

How Can We Plan for It? Local agency IT departments should be included in outreach efforts related to long-range planning. IT and ITS Master Plans should be considered as part of long-range planning efforts to understand how new technologies may affect the capacity of these networks to handle them. Data management strategies should be developed to support how data can be captured, stored, analyzed, and disseminated among public and private transportation partners.

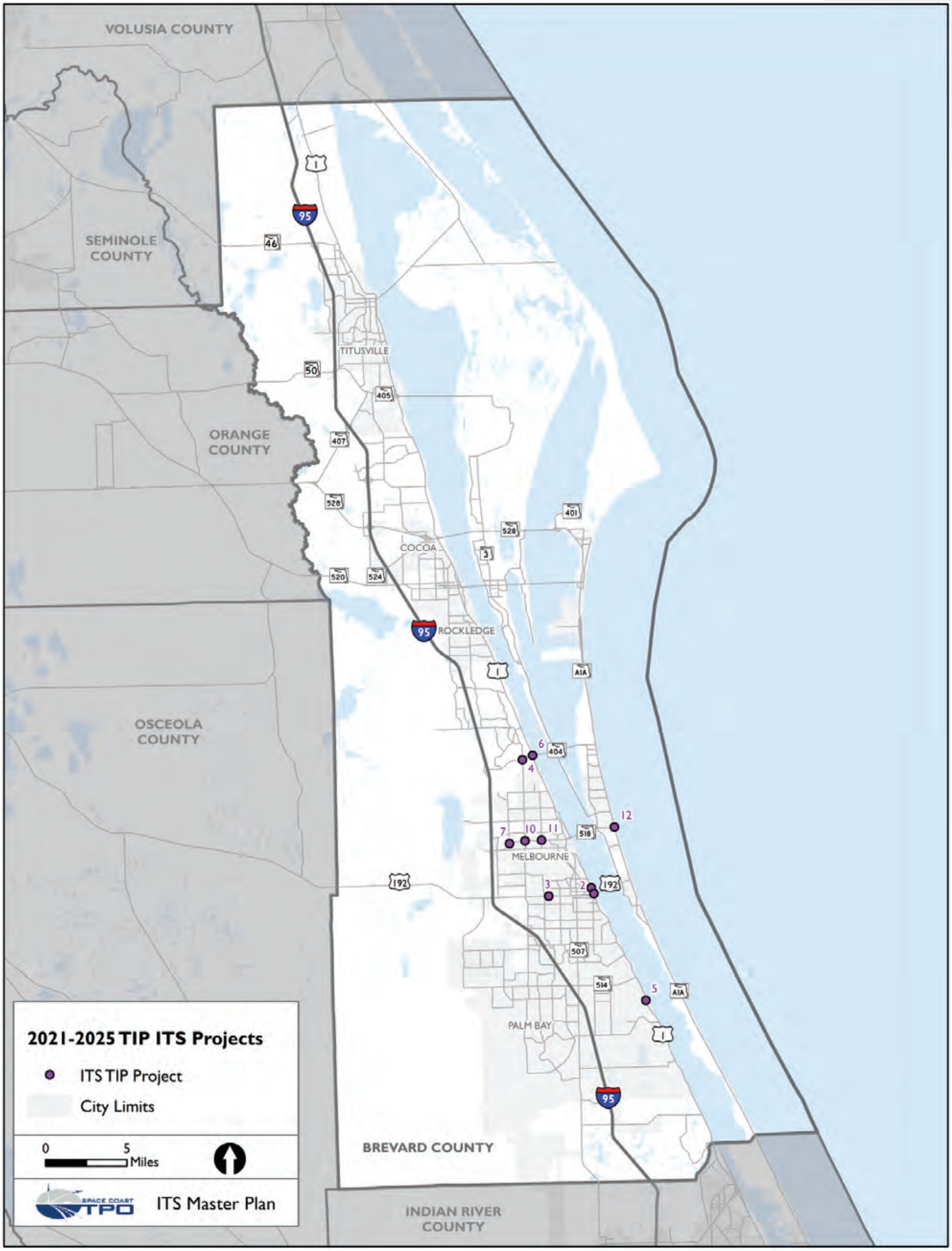
Transportation Improvement Program

The 2021-2025 TIP lists each transportation project to be implemented over the next five years. The TIP is a realistic forecast of projects that have committed state or federal funds, so it serves as the SCTPO's short-term plan. The list of funded transportation projects is developed annually with input from the community and updated throughout the year. The TIP for FY 2021-2025 identifies twelve ITS projects for traffic signal improvements. The projects are listed in Table 2-3 and mapped on Figure 2-2. It is important to note that Map Project #1 is for general support throughout the County so it will not be displayed on Figure 2-2.

Table 2-3: ITS Projects Listed in the 2021-2025 TIP

Map Project #	TIP Project #	Location	Length (Miles)	ITS Communication System	Lead Agency	Year
	4289301	Brevard County ITS Operational Support	0.000	ITS Communication System	Brevard County	2021-2025
1	4356521	SR 5/US 1 at Hibiscus Ballard and US 192 Intersections	2.846	Traffic Signal Update	FDOT	2021
2	4391301	US 192 at McClain–Rebuild Mast Arm	0.038	Traffic Signal Update	FDOT	2022
3	4391351	SR 5054 at Wickham Rd Mast Arms	0.013	Traffic Signal Update	FDOT	2022
4	4410001	US 1/SR 5 from 110' S of Jordan Blvd to 85' N of Jordan	0.037	Traffic Signal Update	FDOT	2021
5	4419451	SR 5 (US 1) at SR 404 EB Ramps Signalization	0.225	Traffic Signals	FDOT	2021
6	4451831	SR 518 Eau Gallie Blvd at Turtle Mound Rd	0.163	Traffic Signals	FODT	2022
7	4452861	Brevard County ATSPM Traffic Control Devices	0.000	Traffic Control Devices/ System	FDOT	2021
8	4452871	City of Melbourne ATSPM Traffic Control Devices	0.000	Traffic Control Devices/ System	FDOT	2021
9	4458131	SR 518 Eau Gallie Blvd @ Wickham Rd	0.072	Traffic Signals	FDOT	2021, 2023
10	4458351	SR 518, Eau Gallie Blvd, at Croton Rd	0.042	Traffic Signals	FDOT	2021, 2023
11	4458551	SR-A1A @ SR 518 / E Eau Gallie Blvd.	0.114	Traffic Signals	FDOT	2021, 2024
12	4479941	Cape Canaveral Spaceport Indian River Bridge ITS Improvements Project		ITS Communication System	FDOT	2021

Figure 2-2: 2021-2025 TIP ITS Projects



Traffic Generators

Brevard County has a number of major traffic generators that have a significant impact on the roadway network. Events, access, freight traffic, and high-density employment sites all make different demands on the infrastructure, and ITS technology has been identified as a larger part of the solution. In every case, as shown in the LRTP, growth is anticipated, and vehicle and/or freight trip generation is anticipated to increase.

Airport

Melbourne-Orlando International Airport (MLB), Brevard County's major airport, includes three runways, eight gates, seven jetways, and a 200,000-square-foot terminal. The airport can accommodate 2 million travelers annually. MLB also is home to the Florida Tech Research Park, which is occupied by aerospace and aviation technology companies, including three aircraft manufacturers. Recently, the Brazilian aviation company Embraer invested a total of $100 million to expand its manufacturing facility to move business jet manufacturing to MLB. MLB is the home to the only North American aircraft assembly facility and only global customer center for Embraer. This addition will provide room for more than 1,000 high-wage jobs. MLB had more than 240,000 enplanements in 2019. Since 2015, MLB enplanements have grown by 9.5 percent. From 2018 to 2019, MLB enplanements increased by 2.7 percent.

Port Canaveral

Port Canaveral is one of the busiest ports in the country serving cruise, cargo, and naval functions. Port Canaveral's net economic impact on Central Florida reached $3.5 billion and plans are in place to increase that number to $10 billion in the next decade. The Port recently adopted a new 30-year Strategic Vision Plan that describes the construction of three new terminals and an integrated transportation center creating space for a consolidated car rental facility and additional parking. It also includes a plan to further develop the cargo facilities and add a Spaceport component that is designed to accommodate growth needs of the burgeoning space industry. Commercial fishing and marine recreation also are identified as growth areas. Overall, the Strategic Vision Plan contains projections to service almost 9 million cruise passengers and more than 30 million tons of cargo by 2048.

Passenger Cruise Activity

In 2019, Port Canaveral had 4.6 million multi-day passengers. This shows a growth of 1.4 percent from 2018. In 2018, Port Canaveral launched a $163 million construction project to build a state-of-the-art cruise terminal that will replace the recently demolished Cruise Terminal 3 on the Port's south side, just west of Jetty Park. The new Cruise Terminal 3 will be the home port for Carnival Cruise Line's newest cruise ship. The two-story terminal, an upgraded berth, roadway upgrades, and an adjacent covered parking garage with room for about 1,800 vehicles was completed in 2020. In 2017, Port Canaveral had a total of 4.2 million passengers, making it the second largest cruise port in the world, with growth of 1 percent from the previous year. Port Canaveral is looking to add three new terminals, update an existing berth, and build a transportation center with rental cars and additional parking. In 2016, the Canaveral Port Authority completed $137 million in capital projects, including $45 million in renovations to 24-year-old Cruise Terminal 5, increasing its capacity from 2,500 to 3,500 passengers. In addition, 21-year-old Cruise Terminal 10 was renovated, with a capacity increase from 3,200 to 5,500 passengers. Cruise Terminal 8, the Disney Terminal, also received a $2-million upgrade.

Eight DMSs are installed along SR 528 between I-95 and the area surrounding the Port. Two of these signs (one eastbound and one westbound) on the mainland are operated by FDOT and could be used to coordinate an evacuation. The other six signs belong to the Port and are used to update drivers on which cruise terminal (Terminal A or B) different cruise ships are docked at while also giving information on the parks and campgrounds at the Port. It is unlikely that these six signs will be readily available in the event of an emergency evacuation.

Port Cargo Activity

Port Canaveral cargo traffic comprises the smallest volume of all the ports in the state, but it saw a 9-percent increase in cargo tonnage from 2016 to 2017 and a 7-percent increase in cargo tonnage from 2017 to 2018; it is expected to grow significantly through 2048. In 2016, the Port invested more than $44 million in widening and deepening the harbor and $15.2 million in cargo terminals and backup areas. Additionally, new berths for spaceport support as well as road and security upgrades were added. The Port is expected to make improvements with berth upgrades and new terminals, including an auto terminal and liquified natural gas terminal.

Currently, the Port has no connection to rail, but with the widening and deepening of the harbor and the completion of the Miami to Orlando high speed rail, future rail alternatives are expected to be evaluated. The Kennedy Space Center (KSC) Master Plan considers a rail line connecting the Port to KSC. Additionally, Port Canaveral is currently studying barge-to-rail services in anticipation of the increased cargo to be serviced by the area.

Port Canaveral processed 6.3 million tons of cargo in 2019, which was a 1.4-percent decrease in cargo tonnage from 2018 to 2019.

Freight Traffic

The freight and shipping industries contribute greatly to the economy in Brevard County and depend on the roadway system. To account for this, the 2019 SOS includes an evaluation of freight traffic, which is reported in terms of total truck AADT, AADT change from 2018 to 2019, and weighted average AADT change from 2014 to 2018 and 2015 to 2019.

The Florida Legislature has designated all interstates and many principal arterials throughout the state as either SIS facilities or SIS connectors because they are needed to connect to important intermodal facilities. Within Brevard County, the SOS roadway network is an important complement to the two SIS facilities, I-95 and SR 528, because it provides a connection between local areas and the two major freeways. The amount of truck traffic on I-95, SR 528, and the surrounding roadway network serves as one indicator of freight and goods movement through the County, as those roads carry large volumes of trucks due to the activity at Port Canaveral and MLB Airport.

The average truck traffic was calculated for I-95, SR 528, and all SIS roadways (see Table 2-4). Highlights of truck volumes include:

- Truck traffic volume decreased by 0.1 percent on I-95 from 2018 to 2019. Truck traffic along I-95 increased from 2017 to 2018, remained steady between 2016 and 2017, and experienced a 31-percent increase between 2015 and 2016. The 31-percent increase from 2015 to 2016 corresponds to a similarly large increase in port traffic at Port Canaveral after the port deepening project.
- Truck traffic volume decreased by 15.2 percent on SR 528 from 2018 to 2019. Truck traffic on SR 528 decreased by 0.3 percent from 2017 to 2018, decreased by 4.2 percent from 2016 to 2017, and increased by 93 percent from 2015 to 2016. The 93-percent increase from 2015 to 2016 corresponds to a similarly large increase in port traffic at Port Canaveral after the port deepening project.
- Truck traffic volume on all other SOS roadways decreased for the first time in eight years. Truck traffic on SOS roadways decreased by 0.8 percent from 2018 to 2019, increased by 1.6 percent from 2017 to 2018, increased by 11 percent from 2016 to 2017, and increased by 8 percent from 2015 to 2016.

Table 2-4: Truck AADTs, 2015 to 2019

Year	I-95		SR 528		SOS Roadways	
	Volume	% Change from Previous Year	Volume	% Change from Previous Year	Volume	% Change from Previous Year
2015	6,306	-0.3	2,093	-19.9	1,038	3.0
2016	8,286	31.4	4,045	93.2	1,125	8.4
2017	8,231	-0.7	3,876	-4.2	1,248	10.9
2018	8,956	8.8	3,865	-0.3	1,268	1.6
2019	8,955	-0.1	3,277	-15.2	1,258	-0.8

Large Technical Work Force

The Space Coast area is home to many technology companies and, in 2018, it was rated "Most Highly Concentrated High-Tech Economy in Florida" by the Milken Institute. In addition, Forbes ranks the area in the top 10 for "Best Cities for STEM Jobs." Due to the success of the area, the County's population is expected to grow to more than 750,000 by 2040, with an expected growth rate of 41 percent in jobs. Most of the job growth is expected to come from large technology companies, including L3Harris, and Blue Origin, which recruit a talented workforce.

L3Harris, the largest aerospace and defense company in the state of Florida, has its corporate headquarters in Melbourne on NASA Boulevard and plans on continuing to expand its workforce. Blue Origin has a 750,000 square-foot facility located at KSC's Exploration Park. Blue Origin plans to bring in hundreds of employees and double its campus size in the upcoming years.

Space Florida

The SCTPO has the unique role of including space travel as a part of its transportation system planning. The KSC is a NASA installation, having been the launch site for every United States manned space flight. As the world's only launch site for the space shuttle, KSC handled ground processing, launch, landing, and recovery of the shuttle for years. During shuttle launches, the Emergency Management Department worked with the local police departments and Orlando-Orange County Expressway Authority to clear traffic congestion in the area, specifically along SR A1A and SR 528. Typically, it would take eight to ten hours to clear congestion after a shuttle launch, but with interagency coordination, the congestion would clear in approximately two to three hours. As mentioned before, pertaining to Port Canaveral, the FDOT-owned DMSs could be used to provide information to travelers along SR 528.

Space Florida was created in 2006 by the Florida Legislature to coordinate all space-related issues in Florida. The SCTPO assisted Space Florida in developing a statewide Spaceport System Plan. This is the first statewide spaceport system plan in the United States and will strengthen Florida's multi-modal infrastructure for space transportation. Since then, there have been updates to the plan and most recently, Space Florida has developed its Vision 2020 strategy, targeting 10 commercial markets across the science, security, and tourism fields.

The SCTPO also worked with the KSC and Cape Canaveral Air Force Station to develop the Cape Canaveral Spaceport (CCS) Complex Master Plan. The CCS Complex Master Plan was updated in January 2017 to identify future development needs. CCS is the most capable orbital spaceport worldwide, with an annual lift capacity of more than 400 metric tons, and it is one of only two spaceports worldwide that support the full range of launch vehicle classes. CCS has had an average of 16 launches per year over the last five years. The number of launches were slowly increasing from 2015 to 2018, but then decreased slightly in 2019. The 2017 update identified improvements needed both to spaceport facilities and other modal improvements needed to support space operations.

On February 6, 2018, SpaceX launched a Falcon heavy spacecraft while almost 115,000 visitors watched and on May 30, 2020, an estimated 150,000 people gathered to watch the launch of the SpaceX Crew Dragon spacecraft. Annually, the KSC hosts 1 million to 1.5 million visitors. These visitors must get to and around Brevard County, which will likely increase demand at the airport, seaport, on transit, and along the roadways.

Park & Ride Facilities

Park & Ride facilities allow for commuters to leave their vehicles in a designated parking space and transfer to bus, rail, or carpool systems for the remainder of their trips. These facilities are essential to the transportation efficiency of the County and should be placed at critical locations in the transit network. There are no ITS systems or devices associated with these locations. Brevard County contains three Park & Ride facilities:

- Viera Park & Ride Lot: Designated bus stop for Route 1 and includes 48 parking spaces
- Eau Gallie Park & Ride Lot: No designated bus service; has 128 parking spaces, including spaces designated for vanpool parking
- Palm Bay Park & Ride Lot: Designated bus stop for Route 23 and includes 105 parking spaces

Intermodal Facilities

The three intermodal facilities located within Brevard County are Port Canaveral, Melbourne-Orlando International Airport, and Kennedy Space Center. For the area to have a positive economy, it is essential to efficiently move people and freight to and from their destinations. Freight movement should be a primary focus along the corridors surrounding Port Canaveral and the airport. Refer to the Traffic Generators section above for a complete evaluation of the County's freight traffic and seaport, airport, and spaceport facilities.

To improve travel time and travel time reliability for both people and freight, ITS strategies can be implemented along any corridor. The use of ITS devices will increase overall efficiency and boost economic development by improving safety, reducing travel time, and increasing reliability.

Information and Data Sharing

Among Various Agencies

FDOT District 5

Local FDOT ITS infrastructure is monitored from the FDOT District 5 RTMC in Sanford. The RTMC currently receives traffic-related incidents into SunGuide (ATMS) as an "early detection" mechanism and locates the incident on a video feed. Then, RTMC provides local fire and rescue agencies the coordinates and details of the incidents by telephone. For major incidents and events, the RTMC has direct coordination with Brevard County Emergency Management.

District 5 is now working on developing diversion routes from I-95 that will feed into the Regional Integrated Corridor Management System software currently being developed. This will allow automated response plans to divert traffic around I-95 via special event signal timing plans pushed from the RTMC.

The following services have been developed and refined over the past two decades to service Florida's limited-access facilities and currently are being considered for arterial application by multiple agencies throughout the state.

Active Incident Management

Active Incident Management is a system in which operators in the RTMC and TMC pinpoint locations of incidents and follow a predetermined guideline to get the appropriate personnel and traveler assistance. These incidents include, but are not limited to, vehicular crashes, disabled vehicles, equipment failures, and severe weather. When the incident is detected, typically through ITS equipment on the roadway, the operator begins by notifying the first responder agencies (i.e., police, fire, etc.). When the first responders are notified, the operator then works to relay what is occurring to the traveling public through systems such as DMS, FL 5-1-1, and Highway Advisory Radio (HAR).

The National Incident Management System (NIMS) provides training and guidelines to agencies involved in incident management to ensure that the system is used properly. The NIMS guideline breaks down each occurrence by incident complexity. There are currently five types of incident protocols available that use different ranges of personnel, need for a written incident action plan (IAP), activation of command, and general staff.

The Active Incident Management System has proven to be a success in many areas, including Brevard County. Florida's freeway incident system is nationally recognized for improving congestion, eliminating secondary crashes, and reducing gas emissions.

Traffic Incident Management

Traffic Incident Management (TIM) is a planned and coordinated process to detect, respond to, and remove traffic incidents and restore traffic capacity as safely and quickly as possible. Each district has a TIM Team that reviews past response actions and explores how that incident management could be improved. Brevard County is part of the District 5 TIM Team. The TIM Team is comprised of local, state, and private partners, including law enforcement, fire rescue, emergency medical services, transportation, towing, medical examiners, media, etc. Its goal is to improve safety and restore traffic efficiency by quickly detecting, responding to, and removing traffic incidents. The Brevard County TIM Team hosts free training seminars for responders to attend.

Between Agencies and the Public

Waze

Waze is a navigation application owned by Google that is free to the community. The application can provide travel time, speed, and incident information for a user's potential route. The information in the application is based on user input, which actively feeds the program data in real time. FDOT began partnering with Waze in 2014 and, since then, has integrated the application into SunGuide. Recently, a decision was made to begin data filtering to send only relevant data to operations. Now, more than 90 percent of the data are filtered out, leaving mostly crashes and road closures.

FL 5-1-1 Traveler Information System/Program (FLATIS)

FLATIS is the state's official source for traffic and travel information. It provided travelers with information regarding congestion, events, construction, maintenance, weather, travel times, parking, and more. Florida 5-1-1 can be accessed by travelers through calling, texting, mobile application, website, and social media 24 hours a day, 7 days a week. Information is gathered primarily by the ATMS using FDOT cameras and sensors, as well as data from Florida Highway Patrol, Waze, and law enforcement.

Analysis of Existing ITS Systems and Networks

The following sections detail the current conditions and infrastructure within Brevard County that have been analyzed during the development of the ITS Master Plan update. Existing systems information was gathered through interviews with officials from local jurisdictions on the following topics:

- Traffic Management Centers
- Traffic Signals
- Advanced Traffic Management Systems
- Closed Circuit TV Cameras
- Dynamic Messaging Systems
- Microwave Vehicle Detection Systems

Stakeholders also provided information and updates regarding their signal networks, current operations, and future plans.

Traffic Management Centers

Currently, two Traffic Management Centers (TMCs) are operated by the City of Melbourne and Brevard County. These agencies have access to the local traffic CCTV cameras but maintain independent traffic signals and ITS. FDOT District 5 maintains the Regional Traffic Management Center (RTMC) in Sanford. A new centralized TMC currently is being designed for Brevard County, but it will serve as a multi-user facility to allow for better coordination among agencies.

In addition to the TMC investments, planning and funding of substantial ITS deployment with a vast fiber optic communications network along critical arterials has been a focus of both FDOT and the SCTPO. The following tables summarize the hardware used throughout Brevard County.

Table 2-5 lists the signal system networks.

Table 2-5: Signal System Networks

Jurisdiction	Number of Signals	Number of Interconnected Signals	Type of Communication for Interconnection	Type of Network Used	Central Software System	Type of Controllers
Brevard County*	351	219	Fiber and wireless	Routed/ distributed network containing physical/virtual lands. Layer 2 edge devices segmented logically to maintain spanning tree limitations.	Trafficware's ATMS. now (version 5.12)	Naztec, mix of 980 and ATC
City of Melbourne	67	67	Fiber and Wireless	Layer II (ITS Express 80404): Layer III Juniper EX4300; Firewall Juniper SRX320	Cubic's ATMS.now	Commander Scout/980 ATC
City of Palm Bay	43	0	NA	NA	NA	Naztec/ Econolite
City of Titusville	42	4	Fiber	4 signals connect to Brevard County's TMC	NA	SN

* includes 5 signals maintained by Titusville where Brevard County maintains the interconnected ITS

Table 2-6 indicates the number and types of ITS end devices maintained.

Table 2-6: ITS End Devices

Stakeholder	Miles of Fiber Optic Cable	Total ITS Devices	CCTV	DMS	MVDS/AVI	Bluetooth
Brevard County	71	170	100	0	0	50
City of Melbourne	4.5	12	12	0	0	7
City of Palm Bay	0	1	1	0	0	0
City of Titusville	0	0	0	0	0	0

CCTV = Closed Circuit Television, DMS = Dynamic Message Sign, MVDS = Microwave Vehicle Detector System, AVI = Automated Vehicle Identification

Traffic Signals

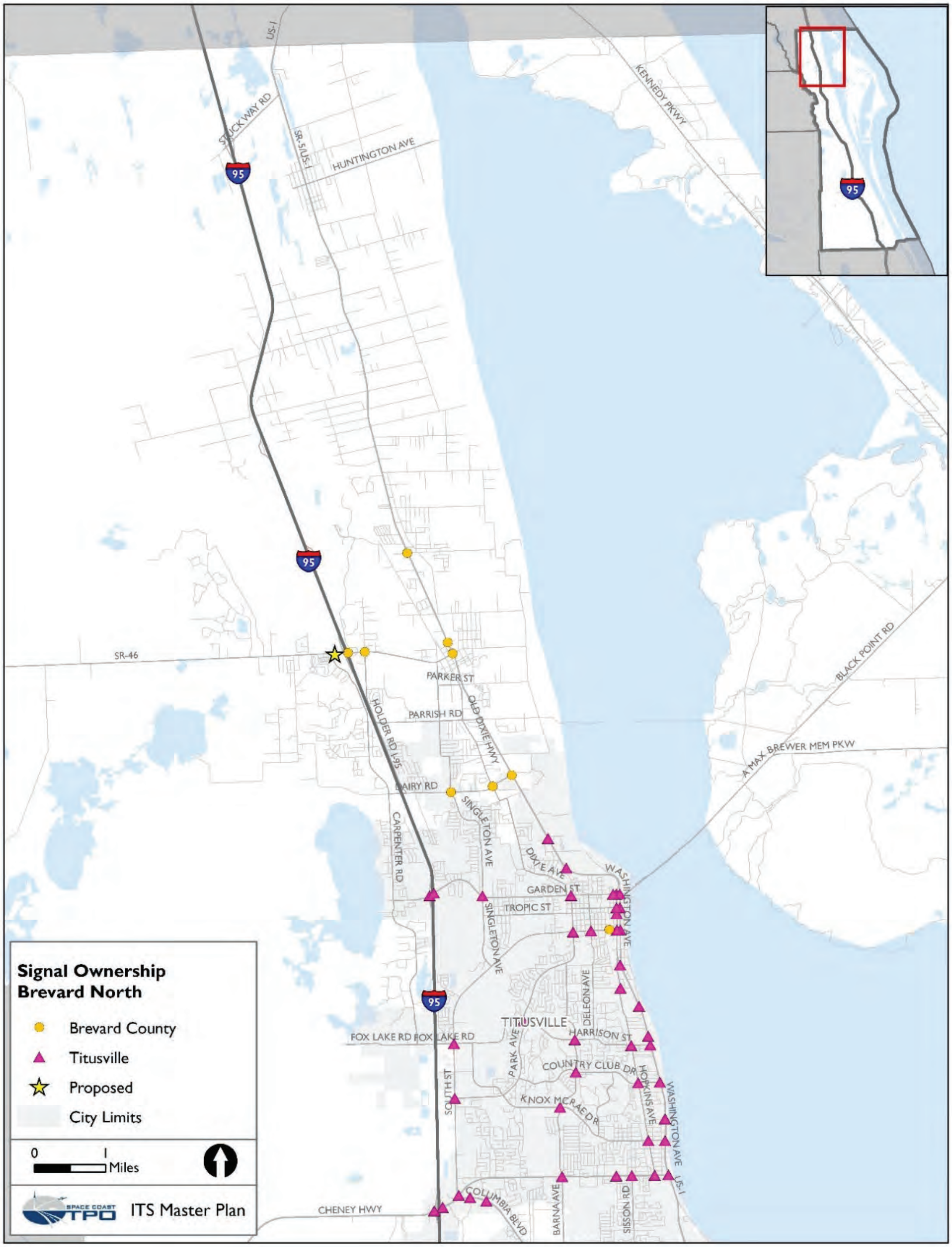
Traffic signals are used throughout Brevard County to decrease congestion and improve safety at each intersection along the corridors. The County is currently responsible for the operation and maintenance of approximately 400 traffic signals. The standard controllers throughout the area are Naztec, except for the City of Palm Bay, which uses Econolite controllers.

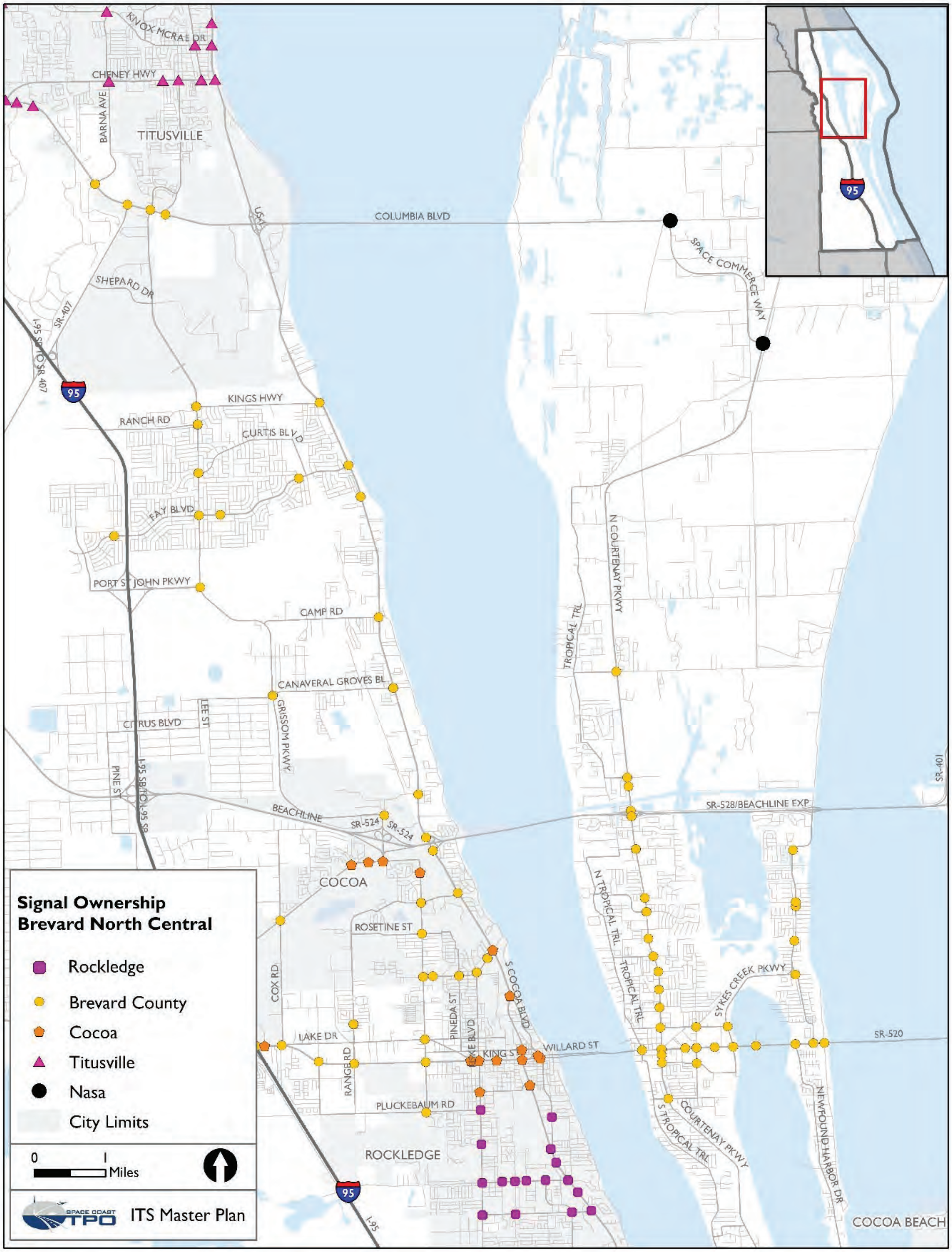
Table 2-7 displays the number and types of signals owned and operated by various jurisdictions within the SCTPO boundary. Figure 2-3 shows mapped signals in Brevard County.

Table 2-7: Signals Owned and Operated within the SCTPO

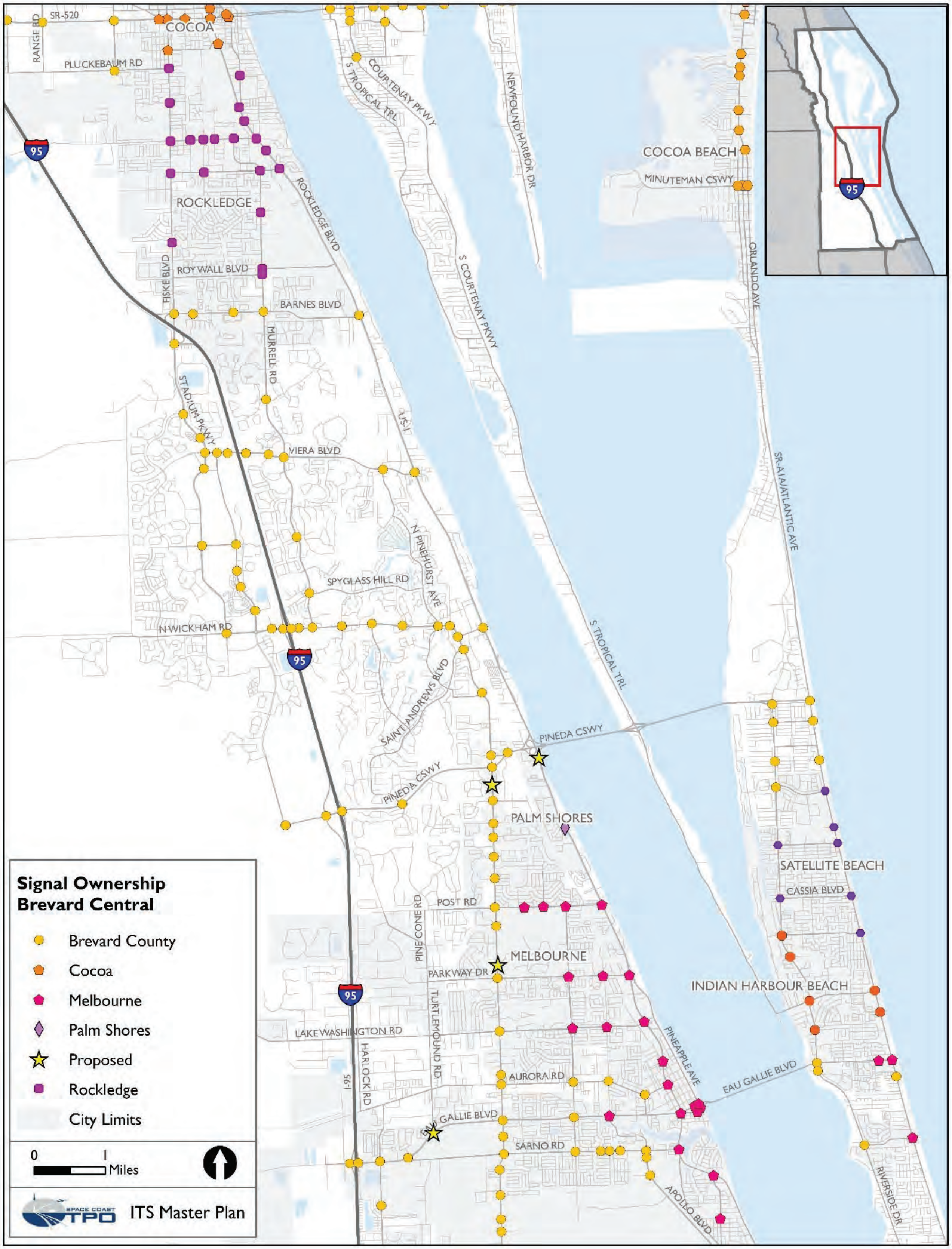
Stakeholder	Number of Signals	Number of Interconnected Signals	Number of Adaptive Signals	Number of Coordinated Signals
Brevard County	351	219	112	unavailable
City of Melbourne	67	67	0	56
City of Palm Bay	43	0	0	11
City of Titusville	42	4	4	0

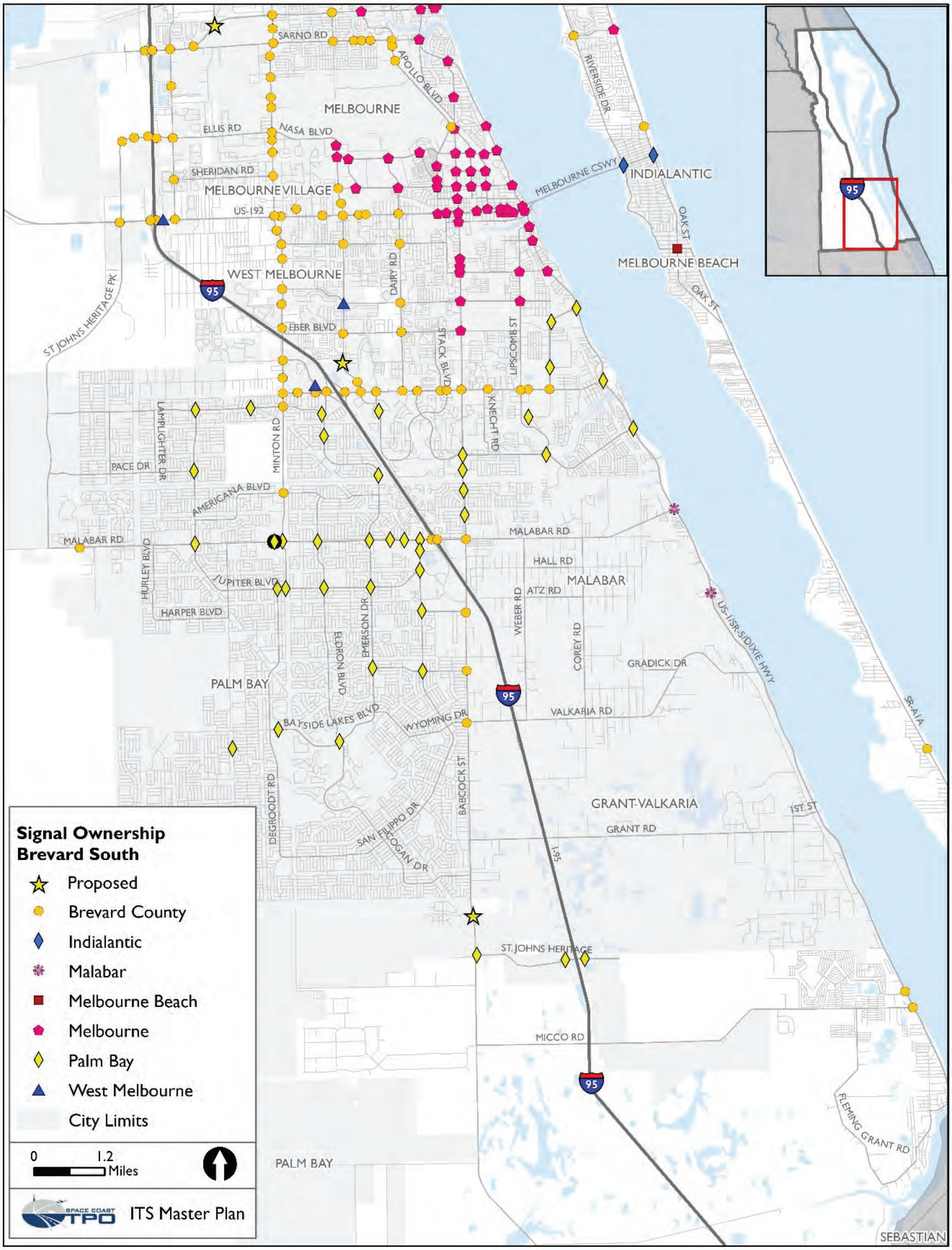
Figure 2-3: Mapped Signals in Brevard County





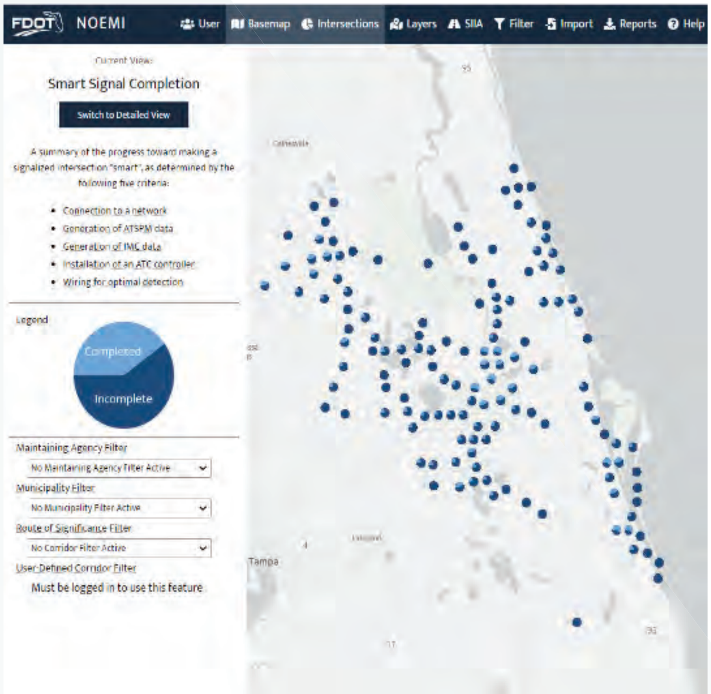
Signal Ownership
Brevard North Central
Rockledge
Brevard County
Cocoa
Titusville
Nasa
City Limits
0
1
Miles
ITS Master Plan
TITUSVILLE
KNOX MCRAE DR
CHENEY HWY
BARNA AVE
COLUMBIA BLVD
SPACE COMMERCE WAY
SHEPARD DR
SR-407
KINGS HWY
RANCH RD
CURTIS BLVD
FAY BLVD
PORT ST JOHN PKWY
CAMP RD
CANAVERAL GROVES BL
GRISSOM PKWY
CITRUS BLVD
LEE ST
PINE ST
BEACHLINE
SR-524
SR-528/BEACHLINE EXP
SR-401
N COURTENAY PKWY
TROPICAL TRL
COCOA
ROSETINE ST
COX RD
S COCOA BLVD
LAKE DR
RANGE RD
PINEDA ST
KING ST
WILLARD ST
SR-520
SYKES CREEK PKWY
N TROPICAL TRL
PLUCKEBAUM RD
ROCKLEDGE
S TROPICAL TRL
COURTENAY PKWY
NEWFOUND HARBOR DR
COCOA BEACH
I-95
95


Signal Ownership
Brevard Central
Brevard County
Cocoa
Melbourne
Palm Shores
Proposed
Rockledge
City Limits
0
1
Miles
ITS Master Plan
COCOA
ROCKLEDGE
COCOA BEACH
PALM SHORES
SATELLITE BEACH
MELBOURNE
INDIAN HARBOUR BEACH
SR-520
PLUCKEBAUM RD
RANGE RD
ROCKLEDGE BLVD
ROY WALL BLVD
FISKE BLVD
BARNES BLVD
MURRELL RD
STADIUM PKWY
VIERA BLVD
SPYGLASS HILL RD
N WICKHAM RD
N PINEHURST AVE
SAINT ANDREWS BLVD
PINEDA CSWY
POST RD
PINE CONE RD
PARKWAY DR
LAKE WASHINGTON RD
HARLOCK RD
TURTLEMOUND RD
AURORA RD
EAU GALLIE BLVD
SARNO RD
APOLLO BLVD
PINEAPPLE AVE
RIVERSIDE DR
CASSIA BLVD
SR-A1A/ATLANTIC AVE
ORLANDO AVE
MINUTEMAN CSWY
S TROPICAL TRL
S COURTENAY PKWY
COURTENAY PKWY
NEWFOUND HARBOR DR
US-1
I-95
95



Signal Ownership
Brevard South
Proposed
Brevard County
Indialantic
Malabar
Melbourne Beach
Melbourne
Palm Bay
West Melbourne
City Limits
0
1.2
Miles
ITS Master Plan
MELBOURNE
MELBOURNE VILLAGE
WEST MELBOURNE
INDIALANTIC
MELBOURNE BEACH
PALM BAY
MALABAR
GRANT-VALKARIA
SEBASTIAN
SARNO RD
ELLIS RD
NASA BLVD
SHERIDAN RD
US-192
APOLLO BLVD
MELBOURNE CSWY
RIVERSIDE DR
OAK ST
DAIRY RD
EBER BLVD
STACK BLVD
LIPSCOMB ST
KNECHT RD
ST JOHNS HERITAGE PK
LAMPLIGHTER DR
MINTON RD
PACE DR
AMERICANA BLVD
MALABAR RD
HURLEY BLVD
JUPITER BLVD
HARPER BLVD
HALL RD
ATZ RD
WEBER RD
COREY RD
GRADICK DR
US-1/SR-5/DIXIE HWY
ELDRON BLVD
EMERSON DR
BAYSIDE LAKES BLVD
WYOMING DR
VALKARIA RD
SR-A1A
DEGROODT RD
BABCOCK ST
SAN FILIPPO DR
COGAN DR
I-95
GRANT RD
1ST ST
ST. JOHNS HERITAGE
MICCO RD
FLEMING GRANT RD
95

NOEMI



NOEMI (Normalized Operational Equipment Management Initiative) is a web-based application that tracks the current state of signalized intersections in their progress to become "smart" signalized intersections.

"Smart" signals—a concept developed by FDOT District 5—include the following parameters:

- Direct connection between the intersection and the appropriate network and centralized ATMS software; either fiber optics or cellular modem
- Ability to generate high-resolution data streams necessary for the implementation of Advanced Traffic Signal Performance Measures (ATSPM); this typically means the upgrade of signal controllers to ATC standard models and integration with the districtwide ATSPM platform
- Hardware capable of collecting and processing intersection movement counts (IMC) data in real-time
- Installation of advanced detection of all lanes on the intersection, including turn lanes
- Upgrade of existing controller cabinet assembly to a TS-2 model equipped with 64 channels and wired in accordance with the District's ATSPM standard

NOEMI also provides the ability to "bore down" into more specifics of each intersection to determine specific parameters of that location. This information is determined from the Signalized Intersection Inventory Application (SIIA), which is a platform used by maintenance and construction crews to document the physical assets at a signalized intersection.

Advanced Traffic Management System

The Advanced Traffic Management System (ATMS) is a collaborative effort between FDOT District 5, SCTPO, Brevard County Signal Maintaining Agencies, and other County stakeholders. The ATMS consists of the design and construction of ITS infrastructure and ITS sub-system components. Devices included in the system are arterial Dynamic Message Signs (DMSs), CCTV cameras, wireless communication segments, microwave detection, and signals. The goal of Brevard County's ATMS is to effectively and proactively manage traffic throughout the County. The devices along each corridor allow operations personnel to find locations and causes of congestion, provide motorists with traffic information related to the cause of congestion, and dispatch emergency responders. By doing so, there is a decrease in congestion caused by incidents, emergency responder notification times, and incident durations while increasing safety.

Table 2-8 lists software and controllers used by the stakeholders.

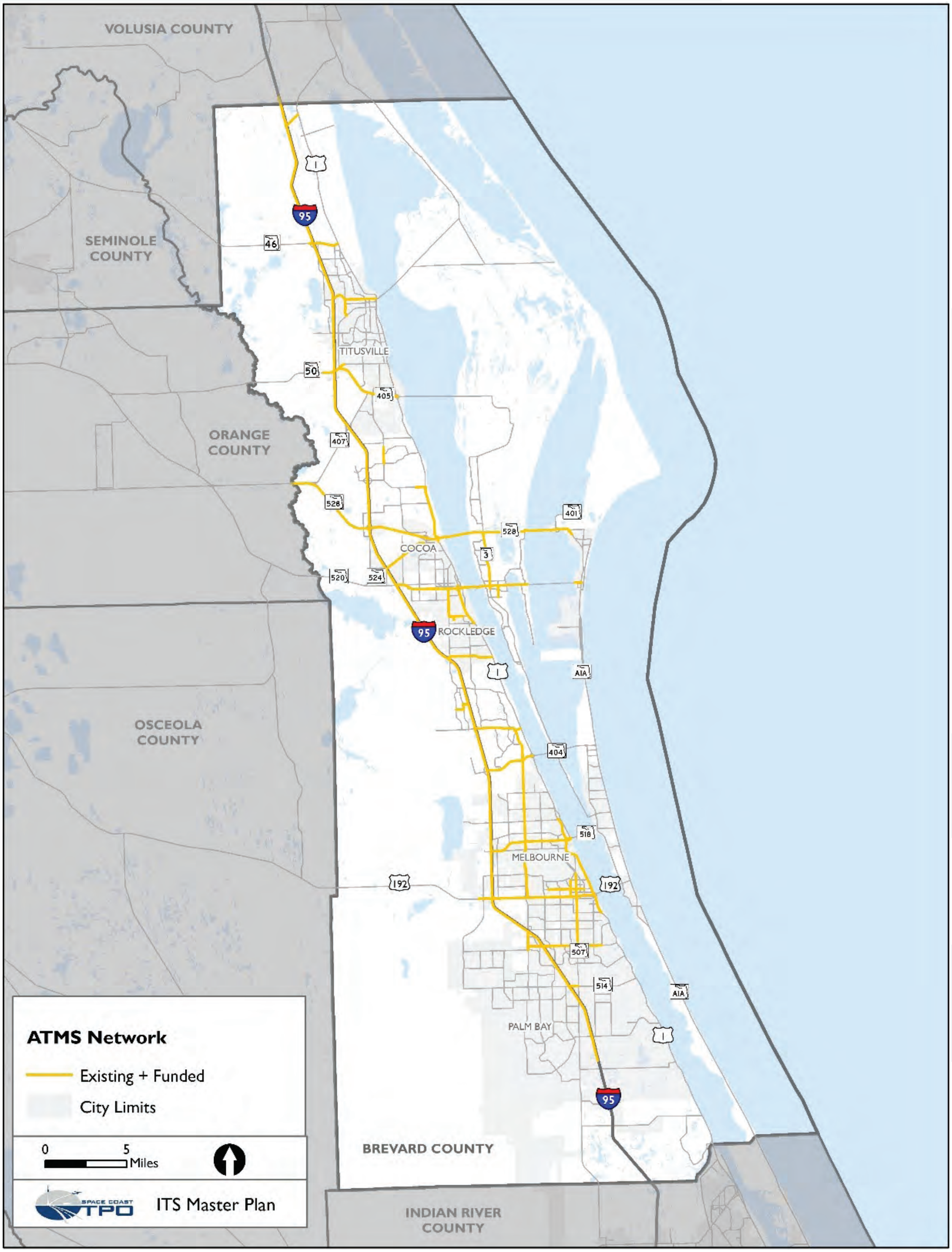
Table 2-8: ATMS Software and Controllers

Stakeholder	ATMS Software	Controllers
Brevard County	Naztec's ATMS.now	Trafficware/Cubic Commander, ATC
City of Melbourne	Naztec's ATMS.now	Commander Scout/980 ATC
City of Palm Bay	None	Econolite
City of Titusville	None (County)	Cubic Commander ATC, NEMA TS-2 Type 1 w/ ethernet (majority), ATC, NEMA TS-2

Brevard County is using Cubic's Trafficware as the standard controllers for the area and can remotely monitor and communicate with all signals connected to the fiber optic network using Cubic's ATMS.now signal management software. The software enables the agency to receive a real-time view of traffic operations while also being able to manage traffic and ITS components. The cities of Melbourne and Titusville also are using Cubic controllers and ATMS software. The City of Palm Bay uses a mix of controllers, but is moving toward primarily using Econolite controllers as the standard throughout the city. Palm Bay intends to use the ATMS software Centracs, enabling the agency to provide traffic control, ITS management, and data sharing.

Figure 2-4, below, details existing and future ITS ATMS networks in Brevard County.

Figure 2-4: Brevard County Existing ITS ATMS



CCTV Cameras

CCTV cameras are used throughout Brevard County to provide video traffic surveillance from the Brevard County and City of Melbourne TMC facilities, as well as the FDOT District 5 RTMC. Each camera can pan, tilt, and zoom to allow system users to observe traffic patterns, locate and respond to incidents, adjust traffic signal timings, and verify the operation of other ITS devices. By using CCTV cameras, the District can decrease congestion involving incidents and decrease incident durations while increasing safety.

Figure 2-5 shows CCTV locations for the entire County, and Table 2-9 illustrates CCTV locations in the City of Melbourne.

Figure 2-5: Brevard County CCTV Locations

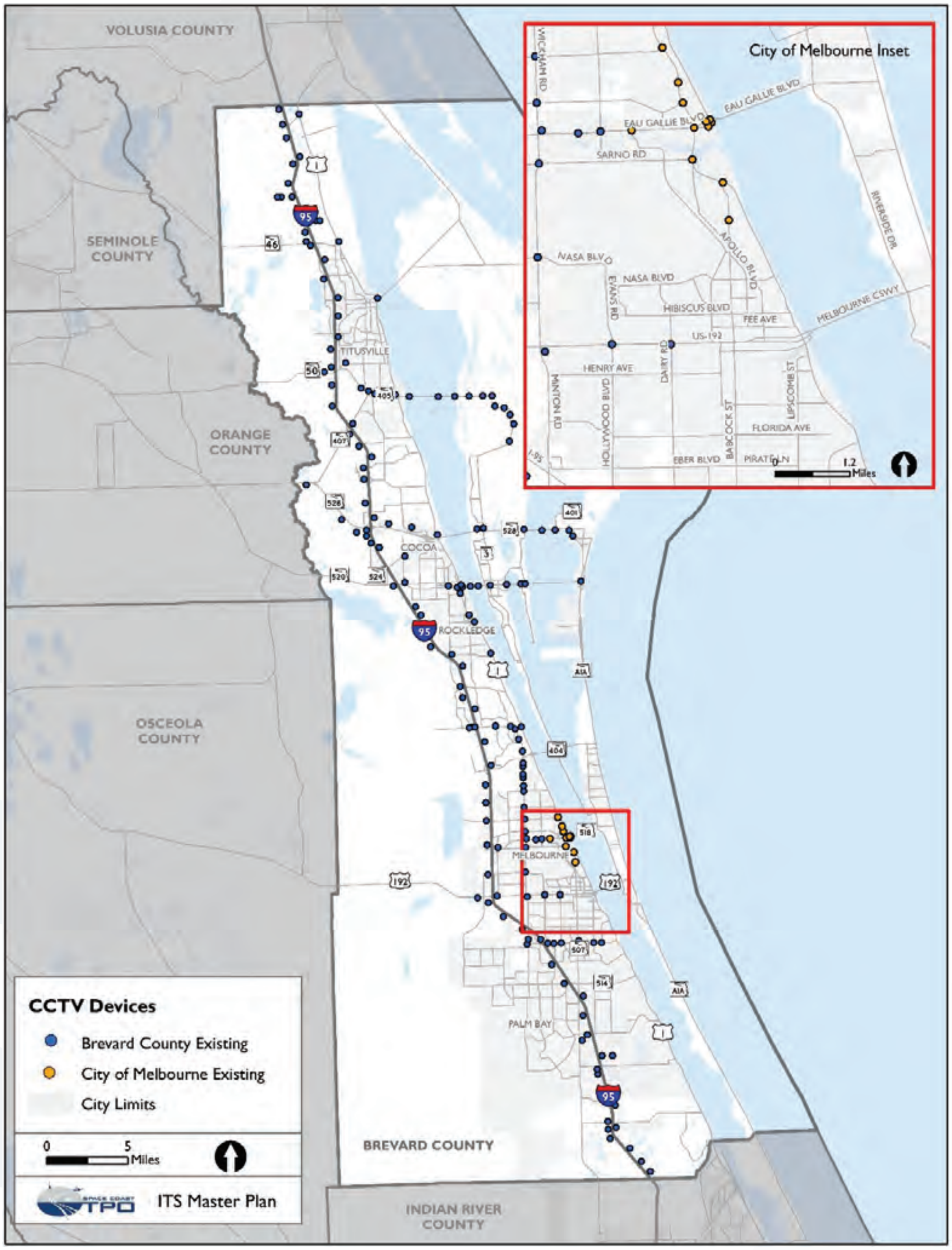


Table 2-9: City of Melbourne CCTV Locations

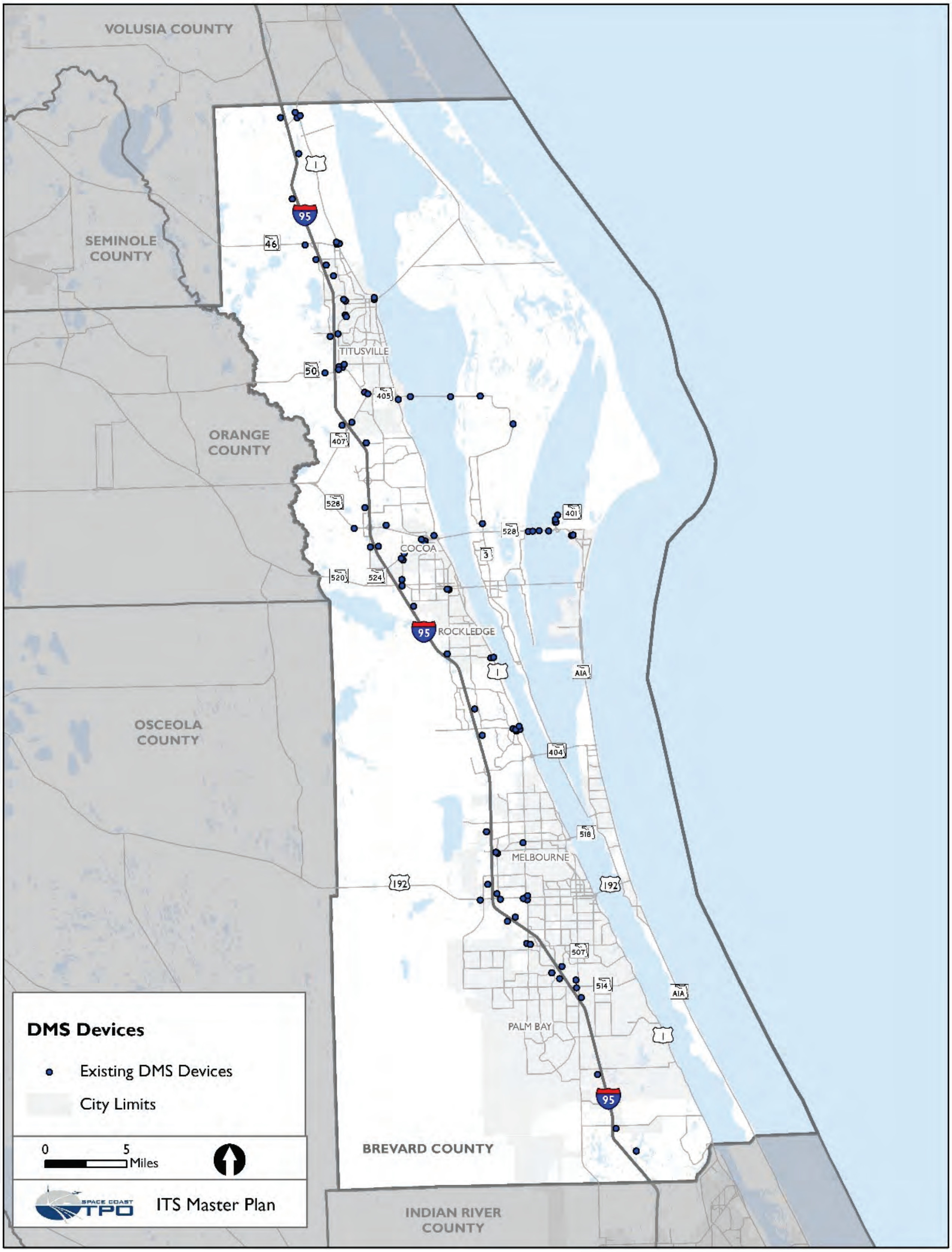
Status	Location	Status	Location
Existing	Montreal Ave & Pineapple Ave	Existing	US 1 & Babcock St
Existing	Eau Gallie Blvd & Pineapple Ave	Existing	Eau Gallie Blvd & Apollo Blvd
Existing	US 1 & Eau Gallie Blvd	Existing	Babcock St & Brevard Dr
Existing	US 1 & Lake Washington	Existing	Montreal Ave & Highland Ave
Existing	US 1 & Aurora Rd	Existing	US 1 & Sarno Rd
Planned	US 1 & University Blvd	Planned	US 192 & Pine St
Planned	US 1 & New Haven Ave	Planned	US 192 & Livingston St
Planned	US 1 & Hibiscus Blvd	Planned	US 192 & Waverly Pl
Planned	US 1 & NASA Blvd	Planned	SR 507 & Eber Blvd
Planned	US 192 & Airport Blvd	Planned	SR 507 & University Blvd
Planned	SR 507 & New Haven Ave	Planned	SR 507 & Hibiscus Blvd
Planned	SR 507 & NASA Blvd		

No additional CCTV cameras currently exist in the cities of Palm Bay and Titusville.

Dynamic Message Signs

DMSs are used throughout Brevard County to provide information to travelers regarding the status of interstates and corridors (see Figure 2-6). The signs also can be used to provide travel information and alerts (America's Missing: Broadcast Emergency Response [AMBER], Silver, etc.) to the public. By using DMSs, the District can push information out to travelers, resulting in a decrease of congestion throughout the County.

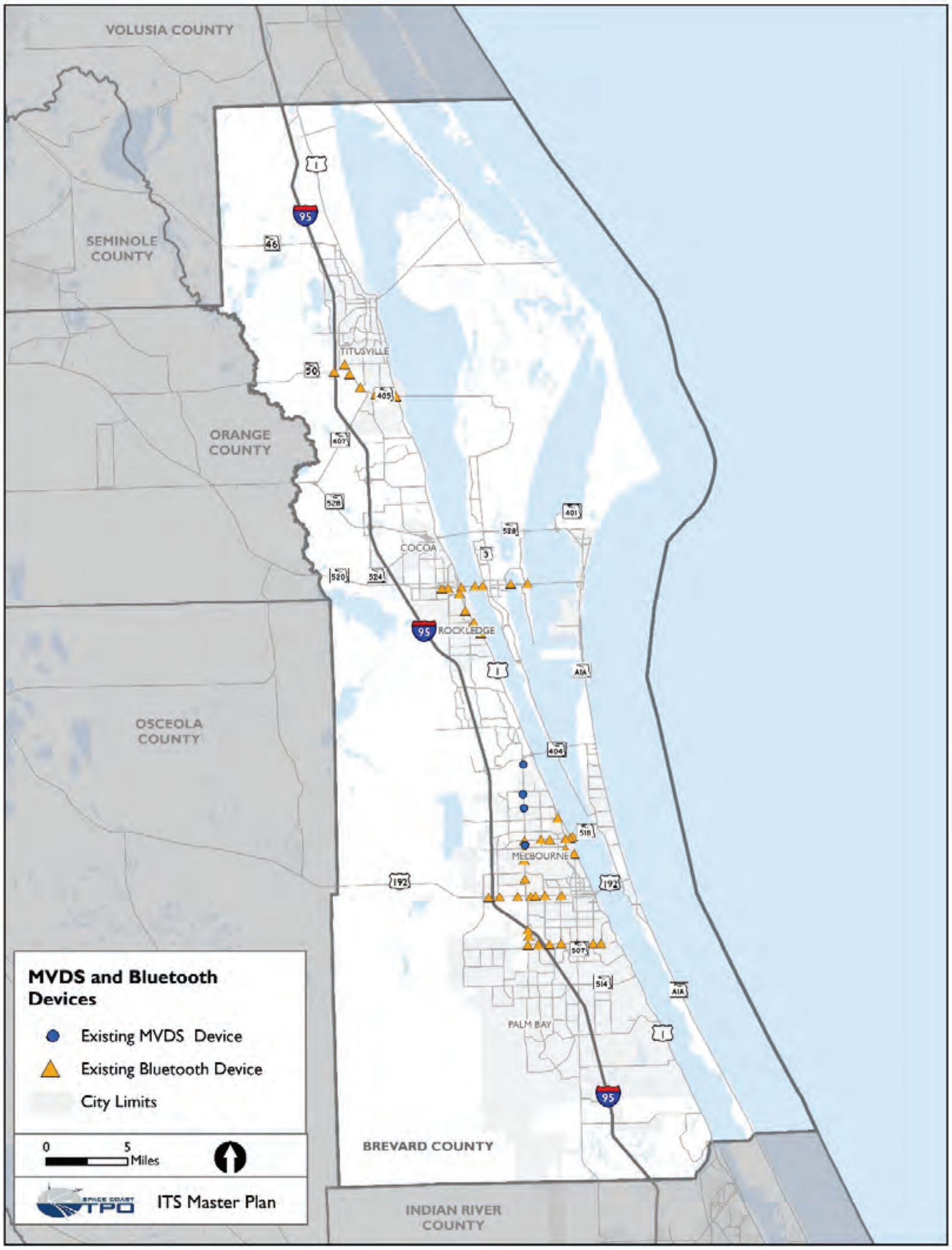
Figure 2-6: Brevard County DMS Locations



Microwave Vehicle Detection Systems and Bluetooth

MVD systems and Bluetooth are being used throughout Brevard County to compile data on vehicle counts, speed, and occupancy. Bluetooth devices are used to determine travel speed, travel time, and origin-destination data for a corridor or route. By using this technology, the County can further understand traffic conditions and plan for future projects to reduce congestion in the area. Figure 2-7 illustrates MVDS and Bluetooth device locations. The majority of the Bluetooth devices currently installed are non-functional because of advances in technology and system support. The devices maintained by the City of Melbourne continue to be active.

Figure 2-7: Brevard County MVDS and Bluetooth Locations



2021 Intelligent Transportation Systems Master Plan Update

Needs

SPACE COAST
Transportation Planning Organization

Introduction

In addition to understanding current conditions and plans, it is important to compile a list of overall project needs as identified by the stakeholders and the Space Coast Transportation Planning Organization (SCTPO). Development of this list of needs was based on an understanding of existing conditions and issues, such as congestion management at events, safety, and agency coordination, and on input from stakeholders.

The following discussion presents trends and factors that may influence decisions about future projects and policy.

Evaluation of the Transportation System

The 2019 State of the System (SOS) Report identified a number of trends that directly relate to the opportunities that Intelligent Transportation Systems (ITS) implementation can provide. While, generally, the safety and congestion metrics trended downward from 2018 to 2019, the high-crash, high-congestion corridors—especially those that do not have projects programmed in the Transportation Improvement Program (TIP)—remain candidates for ITS projects.

Population Growth

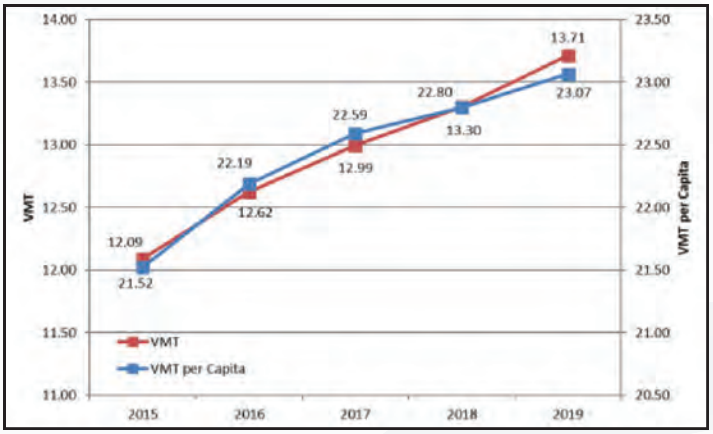
Population growth has a significant impact on the pressure placed on transportation infrastructure. While growth during the Recession years of the early 2000s was low, it has since rebounded, with a growth rate of 1.83 percent. 2019 saw annual growth approximately 0.4 percent higher than the growth in 2018. This was higher than the overall state growth rate of 1.74 percent.

Traffic Volumes

The traffic volumes along each roadway segment in Brevard County, combined with information on the length of each segment, yields an understanding of the "amount" of driving Brevard County residents have performed. This statistic, known as Vehicle Miles Traveled (VMT), is an important factor in understanding travel demand. A second important factor, VMT per capita, is calculated by dividing the total VMT for all SOS roadways (Strategic Intermodal System (SIS) roads and non-SIS roads) by the total population in the County. The VMT per capita estimates the distance traveled by each resident per day.

In 2019, VMT in Brevard County continued to increase by 3.1 percent from the previous year, following the upward trend observed between 2015 and 2018 (see Figure 3-1). Furthermore, 2019 VMT per capita also has increased by 1.2 percent.

Figure 3-1: VMT and VMT per Capita on SOS Roadway Segments (2015-2019)



Source : 2019 SOS

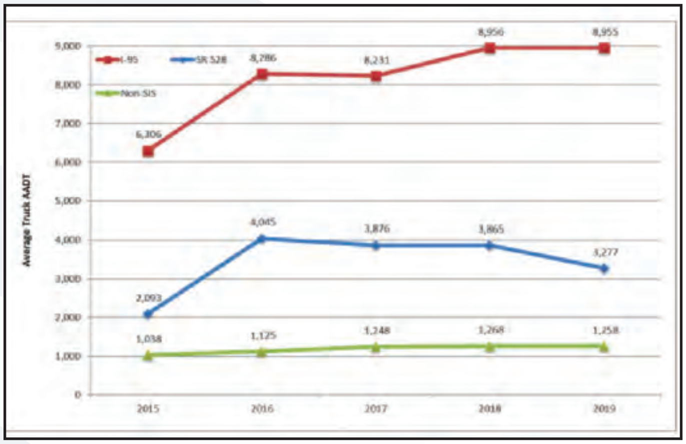
Busiest Intersections

Busy intersections contribute to overall congestion and there can be safety implications. The volumes at these intersections were calculated based on the total average annual daily traffic (AADT) for each approaching segment. This was intended to identify intersections with the highest entering volumes. As noted in the 2019 SOS, most of the previously identified busiest intersections remain on the list. Five of the top 20 busiest intersections are located on U.S. Highway 192 (US 192), five are located along Wickham Road/Minton Road, four are located along Palm Bay Road, two are located along U.S. Highway 1 (US 1), and two are located along Malabar Road (intersections between two of the listed roadways were only counted once; for example, the intersection of Wickham Road at US 192 was only counted for US 192).

Freight Traffic

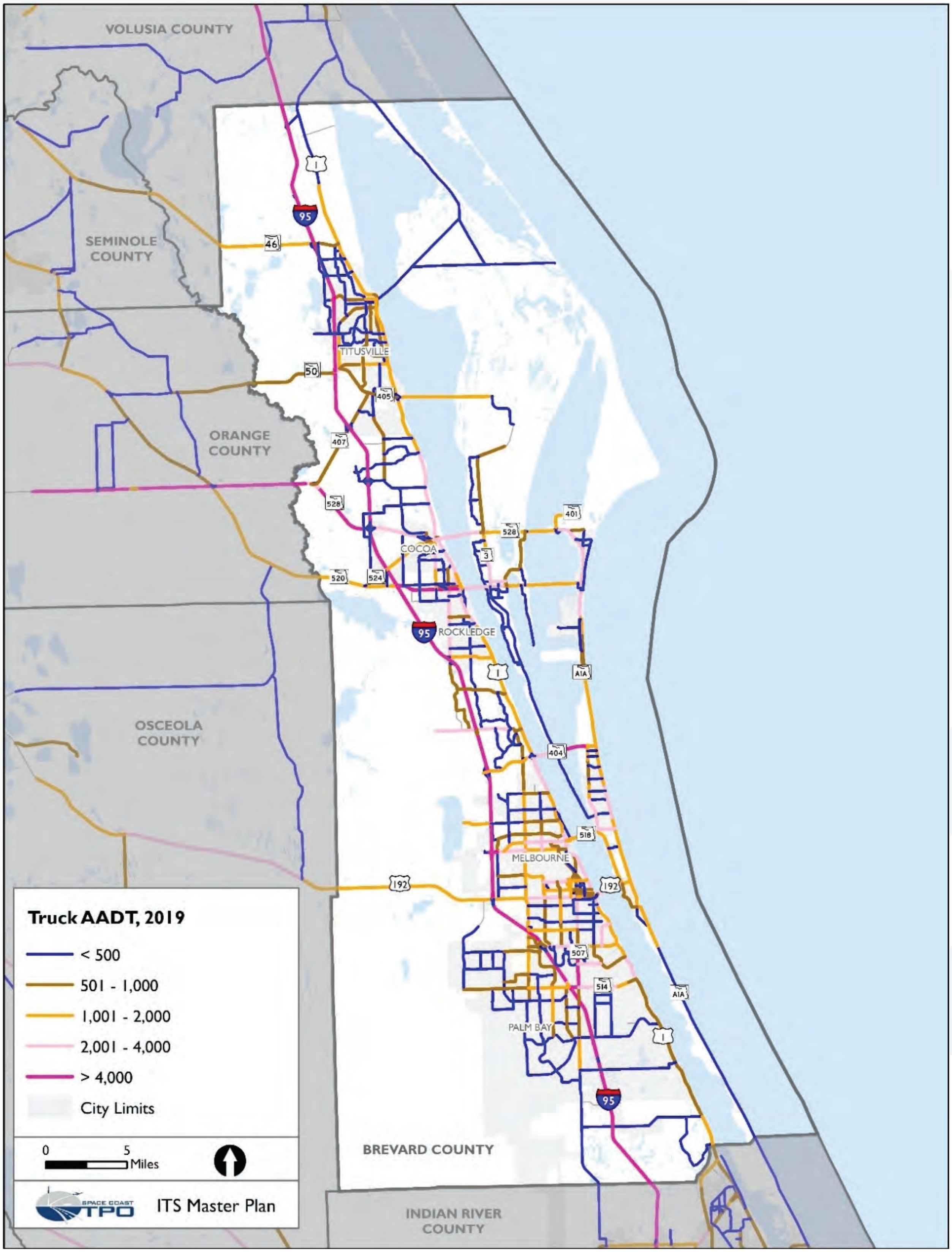
Freight and shipping contribute millions of dollars to the County economy and rely heavily on the County roadway system. The amount of truck traffic on Interstate 95 (I-95), State Road 528 (SR 528), and the surrounding roadway network serves as one indicator of freight and goods movement through the County, as those roads carry large volumes of trucks due to the activity at Port Canaveral and Orlando-Melbourne International Airport (MLB). Within Brevard County, the two SIS facilities, I-95 and SR 528, both saw freight volumes decrease in the years since the significant increase related to the port deepening project at Port Canaveral, which was completed in 2015. I-95 truck traffic volume decreased 0.1 percent from 2018 to 2019 and SR 528 saw a 15.2 percent decrease. Truck traffic volume on all other SOS roadways decreased for the first time in eight years. Truck traffic on SOS roadways increased by 0.8 percent from 2018 to 2019, increased by 1.6 percent from 2017 to 2018, increased by 11 percent from 2016 to 2017, and increased by 8 percent from 2015 to 2016.

Figure 3-2: Average Truck AADTs (2015-2019)



Source : 2019 SOS

Figure 3-3: Truck Volumes

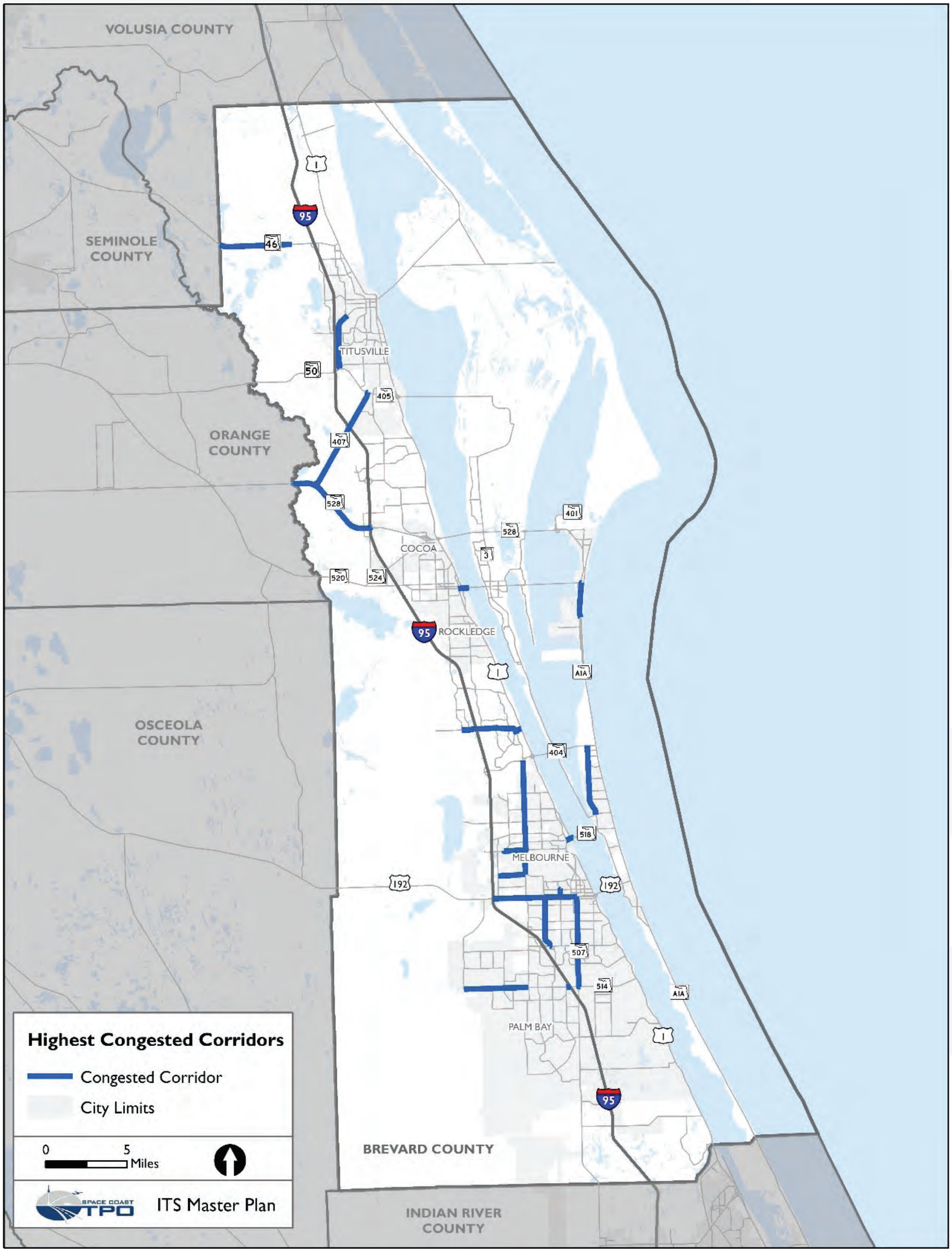


Corridor Congestion

The volumes/capacities from the 2019 SOS data were reviewed on a corridor level by calculating the weighted average of the corridor's AADT versus the weighted average of the corridor's capacity. In addition to the overall corridor congestion, the segments comprising the corridors were reviewed to identify spot locations where congestion is present. It was found that 42 of 219 corridors had one or more segments with volume to capacity (v/c) ratios > 0.85. Overall corridors with average v/c ratios higher than 1.0 included the following:

- SR 520 (westbound) from the Causeway to US 1
- Malabar Road from San Filippo Drive to I-95
- SR 520 (eastbound) from US 1 to Riveredge Boulevard
- SR 46 from Volusia County Line to Fawn Lake Boulevard

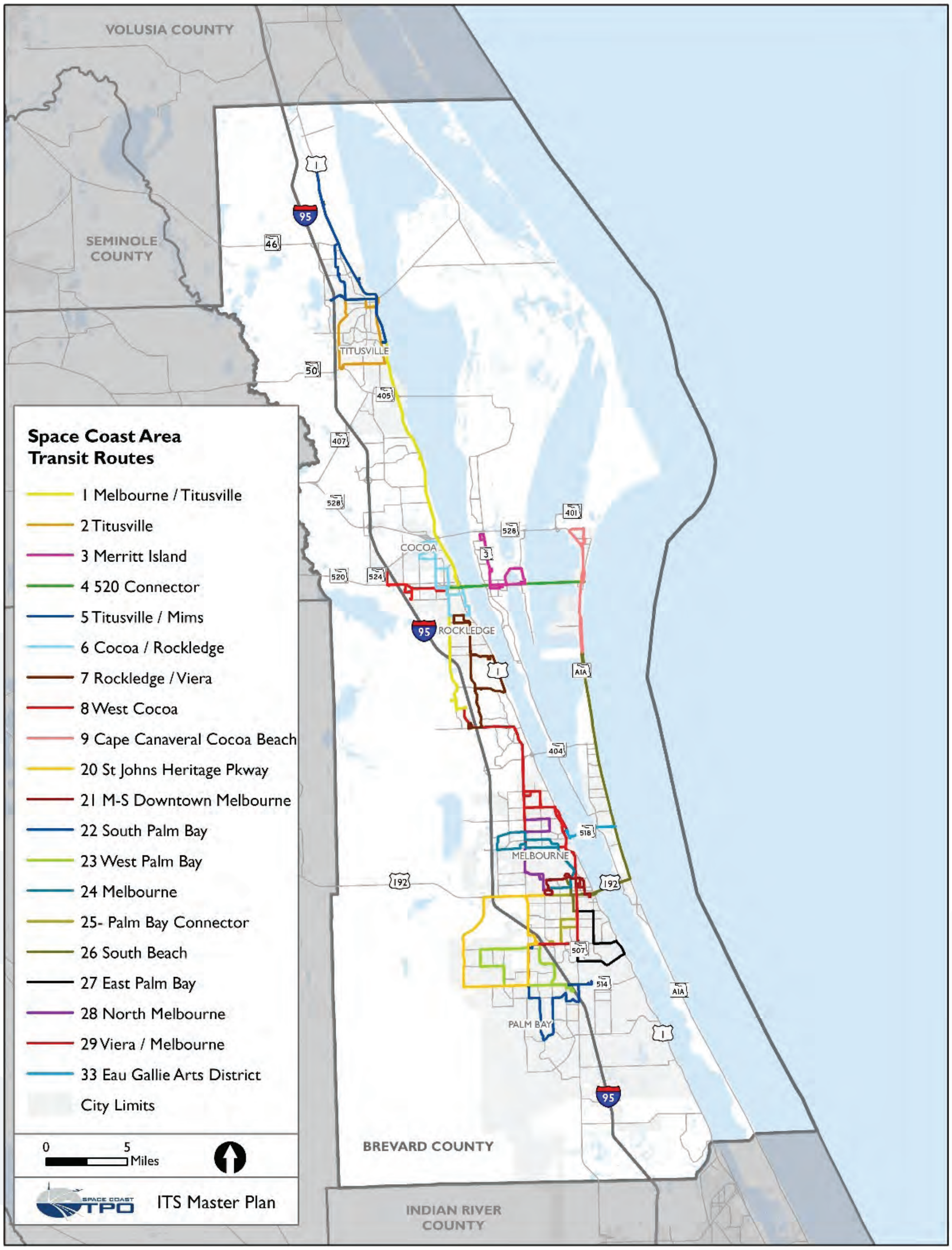
Figure 3-4: Corridors with Highest Rates of Congestion



Transit

Bus service is an important component of the County's multi-modal transportation network. The following map illustrates the fixed-route system run by Space Coast Area Transit. In 2019, Space Coast Area Transit experienced an overall ridership decrease (14.9 percent).

Figure 3-5: Space Coast Area Transit System



The 10-year Transportation Development Plan (TDP) was completed in 2017. Improved span of service is envisioned systemwide in 2020, with five additional fixed routes being added by 2023.

Table 3-1: Fixed-Route Expansion

Fixed-Route Expansion
Palm Bay-Malabar—with 100% Americans with Disabilities Act (ADA) coverage
Malabar-Degroodt-Bayside—with ADA coverage of 50% of route
Malabar-San Filippo-Bayside—with 100% ADA coverage
Melbourne-Sebastian via US 1—with ADA coverage of 60% of route
Palm Bay-Barefoot Bay-Sebastian via US 1—with 100% ADA coverage

Bicycle/ Pedestrian Facilities

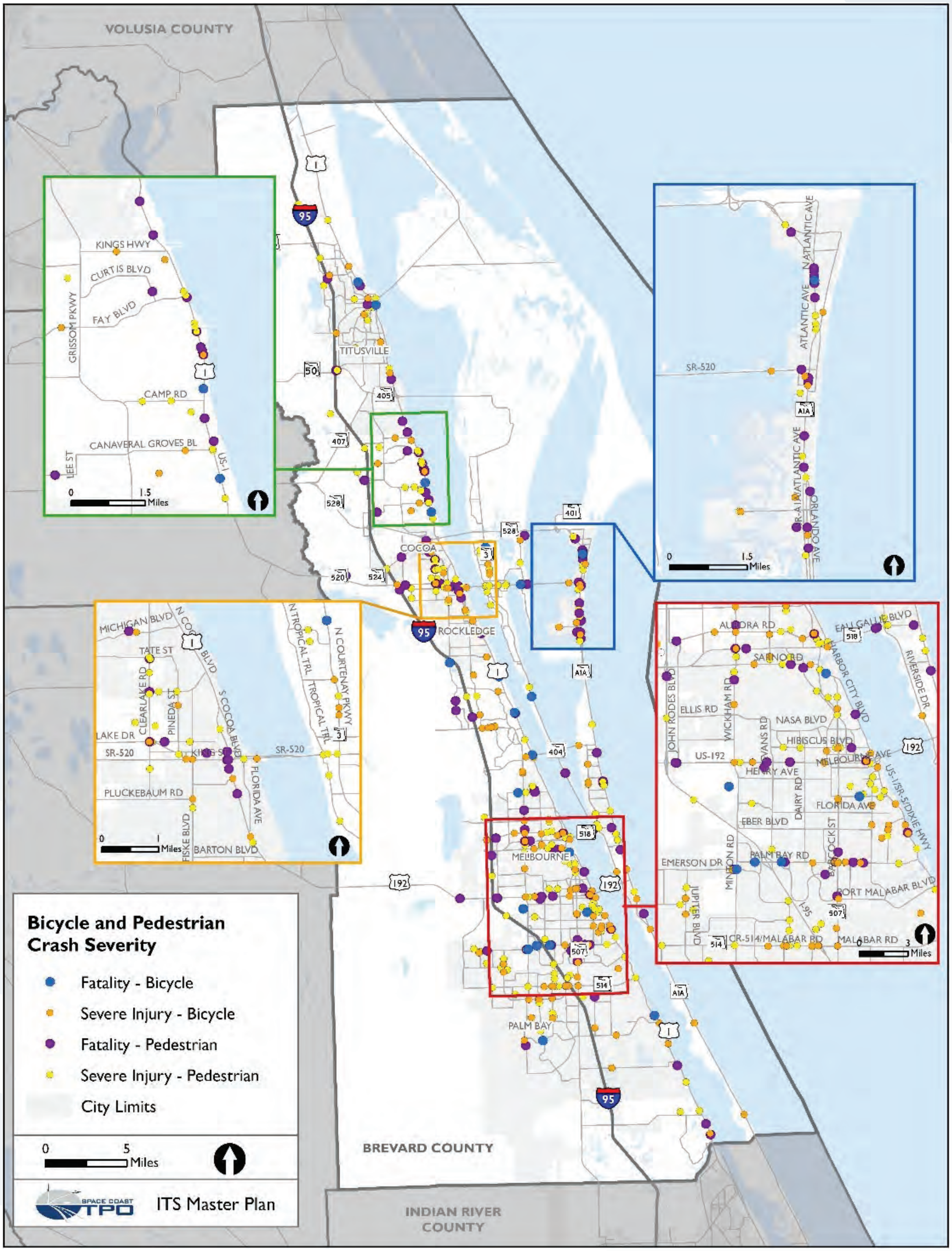
The SCTPO recently adopted a new Bicycle and Pedestrian Master Plan. The plan lists more than 400 miles of bicycle improvements and 251 miles of pedestrian improvements along 137 priority corridors. The plan supplements recommendations made in a number of Florida Department of Transportation (FDOT), SCTPO, or local agency-led corridor plans. These recommendations may be constructed as stand-along projects or as part of corridor or intersection reconstruction.

Bicycle/Pedestrian Crash Trends

Brevard County was ranked as one of the top 15 counties in Florida for pedestrian/bicycle crashes. Because of this, the SCTPO is placing a greater emphasis on safety for these types of vulnerable road users. Pedestrian and bicycle crash data from 2014 to 2018 was used to identify high-crash corridors. Most of the corridors having high pedestrian and bicycle crash frequencies are located along SR A1A, US 1, and Wickham Road. In 2019, Smart Growth America published its annual Dangerous by Design report. The Palm Bay-Melbourne-Titusville area was ranked number 3, with 165 pedestrian deaths between 2008-2017. Florida ranks number 1 as the most dangerous state in which to walk.

The following maps illustrate all bicycle and pedestrian crashes from 2014 to 2018.

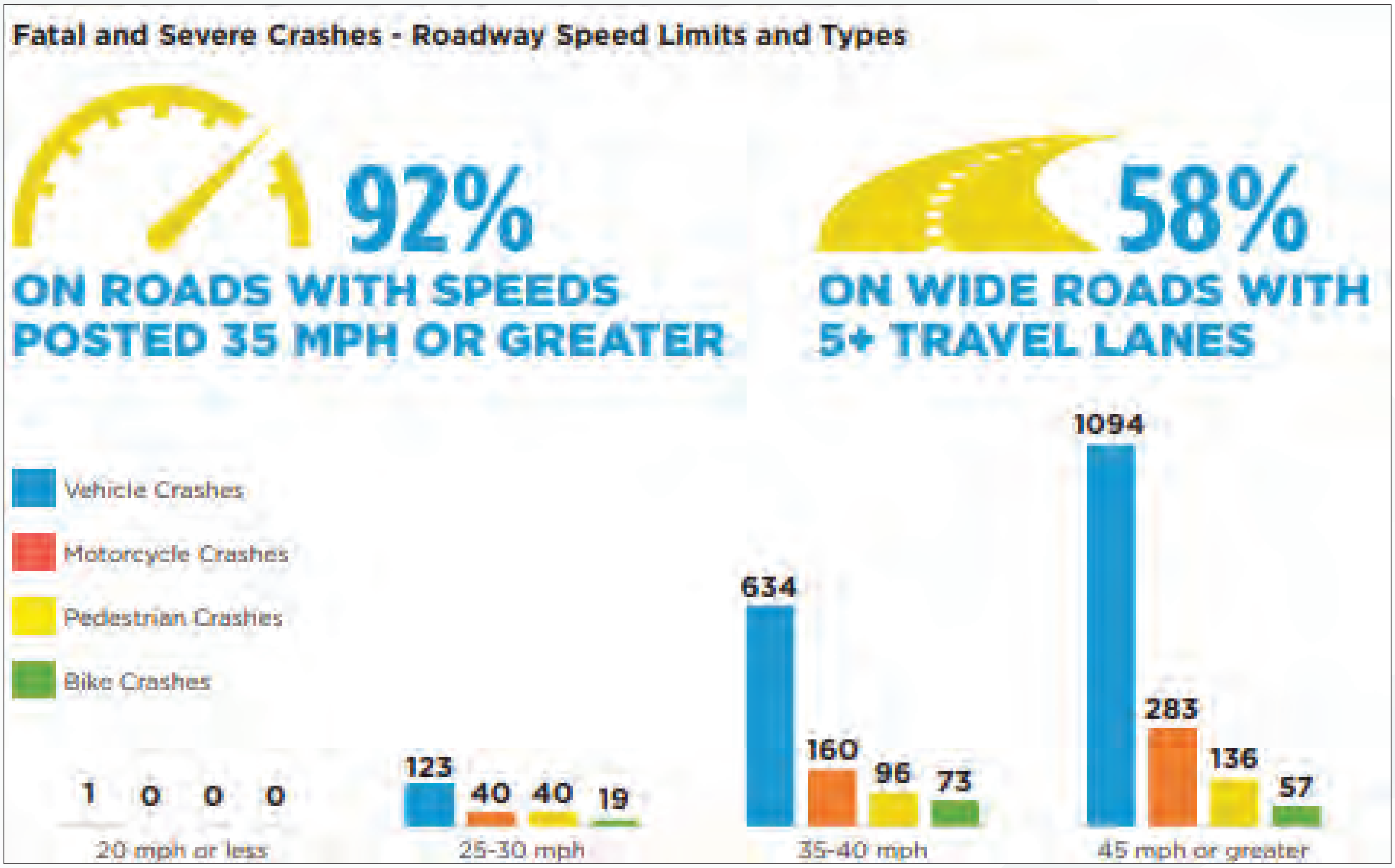
Figure 3-6: Fatal and Severe Injury Bicycle Crashes



Vision Zero Action Plan

The goal of the SCTPO Vision Zero Action Plan is to change the paradigm to no longer accept traffic fatalities and severe injuries as status quo. Using an in-depth, data-driven, and collaborative approach, the Plan identifies and analyzes trends by mode and characteristics such as posted speed and road type.

Figure 3-7: Fatal and Severe Crashes

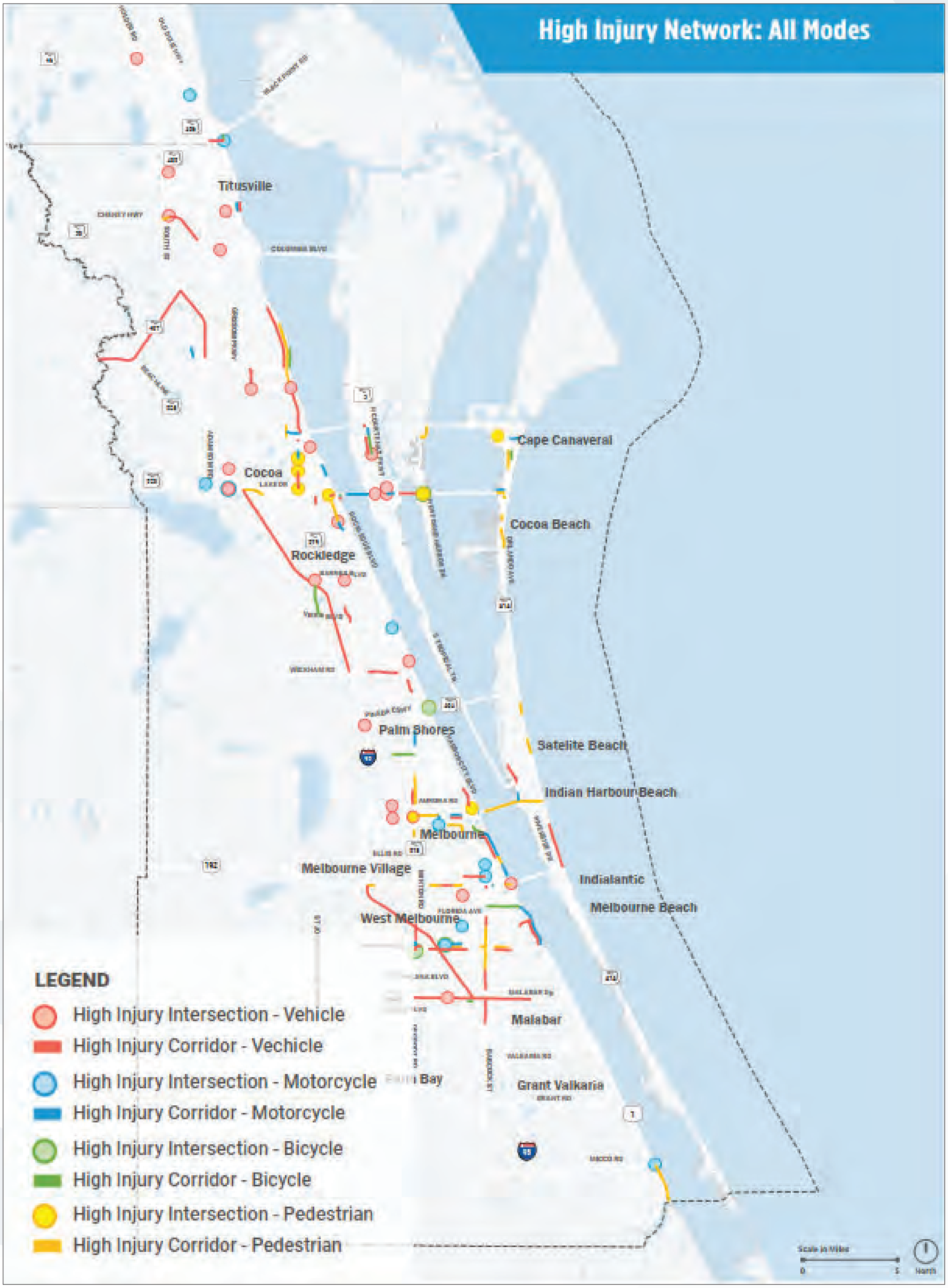


Source: SCTPO Vision Zero Action Plan

Additional information—such as time of day, weather conditions, and behaviors—also were analyzed.

The Plan used the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual Equivalent Property Damage Only Average Crash Frequency Method to determine crash frequency and determined that the High Injury Network spans 15 percent to 20 percent of the roadway network, and it accounts for 55 percent of all fatal crashes and 15 percent of all severe injury crashes.

Figure 3-8: High Injury Network: All Modes



The plan identifies specific actions that can be taken to reduce crashes, including those presented in Table 3-2, which could be addressed with ITS solutions.

Table 3-2: Actions to Reduce Crashes on Brevard County Roadways

Engineering & Enforcement
Work with FDOT and individual cities to implement best practices in setting target speeds and speed limits.
Encourage the use of speed feedback signs on high-injury corridors.
Target the Vulnerable Road User High-Injury Network to gather count data.
Explore corridors where a speed management pilot would be applicable and could be deployed.
Using the High-Injury Network, prioritize lighting projects to reduce crashes where dark/unlit conditions are an observed crash factor.

Previously Identified Needs

The following tables list specific needs identified in the previous plan that still are considered most important by stakeholders, along with projects either under construction or in development and specific future projects that have been identified by local agencies.

Table 3-3: Needs and Status

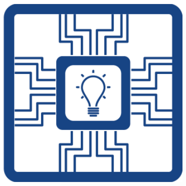
Identified Need	Description	Status
Traffic Management Center (TMC) support	The construction of the new TMC will upgrade the technology needed to allow for areawide ITS monitoring and management; however, staffing limitations continue to hamper the system. Software needs include the need to request control and design needs to consider unicast versus multicast capabilities. SunGuide Account Access provides better coordination of equipment to avoid duplication of hardware and sharing of resources.	Design beginning in 2021
Active Arterial Management (AAM)	Currently, the arterial network is maintained and operated by four different agencies. There is a lack of consistency in the level of service, as well as a lack of uniform performance measurement throughout the region. AAM seeks to optimize the arterial network through performance-based operations and maintenance initiatives.	
Insufficient Maintenance and Resources	Insufficient staffing resources and a lack of funding lead to inconsistent arterial signal/ITS maintenance and operations practices. The result is the current infrastructure not being used to its fullest capabilities, which inhibits the use of performance management.	
Regional Signal Coordination/Re-timing	Regular signal retiming can improve system efficiency. Lack of staffing and funding resources impact the ability to gain efficiencies.	Brevard County is developing a retiming plan; FDOT retimes signals on State Roads on a 5-year cycle, City of Melbourne retimes their signals on a 3-year cycle.
Work Zone Management	Work zone management can lead to improved safety and travel time improvements through work zones.	
Transit-Based ITS	Increasing transit-based ITS, such as Automatic Vehicle Location systems and Transit Signal Priority, could increase system efficiency, which would improve ridership.	Currently being implemented by Space Coast Area Transit
Asset Management	Enhance asset management by incorporating FDOT's ITS Facility Management (ITSFM) software. The ITSFM software enables increased ITS availability because the ITS Operation and Maintenance (O&M) personnel have access to accurate asset inventory and as-built data needed to efficiently maintain the ITS subsystems, including camera feeds to the state wide 511 Traffic Information System, which is used by millions of people each year. ITSFM helps keep ITS information accurate in real-time and provides users the confidence to trust system output and reports.	
Railroad Signal Pre-Emption along US 1	Signal pre-emption along US 1 at railroad crossing locations	Study underway to develop recommendations; will coordinate with TMC
Wireless Connectivity	Potentially used along beaches and constrained corridors or as redundant network for fiber	Will replace existing radio communications for City of Melbourne
Traffic Incident Management (TIM) Coordination	Coordinated by FDOT with local involvement	

Table 3-4: Existing/Planned and Future Unfunded Projects

Identified Need	Description	Status
FDOT District 5 and local agencies	Upgrading traffic signal controllers to ATC models districtwide	
FDOT District 5 and local agencies	Intersection Movement Count (IMC) cameras, installed as part of the PedSafe/Greenway project (Sept 2020)	
City of Melbourne	Intersection Movement Count (IMC) cameras, installed as part of the PedSafe/Greenway project (Sept 2020); Expansion projects on US 1, Babcock, and Strawbridge	NASA Blvd Expansion Project
City of Palm Bay	Malabar Road ITS corridor (Jupiter to I-95 to Babcock); project will link the signals with fiber and wireless communications for signal timing and install Dynamic Message Systems (DMS) and cameras to manage the corridor	
Space Port	Space Florida: NASA Causeway, Space Commerce Way. Fiber optic cable from US 1, Dynamic Message Signs (DMSs), closed-circuit television (CCTV), microwave vehicle detection system (MVDS), Bluetooth travel time sensors, bridge security and load monitoring, smart streetlights	

While the stakeholder and implementing agencies take a ground-level or project view limited mostly to their own jurisdictions, the TPO—as an oversight and funding agency—is interested in a higher-level perspective. Throughout the data-gathering phase, discussions were held with SCTPO staff about how to define those needs and how they coordinated with the projects. The needs identified by SCTPO staff include: Safety, Innovation/Technology, Operations, Corridor Function, Resiliency, and Leadership/Policy. These needs are further defined below:

Safety. These projects or strategies will be related to the Vision Zero High-Injury Network and vulnerable road users.



Innovation/Technology. These projects or strategies are specifically related to being ready for future technologies.

Operations. These projects or strategies are specifically related to people and better management of the system(s).

Corridor Function. These projects or strategies are related to what is needed for the most heavily congested corridors to work better and will include approaches such as Active Arterial Management (AAM) or Integrated Corridor Management (ICM).

Resiliency (including redundancy and security). These projects or strategies are related to what needs to be done so that the system can withstand stressors over time and bounce back after a hurricane or other major event.

Leadership/Policy. These projects or strategies relate to the information our elected officials need to make policy decisions that will ultimately lead to more funding for operations and maintenance and the overall system.

These needs correspond to the direction the agency has been taking with the recently published Vision Zero Plan and 2045 Long-Range Transportation Plan. They also provide the context for the next phase of plan development. The following Table 3-5 includes a broad list of needs identified by the stakeholders during the general discussion of area needs. Many of these needs relate more directly to issues they are experiencing "on the ground" and may be applicable to specific locations or corridors, but some of them have regional application.

Table 3-5: ITS Needs Identified by Stakeholders

ITS NEEDS
Communications
Expand existing traffic operations communications
Adopt FDOT standards/adapt to local needs
Traffic Operations and Management
TMC Operations
Regular Signal Re-Timing
Regional Signal Coordination
Improve Pedestrian/Bicycle Safety
Expand Video Surveillance
Automated Traffic Signal Performance Measures (ATSPM)
Expand Traffic Data Management (Travel Time, Speed and Volume)
Traffic Signal Control Interoperability
Reduce Interstate Congestion – Off ramps
CAV Signal Systems
Adaptive Signal System
Rural Safety
EV infrastructure
Traveller Information
DMS Installation
Dynamic Detour Route Development and Management
Expand 511 to Arterial System
Parking Management
Advanced Railroad Crossing Technology
Incident Management
Interagency Incident Management (TIM/RISC)
Incident Scene Safety
Public Transit Management
TSP Support/ Queue Jumps
Automatic Vehicle Location (AVL) and Automatic Passenger Counter (APC)
Passenger Advisory System
Mobility as a Service
Improve First Mile – Last Mile Service
Increase Ridership
Emergency Management
Remote Monitoring/ Information Sharing
Automatic Incident Detection
Incident Scene Safety
Evacuation Planning

2021 Intelligent Transportation Systems Master Plan Update

Intelligent Transportation Systems Strategies

SPACE COAST
Transportation Planning Organization

Introduction

The previous sections for the 2021 Intelligent Transportation Systems Master Plan Update analyzed the existing conditions, identified stakeholder needs, and detailed gaps in the various networks and current transportation system. Those needs and areas where there currently are gaps include managing congestion, enhancing safety, collaborating with agencies, and staying on top of operations and maintenance. Additionally, the lack of dedicated funding for signal system maintenance, arterial operations, and capital improvements continues to limit the possible benefits to the overall transportation network and impedes improvements to system efficiency and reliability. The recommended strategies, therefore, include the installation of technology, but also updates to operational policy and programmatic upgrades.

Each stakeholder need was evaluated and classified under one of two categories: technology deployment or programmatic/operational policy. In many cases, both categories apply. The recommendations in response to the needs may be a technology deployment or it may be an operational or policy improvement.

Technology strategies include hardware-based strategies, devices, or systems to accomplish a particular function or achieve a specified solution. These strategies rely on the physical manifestation of an installation to achieve the objective and typically require capital costs for construction and continuing maintenance and operations costs. One example is the installation of closed-circuit television (CCTV) cameras deployed to monitor real-time traffic and roadway conditions.

Conversely, programmatic strategies do not rely solely on the physical implementation of a solution but involve procedural, policy, or back-end development support (e.g., software solution) that are necessary for successful program management. Programmatic solutions cannot be readily purchased as off-the-shelf offerings. Examples of programmatic strategies include the development of Standard Operating Guidelines (SOG) for signal retiming or the development of a customized data dashboard for arterial roadway traveler information. The approach taken as part of this master plan update includes projects and strategies identified in both categories.

Recommended Strategies

Technology Deployment

Ethernet-Based Communication. This is a technology subset used to transmit and receive data between field devices, Traffic Management Centers (TMCs), partner stakeholders, third-party providers, and other interested entities. Ethernet-based communication is key to developing a reliable, functional Intelligent Transportation System (ITS) providing all of the desired applications.

While fiber optic communication is the preference based on reliability, maintenance, and cost, communication also can be established using either cellular or point-to-point wireless means. Connections between all end devices and the central network and redundancy are two important considerations. Ethernet-based communication includes physical cabling (e.g., fiber optics, twisted-pair copper patch cables), Layer 2 network switches, Layer 3 network routers, fiber optic connection hardware (e.g., splice enclosure, patch panel), cellular modem, and wireless access point (WAP) radios.

CCTV Camera. This is a technology subsystem used to provide video feeds to monitor real-time roadway and traffic conditions. The video imaging captured by field devices will be transmitted to the centralized network and routed to the appropriate TMCs for use with various applications (e.g., display on video walls, advanced video analytics).

Cameras are available in two primary functional types: fixed and pan-tilt-zoom (PTZ) (Figure 4-1). Regardless of type, the preference for all cameras is high-definition, IP-based models. Cameras may be installed along limited-access interstates and arterial corridors at either signalized intersections or mid-block locations.

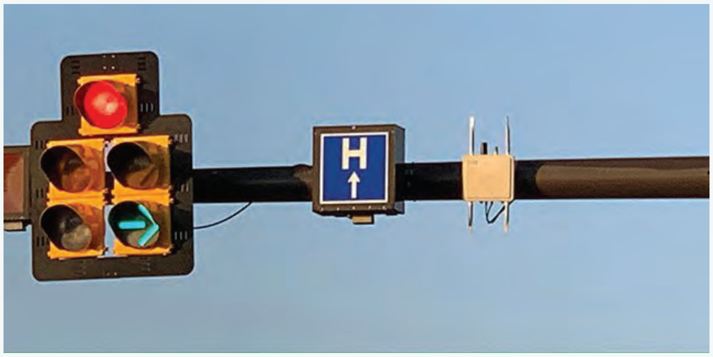
Figure 4-1: Examples of CCTV Cameras

Figure 4-2: Examples of Traffic Signal Controllers

Traffic Signal Controller. This is a technology subsystem used to manage both detection inputs (e.g., vehicles, bicyclists, and pedestrians) and signal outputs within a signalized intersection. The upgrade of existing or installation of new traffic signal controllers should include models that adhere to the Advanced Transportation Controller (ATC) standard. ATC models will provide the local maintaining agency the ability to generate high-resolution data for applications such as Advanced Traffic Signal Performance Measures (ATSPM), as well as other higher-level functionality, such as Connected Vehicle (CV) applications (e.g., Signal Phase and Timing [SPAT], Transit Signal Priority/Emergency Vehicle Preemption [TSP/EVP]).

Connected Vehicle Roadside Unit. This technology subsystem is used to exchange information between vehicles and the roadside infrastructure using wireless communication methods. Roadside units (RSUs) will provide the local maintaining agency the ability to provide real-time information concerning traffic patterns and roadway conditions directly to the motorist through in-vehicle systems. Example in-vehicle messages provided to motorists include SPAT, Traveler Information Messages (TIMs), Roadside Alerts (RSAs), Pedestrian in Crosswalk, and more. Based on a recent ruling from the Federal Communications Commission (FCC), all RSU models should support Cellular Vehicle-to-Everything (C-V2X) communications. RSUs may be installed at signalized intersections and mid-block locations within the arterial corridors, as well as along the limited-access interstate.

Figure 4-3: Example of a Roadside Unit



Dynamic Message Sign. This technology subsystem is used to provide travelers with real-time information concerning unique driving conditions, events, or alerts through variable electronic display messages. Dynamic message signs (DMSs) are fully customizable and can be managed remotely from the TMCs to display the appropriate messages, including travel time information, closures and detour guidance, construction zones, incident and special event notifications, and general public safety messages (e.g., AMBER alert). Deployed as either overhead or ground-mounted signing, DMS displays come in a variety of sizes depending on the geometry and posted speed of the roadway (e.g., interstate vs. arterial). Embedded DMSs are small-scale displays installed into static signs with a maximum one word or one line text-based messaged (e.g., "OPEN," "CLOSED," "FULL").

Figure 4-4: Example of a Dynamic Message Sign

Blank Out Signs. This is a technology subsystem used to provide information to motorists from a predetermined set of electronic displays. Blank out signs are manufactured with a defined number of LED displays, typically ranging from one to six; however, some models can accommodate more than 100 displays on a single sign. Blank out signs are effective means for communicating information to motorists and they typically are used to reinforce non-standard conditions, such as "YIELD TO PEDESTRIAN," "NO LEFT TURN," or "TRAIN APPROACHING." These signs can be installed at either signalized intersections on overhead signal structures or at significant destinations via ground-mounted options.

Figure 4-5: Examples of Blank Out Signs

Vehicle Detection System. This technology subsystem is used to collect real-time traffic conditions, including vehicle presence, passage, travel time, travel speed, volume, lane occupancy, origin-destination, and more. Vehicle detection systems will be deployed at signalized intersections to activate signal phasing, as well as midblock locations along the arterial and limited-access interstate corridors to determine real-time traffic data. Vehicle detection system are available in numerous forms, including bluetooth/wi-fi readers, microwave and doppler radar, video imaging systems, inductive loops, wireless magnetometers, and more.

Figure 4-6: Example of a Vehicle Detection System

Pedestrian/Bicycle Detection System. This technology subsystem is used to determine real-time traffic conditions for vulnerable road users—namely, pedestrians and bicyclists. These detectors will function similarly to vehicle detection systems by activating signalized intersections to provide the appropriate phase for pedestrian and/or bicycle crossings, while also collecting real-time data such as presence, volume, origin-destination, and more. Pedestrian detection systems are available in two classifications: active and passive. The primary difference is active systems require action or involvement from the pedestrian (e.g., push button detector), whereas passive systems detect pedestrians automatically through radar, video imaging, Light Detection and Ranging (LiDAR), or other means. These systems may be deployed at signalized intersections, mid-block crossing locations, and areas of high pedestrian traffic.

Figure 4-7: Examples of Pedestrian/Bicycle Detection Systems

Adaptive Traffic Signal Control. This technology subsystem is used to dynamically adjust traffic signal phasing and timing to accommodate changing traffic patterns and ease congestion based on real-time vehicle detection. Adaptive traffic signal control (ATSC) technology provides an additional layer of logic to the traffic signal controller to perform high-level analysis of the detection inputs to optimize the time allotted to each movement. ATSC is delivered in a number of forms—including software-based solutions (e.g., SynchroGreen) and hardware-based deployments (e.g., InSync)—and can be implemented either with optimization occurring at each intersection or from a centralized server, such as the Sydney Coordinated Adaptive Traffic System (SCATS). It is important to note that ATSC is not applicable at all locations and tends to yield the best results when deployed as a corridor-wide solution with dependency on adequate vehicle detection systems.

Transit Signal Priority. This is a technology subsystem used to detect transit vehicles (e.g., buses) and provide favorable traffic signal phase and timing conditions to reduce dwell time at signalized intersections and improve overall running time operation. Typically, the operational improvements are achieved by extending green or shortening red phases as the transit vehicle approaches the intersection. Transit signal priority (TSP) systems can be either centralized or distributed, often relying on either Global Positioning Systems (GPS) or field hardware (e.g., infrared optical or radio transceivers). TSP can be deployed at signalized intersections and is best suited for corridor-wide implementations.

Emergency Vehicle Preemption. This technology subsystem is used to detect emergency vehicles (e.g., fire truck, ambulance) approaching a signalized intersection to halt conflicting traffic and provide right of way to reduce response times. This differs from signal priority systems by preempting signal phases as necessary to ensure the emergency responder vehicle is provided the green phase at arrival to the intersection. Detection hardware for emergency vehicle preemption (EVP) includes GPS, infrared optical, acoustic, and localized radio signal systems. EVP can be deployed at isolated intersections or as a corridor-wide solution.

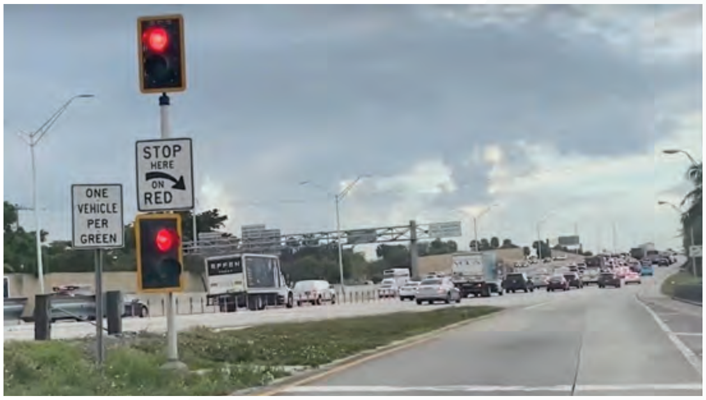
Wrong Way Driving System. This technology solution is comprised of multiple subsystems used to detect and notify motorists as well as alert operational staff of wrong way driving events in real time. Wrong Way Driving Systems (WWDS) are composed of three primary elements: detection subsystem, motorist warning subsystem, and logic controller. Providing flexibility to accommodate all geometric scenarios, the detection subsystem is available in numerous forms, including inductive loops, microwave and doppler radar, LiDAR, and thermal imaging video. Similarly, the motorist warning subsystem is available in a variety of forms, including rectangular rapid flashing beacons (RRFBs), light-emitting diode (LED)-embedded sign panels, standard flashing beacons, blank out signs, and more.

Following the detection of a vehicle entering a roadway in the wrong direction, the WWDS will begin to notify the driver of the need to perform corrective measures (e.g., turn around). If the vehicle continues to travel in the wrong direction, the system will trigger an event verification in which the preprogrammed response will activate. This response is variable and determined by the maintaining agency and can include automated email or text message communications to a canned distribution list, alerts provided to the TMC, notification provided to local emergency responders, override of DMS displays with warning messages, and more. WWDSs typically are deployed at the off-ramps of major interchanges, such as limited-access interstate exit ramps to arterial corridors.

Figure 4-8: Example of a Wrong Way Driving System

Ramp Signal System. This technology solution is comprised of multiple subsystems used to regulate the flow of traffic entering freeways based on real-time traffic conditions of either the mainline or the ramp. Typical ramp signal systems (or "ramp metering") deployments include three primary elements: vehicle detection subsystem, traffic signaling subsystem, and logic controller. Vehicle detection systems are employed on both the mainline and on-ramp to identify potential gaps in mainline traffic volume, allowing for vehicles to seamlessly integrate into the flow without disruption. Vehicles on the ramp are provided green or red indications from the traffic signal heads to dictate the appropriate movement and meter incoming traffic. All detection inputs and signal outputs are managed by the local signal controller. Ramp signal systems are deployed on interchange on-ramps entering onto major freeways.

Figure 4-9: Example of a Ramp Signal System



Advanced Motorist Warning System. This is a subset of technology used to provide drivers with visual cues to emphasize or draw attention to potentially dangerous conditions to either motorists or vulnerable road users (e.g., pedestrians, bicyclists). Advanced Motorist Warning Systems (AMWS) are available in a variety of forms and can be operated in either continuous or activated modes with complimentary detection subsystems. The following represent potential AMWS deployments:

- Standard flashing beacon
- RRFB
- LED-highlighted sign
- High-Advisory Crosswalk (HAWK)

Figure 4-10: Examples of Advanced Motorist Warning Systems

Electronic Feedback Signs. This technology subsystem is used to provide variable information to motorists based on either integrated detection systems or information provided from the centralized network. Electronic feedback signs are designed to provide additional safety benefits through traffic calming and speed reduction. Examples of electronic feedback signs include:

- Variable Speed Limit (VSL) sign
- Driver Feedback Signs (e.g., "YOUR SPEED")

Figure 4-11: Examples of Electronic Feedback Signs

Intelligent Lighting. This subset of technology applies advanced controller logic to roadway lighting to provide increased visibility of high-emphasis areas (e.g., crosswalks), reduced power utilization, and dynamic adjustments of luminance levels based on detection, time of day, and other parameters. Intelligent lighting systems are deployed in conjunction with other subsystems—including vehicle, bicycle, and pedestrian detection—with applied business logic to meet the specific needs of each location. This technology is applicable at both signalized and unsignalized intersections, as well as arterial corridors and mid-block locations (e.g., pedestrian crossings). Examples of intelligent lighting include:

- Lighted crosswalks
- In-road lighting
- Adaptive lighting

Figure 4-12: Examples of Intelligent Lighting

Advanced Transit Mobility Kiosk. This subsystem of technology provides transit users at specified stops with real-time information on the transit system via a user interface. Through connection with the centralized network and computer-aided dispatch (CAD) system, the transit agency can provide updates on schedules, arrival times, optimal routes, connection points, multimodal options, pricing, and more to help drive decisions tailored to each individual user. Advanced transit mobility kiosks will include a human-machine interface (e.g., touchscreen) allowing the user to interact with various platforms within the graphical user interface (GUI), such as a map-based feature with real-time vehicle location information. This technology may be deployed at transit stops either on the roadside, within existing transit shelters, or at central hub locations.

Figure 4-13: Examples of Advanced Transit Mobility Kiosks

In-Vehicle Systems. This is a subset of technology installed within vehicles used to perform one or more specified functions based on the vehicle type (e.g., standard, fleet, transit, emergency responder). The following represent examples of in-vehicle systems:

- Automatic Vehicle Location (AVL) uses standard GPS technology to monitor vehicle locations, which allows agencies (e.g., transit, emergency responder) to more efficiently pinpoint vehicle location and routes in real time. This allows transit agencies to monitor schedule adherence and provide accurate estimated arrival times to users based on predefined check points. Additionally, this allows the CAD system to communicate to signalized intersections along a pre-defined route to provide either EVP or TSP to the appropriate vehicle for more efficient travel. AVL information also is critical for maintaining agencies to identify vehicle location in case of an emergency or necessary maintenance repair.

- Automatic Passenger Counters (APCs) allow transit agencies to track active ridership on any of their equipped vehicles. This technology provides the transit agency with granular data, including which stops are frequented by users at which time of the day, origin and destination of riders, average in-vehicle dwell time of riders, and more. With these data, agencies are able to make decisions to optimize the overall transit system and provide a more tailored user experience.

- Automated Fare Collection Systems provide transit agencies with an automated means of collecting and processing fares for public transportation services to reduce passenger loading times and increase operator safety. Instead of cash transfers, users can pay fares through electronic means, such as smart phones (e-tickets), smart cards, and transponders.

- On-Board Units (OBUs) provide vehicles the ability to receive and transmit CV messages powering various safety and mobility applications. OBUs receive messages from other vehicles (e.g., vehicle-to-vehicle [V2V]) and from roadside equipment (e.g., vehicle-to-infrastructure [V2I]) in order to provide the motorist with real-time information through the human-machine interface (HMI) in the form of audible or visual cues (e.g., "Slow Traffic Ahead").

- Digital Signage provides transit agencies the ability to disseminate information in real-time to user while onboard the vehicle. Information displayed may include arrival and departure times, upcoming connection points, public safety announcements, and more.

Figure 4-14: Examples of In-Vehicle Systems

Railroad Crossing Safety Systems. This technology subset is deployed to manage traffic at highway-rail intersections to enhance motorist safety through advanced systems. The benefits from railroad crossing safety systems can be recognized through the deployment of either hardware- or software-based systems. A typical installation will include all capabilities from the standard railroad grade crossing service package plus additional safety features to mitigate the risks associated with higher rail speeds, while also leveraging CV technologies. The active warning systems include positive barrier systems that preclude entrance into the intersection when the barriers are activated.

The railroad crossing safety system equipment is activated on notification by wayside interface equipment, which detects or communicates with the approaching train. For this strategy, the wayside equipment provides additional information about the arriving train, including direction of travel, estimated time of arrival, and estimated duration of closure. The system will alert and/or warn drivers approaching an at-grade railroad crossing if a crash-imminent trajectory is detected to avoid crossing or collision with an approaching train. This information may be conveyed to the driver prior to, or in context with, warning system activation. The system also includes additional capabilities that enable the detection of an entrapped or immobilized vehicle within the at-grade crossing and provides a notification to the appropriate highway and railroad officials.

Project Approach

The identified stakeholder needs recommended for technology deployment solutions were further analyzed and categorized into eight unique project types:

1. Advanced Traffic Management System
2. Interstate
3. Intersection Safety
4. Event Management
5. Parking Management
6. Transit
7. Automatic Incident Detection
8. Bicycle/Pedestrian

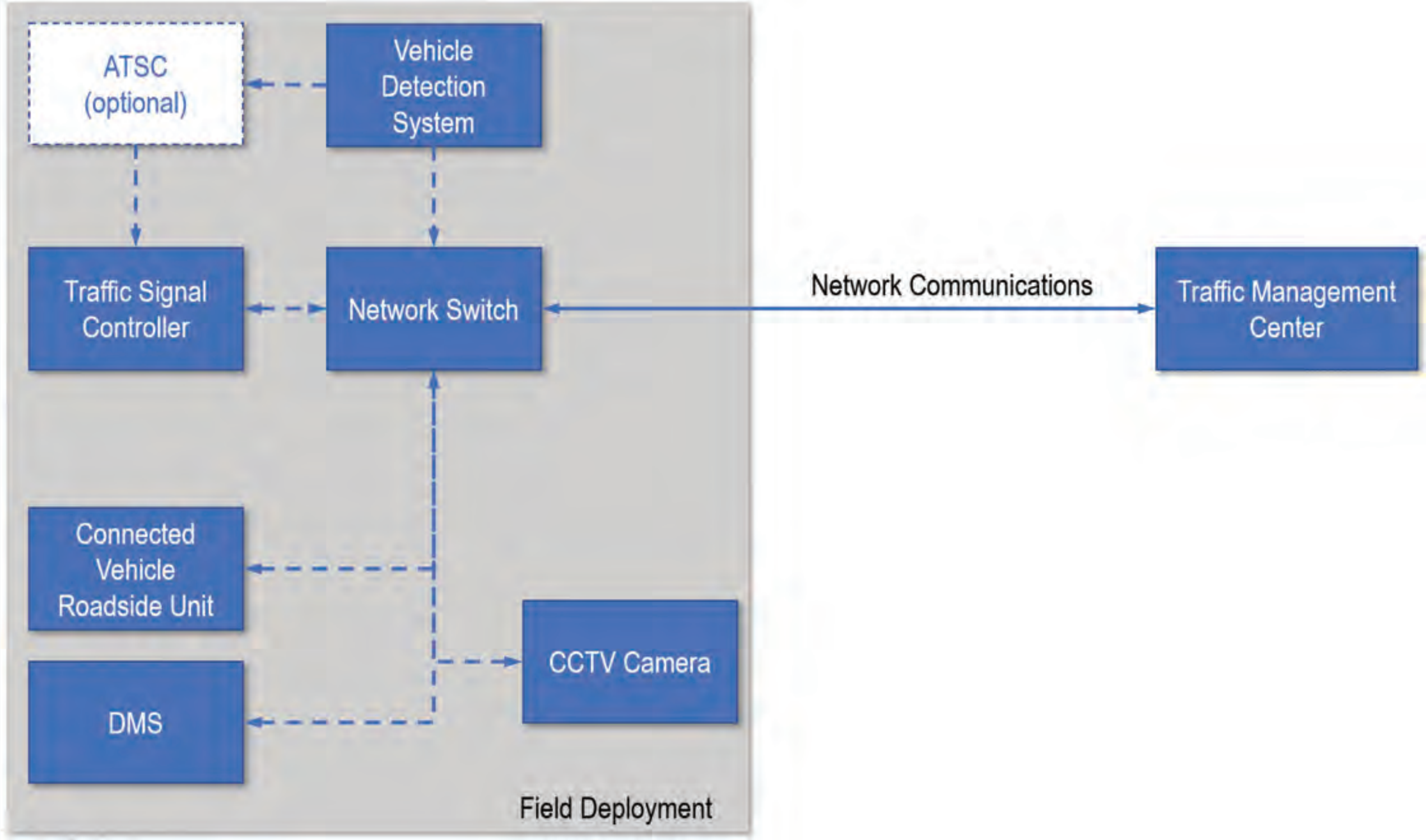
Advanced Traffic Management System Projects

Advanced Traffic Management System (ATMS) projects will leverage multiple technology strategies to improve the overall operational capabilities of a corridor. ATMS projects will provide the foundational framework for subsequent deployments, including a robust Ethernet-based communications network providing scalability and redundancy between field devices and the appropriate Traffic Management Center(s).

Example technology-based strategies employed as part of ATMS projects include:

- Ethernet-based Communications (e.g., fiber optics, point-to-point wireless access points, cellular modems)
- CCTV Cameras
- ATC model Traffic Signal Controllers
- CV RSUs
- Arterial DMSs
- Vehicle Detection Systems (e.g., Bluetooth Readers, Microwave Vehicle Detection Systems [MVDSs])
- ATSC

Figure 4-15: High-Level Block Diagram of Advanced Traffic Management System Project



Each technology can be deployed on either a corridor-by-corridor basis or systemwide in a multi-phased approach. Examples of systemwide options include:

- Installation of fiber optic cabling to expand existing communications and fill existing gaps along corridors throughout the County with drops to signalized intersections and future mid-block devices
- Systemwide upgrade of traffic signal controllers to ATC models
- Deployment of CV RSUs/Vehicle Detection Systems at all signalized intersections
- Installation of CCTV cameras at strategic signalized intersections and mid-block locations
- Installation of mid-block devices (e.g., MVDS, DMS) along strategic corridors

Following the deployment of initial ATMS project technology, all subsequent efforts can build on the established foundation. For example, using previously installed fiber optic communications to bring a new mid-block detector location online will reduce the cost of the future project by requiring only modifications to the existing trunkline instead of new construction.

ATMS projects are applicable for both urban and rural corridors. For corridors that are more rural, including those with a smaller number of signalized intersections, potential improvements may only include the installation of CCTV cameras, DMS, vehicle detection systems, and network communications (e.g., fiber optics, wireless point-to-point).

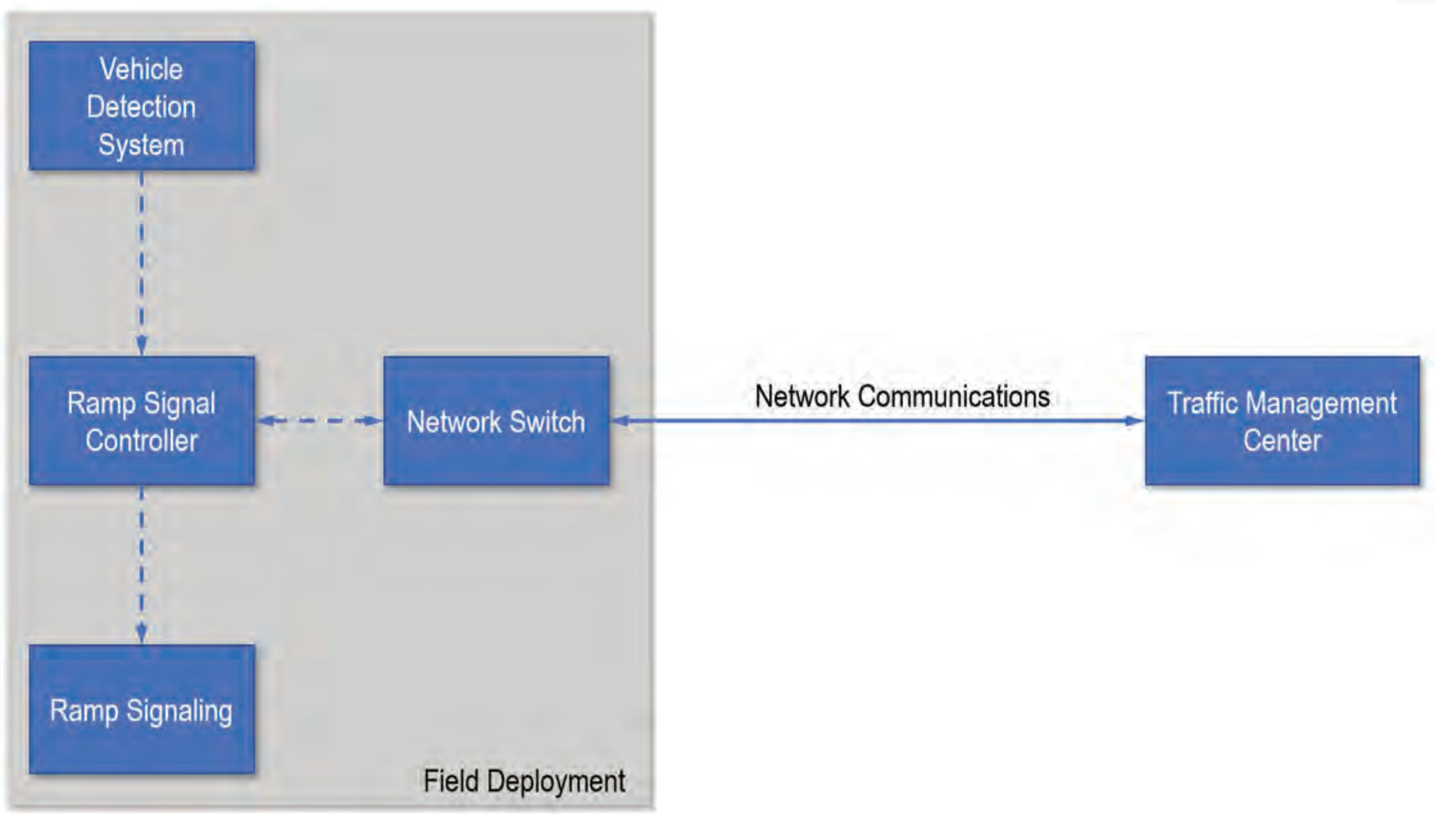
Interstate Projects

Interstate projects will use technology to alleviate congestion on either the mainline or arterial corridors as a result of queuing or "spillback." All strategies are not applicable at every interchange; therefore, each location should be analyzed for roadway geometrics, historic traffic volume and crash data, and real-time traffic pattern observations to determine the appropriate technologies to be developed for optimal benefit.

Example deployments include, but are not limited to, the following:

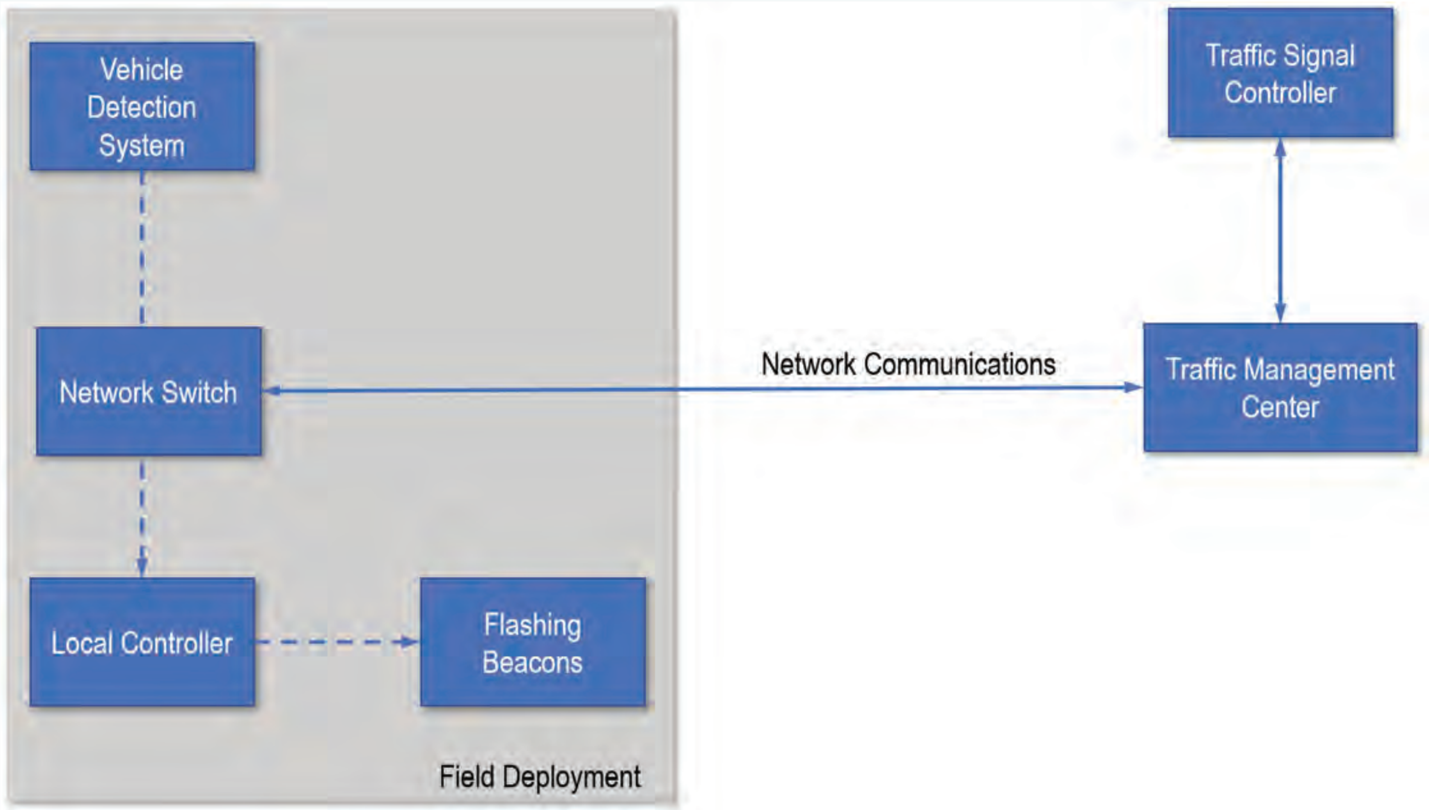
- Ramp signal systems (RSSs), or "ramp metering," will use vehicle detection at both ramp and mainline locations to identify gaps in traffic flow and allow vehicle(s) to safely enter in the existing mainline traffic flow (applicable at locations where incoming ramp traffic bottlenecks interstate pattern)

Figure 4-16: High-Level Block Diagram of Interstate—Ramp Signal System Project



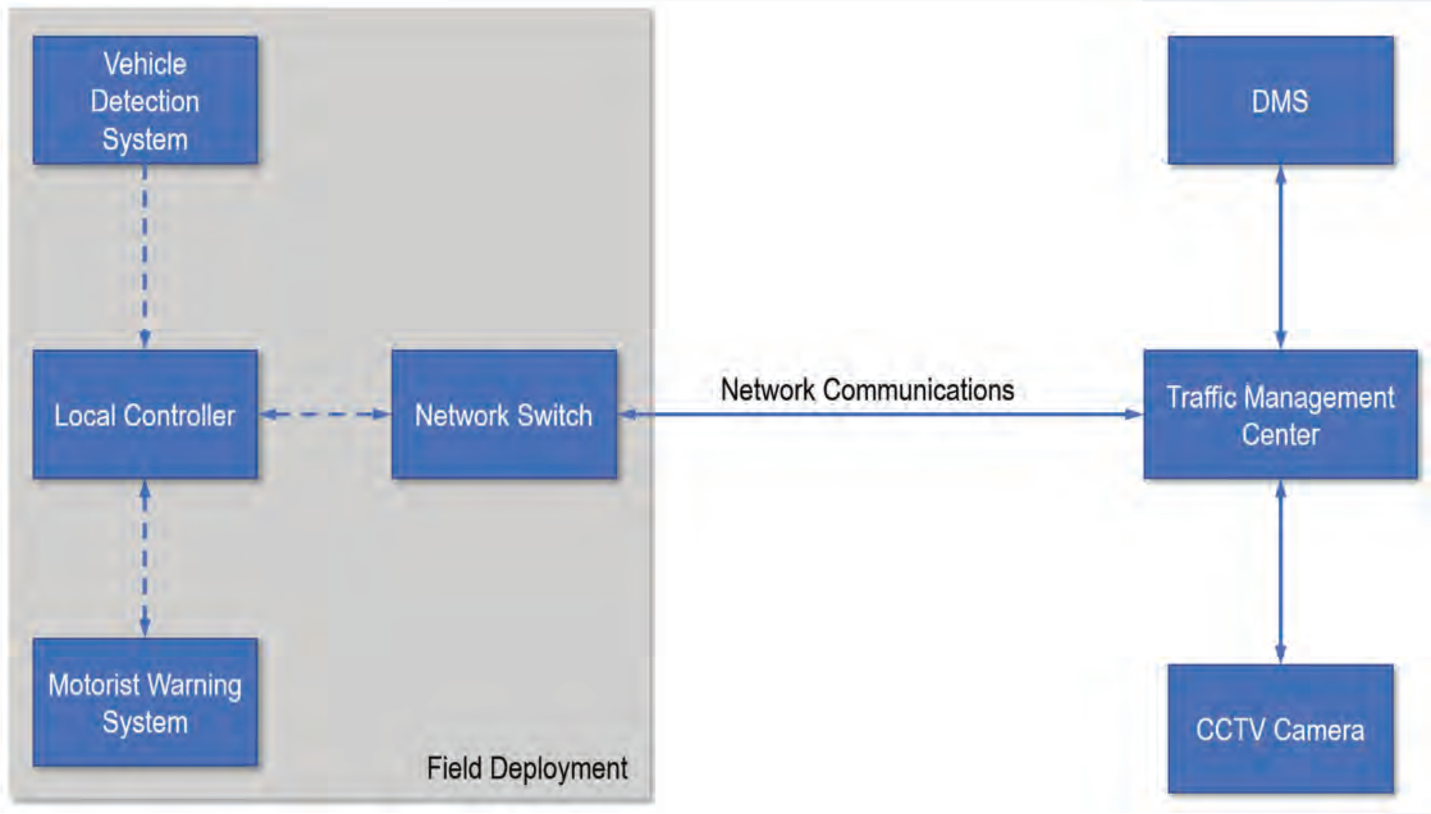
- Queue warning systems use a series of detection and motorist information systems to identify queues at off-ramps and activate "flush" plans to mitigate spillback and warn drivers upstream of the mainline (applicable at locations where off-ramp traffic queues into oncoming interstate traffic)

Figure 4-17: High-Level Block Diagram of Interstate—Queue Warning System Project



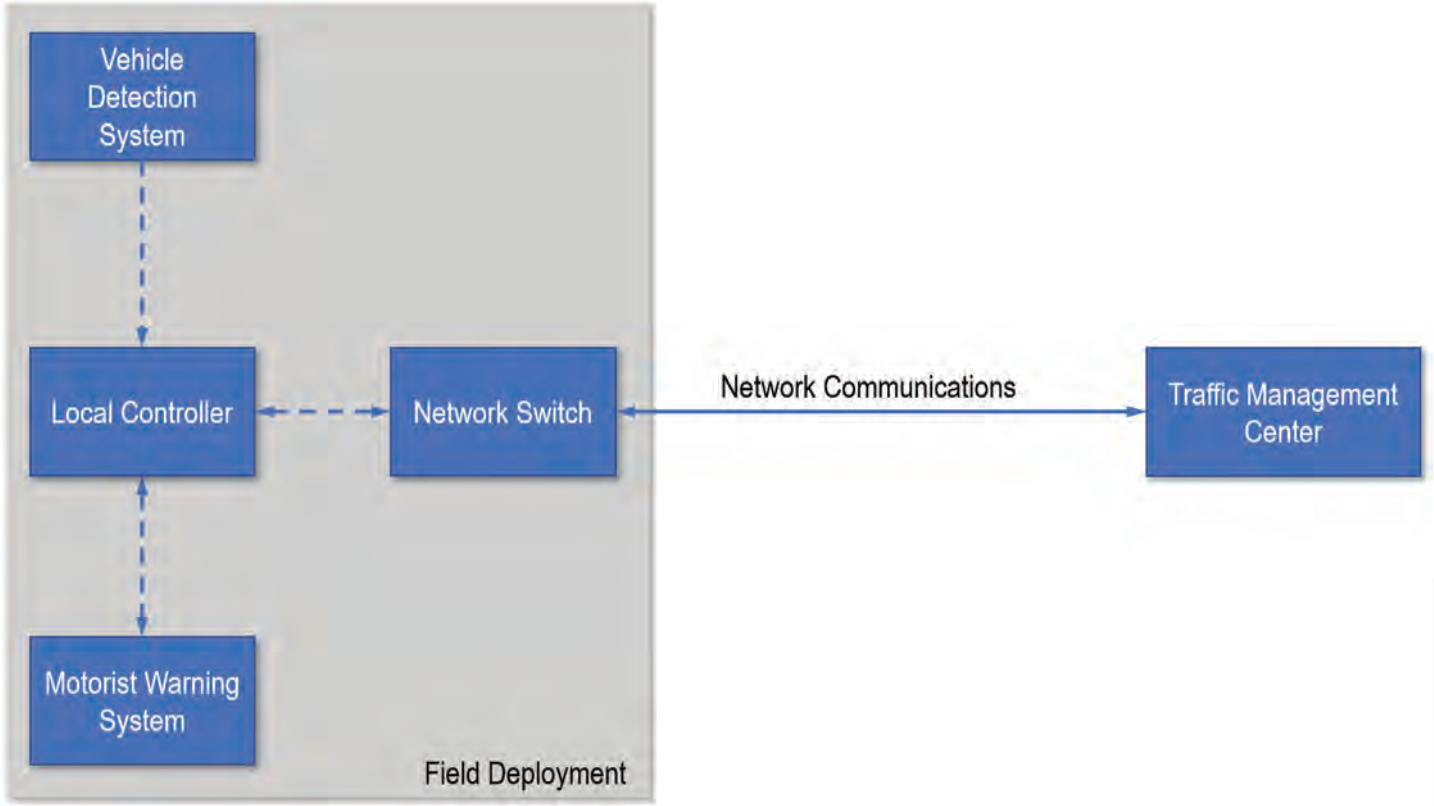
- Wrong way driving systems (WWDSs) use a series of detection and motorist awareness systems to identify drivers that make improper movements onto limited-access off-ramps, provide alerts to correct these actions, and notify the appropriate traffic management personnel (applicable at interchange off-ramps other than system-to-system connections)

Figure 4-18: High-Level Block Diagram of Interstate—Wrong Way Driving System Project



- Automated Truck Warning Systems (ATWSs) use detection sensors to determine vehicle type and speed approaching the off-ramp to notify drivers to slow down based on ramp geometrics (applicable at interchange off-ramps with non-linear geometrics, e.g., loop ramp)

Figure 4-19: High-Level Block Diagram of Interstate—Automated Truck Warning System Project



Intersection Safety Projects

Intersection safety projects will focus on improving road user safety at isolated locations that experience high vehicle, pedestrian, and bicycle crash rates through the deployment of various technology kits. Each "kit" provides available solutions to mitigate the potential of incidents for each of the four conditions below:

1. Kit "A"—Vehicle-to-vehicle (unsignalized intersections)
2 Kit "B"—Vehicle-to-vehicle (signalized intersections)
3. Kit "C"—Vehicle-to-bicyclist
4. Kit "D"—Vehicle-to-pedestrian

These projects are intended to be site specific and not corridor or regional solutions. Examples of technologies that may be deployed as part of these types of projects include:

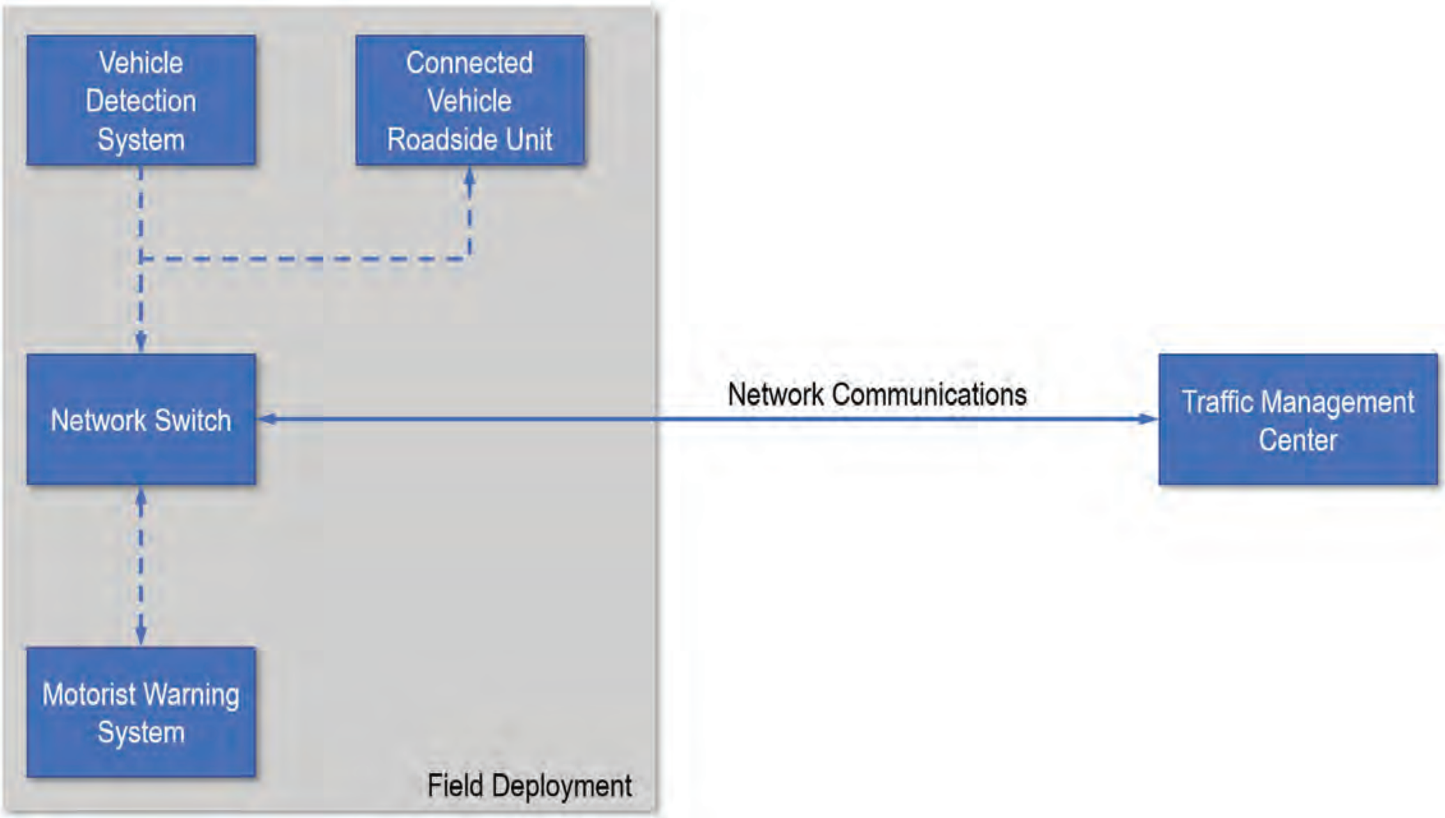
- Blank Out Signs (e.g., "Yield to Pedestrians")
- Passive Pedestrian Detection (PPD)
- Bicycle Detection
- Advanced Motorist Warning Systems (e.g., HAWK, RRFB)
- Electronic Feedback Signs (e.g., "Your Speed XX")
- CV RSUs
- Intelligent Lighting (e.g., adaptive lighting, in-road lighting, lighted crosswalks)
- ATC Traffic Signal Controllers (e.g., installation or phasing and timing modifications)
- ATSC
- Network Communications (e.g., fiber optics, wireless)

Kit "A" was developed to mitigate scenarios at unsignalized intersections where large numbers of vehicle-to-vehicle crashes occur. While the following strategies are technology-driven, potential geometric solutions also should be evaluated, including traffic calming, roundabouts, and other roadway geometric modifications identified during the intersection control evaluation process.

Potential Kit "A" strategies include:

- Vehicle detection (e.g., installed on minor street to actuate Advanced Motorist Warning Systems)
- LED-highlighted signs (e.g., "STOP," "STOP AHEAD," "YIELD," "INTERSECTION AHEAD")
- Standard flashing beacons with static sign panels
- CV RSUs (e.g., TIM, RSA)
- Signalization of the intersection (if warranted)

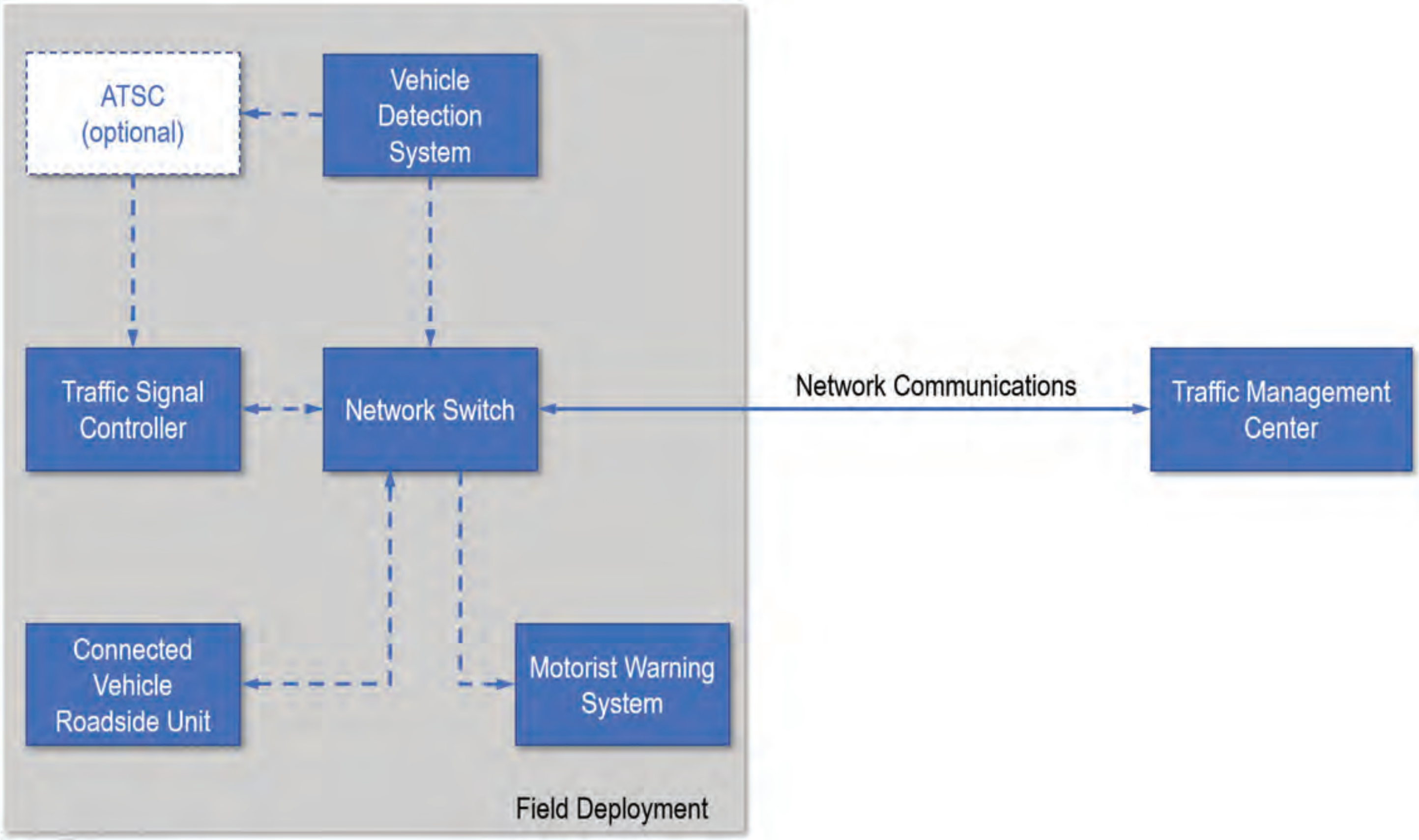
Figure 4-20: High-Level Block Diagram of Intersection Safety—Kit "A" Project



Kit "B" was developed to alleviate vehicle-to-vehicle collisions at signalized intersections. Potential Kit "B" strategies include:

- Signal Retiming/Phase Modifications (e.g., protected vs. permissive, split phase)
- Vehicle Detection (e.g., advanced or "dilemma" zone)
- ATSC
- Red Light Enforcement (e.g., Tattletale light, red light violation camera by local law enforcement agency)
- CV RSUs (e.g., SPAT, Red-Light Violation Warning)
- Advanced Motorist Warning System (e.g., flashing beacon, LED-highlighted signs located upstream of intersection and activated by red phase)

Figure 4-21: High-Level Block Diagram of Intersection Safety—Kit "B" Project

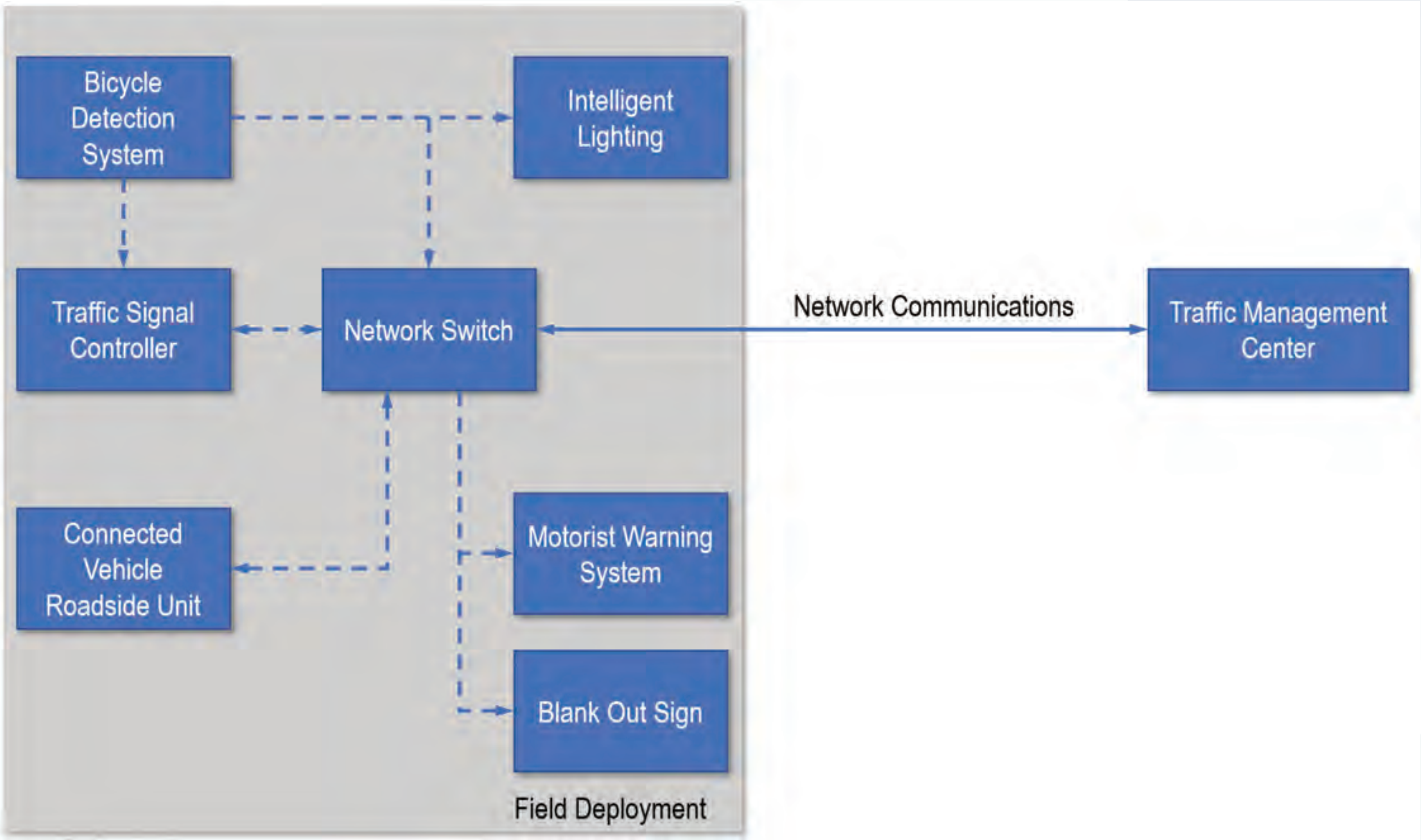


Kit "C" was developed for both intersection and mid-block locations at which data show frequent occurrences of vehicle-to-bicycle incidents. In addition to the proposed technology strategies, considerations should be made for high-emphasis bicycle lane pavement markings, roadway geometric modifications, and high-level planning efforts to ensure continuous, end-to-end bicycle pathways.

Potential Kit "C" technology strategies include:

- Signal Retiming/Phase Modifications (e.g., protected vs. permissive)
- Blank Out Signs (e.g., "YIELD TO BICYCLE")
- Bicycle Detection
- Advanced Motorist Warning System (e.g., RRFB)
- ▪CV RSUs (e.g., TIM, RSA)
- Intelligent Lighting (e.g., adaptive lighting)

Figure 4-22: High-Level Block Diagram of Intersection Safety—Kit "C" Project

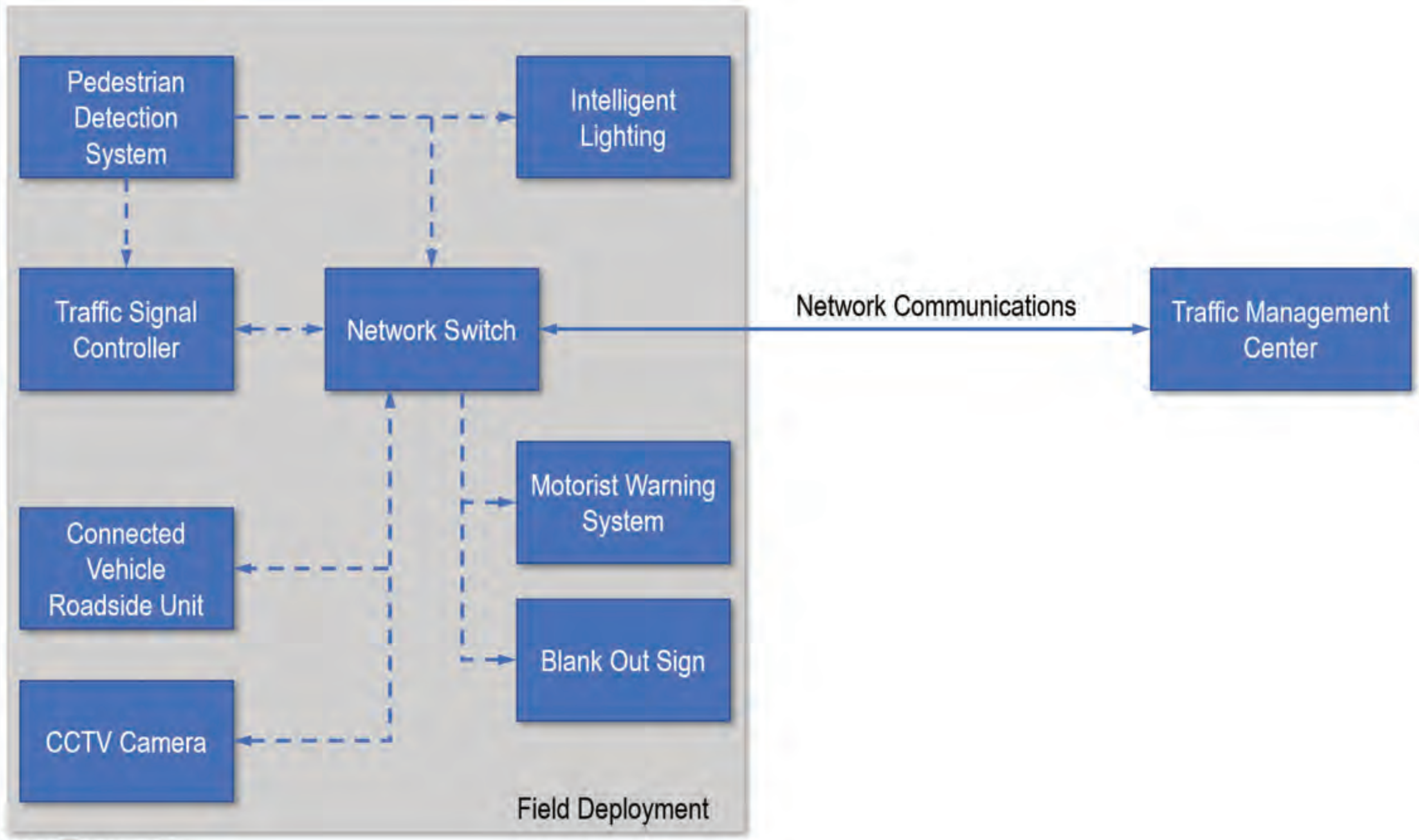


Kit "D" was developed to mitigate scenarios at signalized intersections where large numbers of vehicle-to-pedestrian crashes occur. While technology deployment strategies are provided, potential geometric solutions also should be evaluated, including traffic calming, pedestrian refuges, modifications of existing curb ramps, pedestrian deterrent fencing, and more.

Potential Kit "D" technology deployments include:

- Signal Retiming/Phase Modifications (e.g., leading pedestrian interval, pedestrian only phases)
- Pedestrian Detection (e.g., passive pedestrian detection, accessible pedestrian detection)
- CCTV Cameras (e.g., near-miss analytics)
- Blank Out Signs (e.g., "YIELD TO PEDESTRIAN")
- Advanced Motorist Warning Systems (e.g., RRFB)
- CV technologies (e.g., TIM, RSA, Pedestrian in X-Walk)
- Intelligent Lighting (e.g., lighted crosswalks, adaptive lighting, in-road lighting)

Figure 4-23: High-Level Block Diagram of Intersection Safety—Kit "D" Project



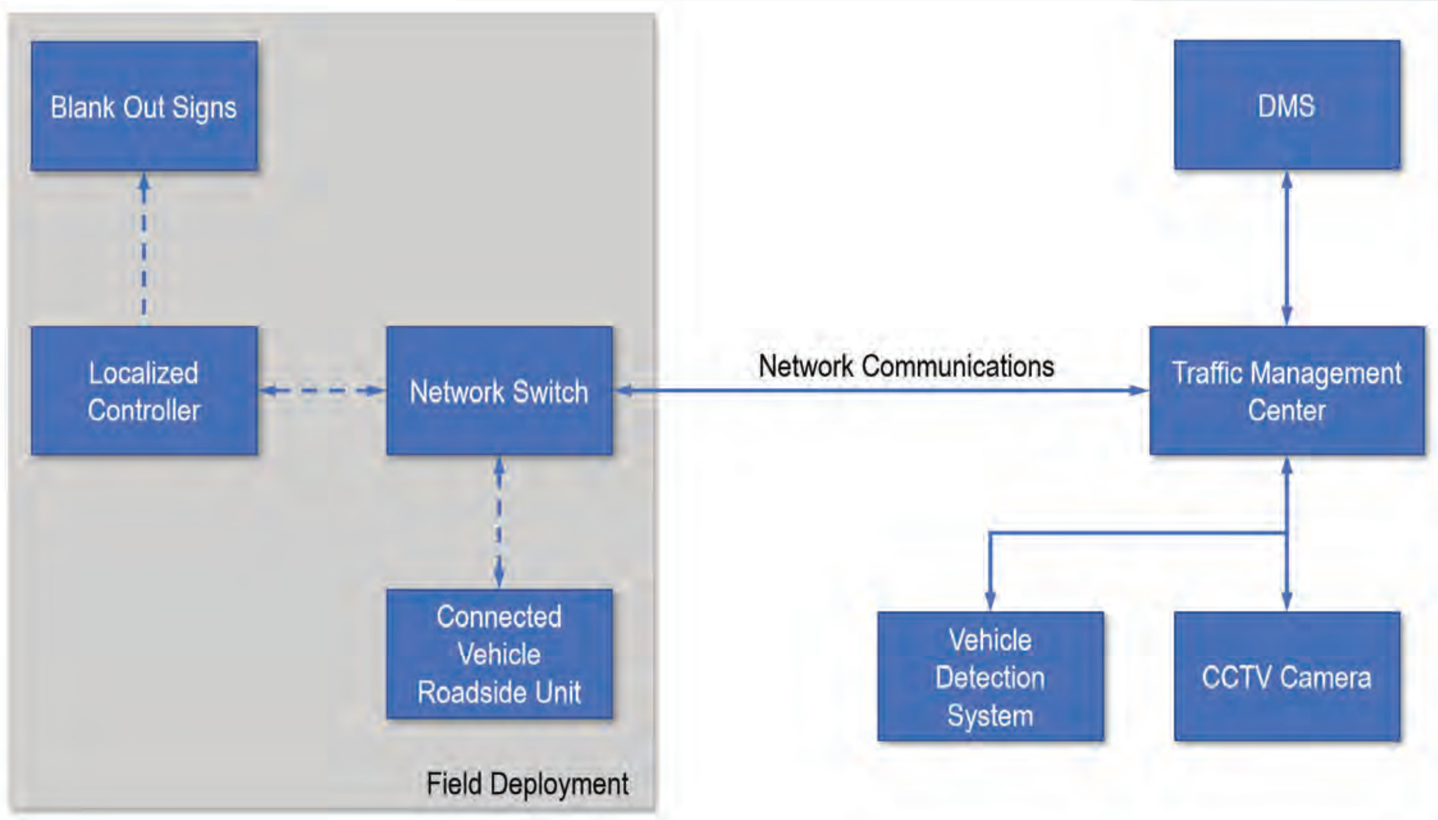
Event Management Projects

Event management projects will implement technology to monitor, manage, and operate traffic during both planned and unplanned events. Examples of planned events include recurring weekday congestion, scheduled roadway construction, preventative maintenance activities, and special events (e.g., parades, space launches, sporting events). Conversely, unplanned events are occurrences without warning or planning, including incidents, non-recurring congestion, emergency maintenance, natural disasters, and more. Various technologies will be deployed along corridors with high traffic volumes resulting from special events with a focus on providing origin-destination wayfinding to and from Interstate 95. Corridors will be analyzed to provide motorists with way finding information via programmable blank out signs for event arrivals and departures, as well as detour routes.

Example deployed technologies for Event Management projects include:

- Communications (e.g., fiber optics, wireless, cellular)
- CCTV Cameras
- Vehicle Detection Systems (e.g., Bluetooth readers, MVDS)
- DMSs
- Blank Out Signs with localized controller
- CV RSUs (e.g., TIM, RSA)

Figure 4-24.: High-Level Block Diagram of Event Management Project



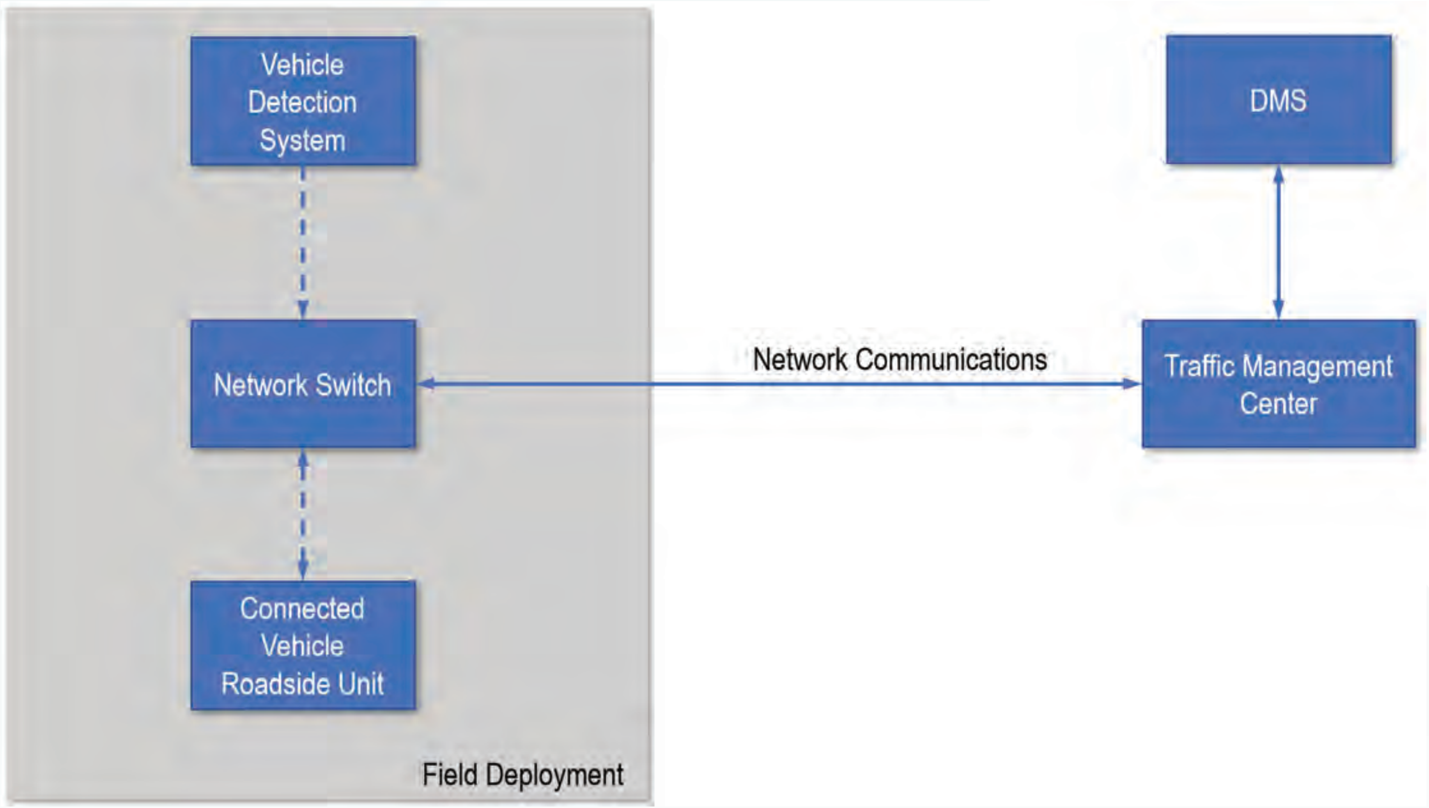
Parking Management Projects

Parking Management projects will deploy various technologies to determine the number of available stalls in parking facilities and provide the information to travelers in real time. This technology may be deployed on a variety of parking facilities, including garages, surface lots, and on-street parking. Providing this information to motorists ahead of key decision points will allow for drivers to make alternate plans and avoid queues on arterial corridors. Notable parking facilities may include beach access, space launch viewing, downtown, sporting and entertainment venues, and more.

Deployed technologies include, but are not limited to:

- Communications (e.g., fiber optics, wireless, cellular)
- Vehicle Detection Systems (e.g., video imaging, microwave radar, inductive loops)
- DMSs (e.g., arterial DMS, static sign panels with embedded DMS)
- CV RSUs (e.g., TIM)

Figure 4-25: High-Level Block Diagram of Parking Management Project



Transit Projects

Transit projects will implement technologies to improve the operational efficiency and user experience through the deployment of both in-vehicle and infrastructure solutions. Transit-based improvements are categorized into three effort types:

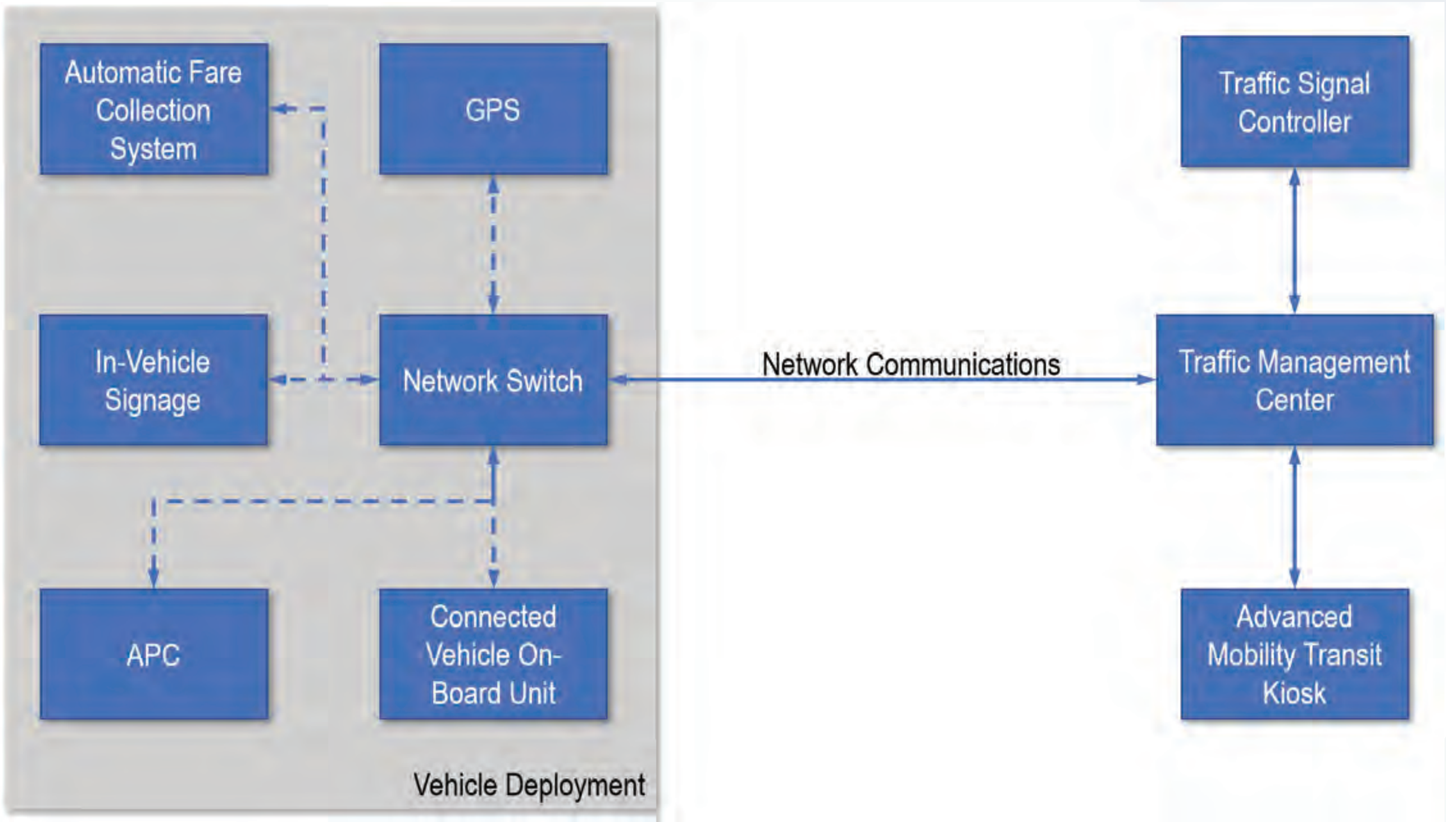
1. In-Vehicle Systems
2. Route-Based Infrastructure
3. Transit Stop Systems

In-vehicle systems will provide both transit operators and riders alike with pertinent real-time information (e.g., route schedules, arrival times, and departure times) while also providing increased reliability of service. While some in-vehicle systems while interact directly with transit users (e.g., dynamic signage) others may provide operational information back to the centralized system for application.

Examples of in-vehicle technology solutions include:

- CV OBU (e.g., TSP, Vehicle Turning Right in Front of Bus Warning, Dynamic Transit Operations)
- GPS (e.g., Automated Vehicle Location (AVL) for fleet management, centralized Transit Signal Priority)
- APC
- Digital Signage (e.g., real-time arrival time updates, scheduling information, next stop)
- Public Wi-Fi
- Automated Fare Collection System

Figure 4-26: High-Level Block Diagram of Transit—In-Vehicle Systems Project

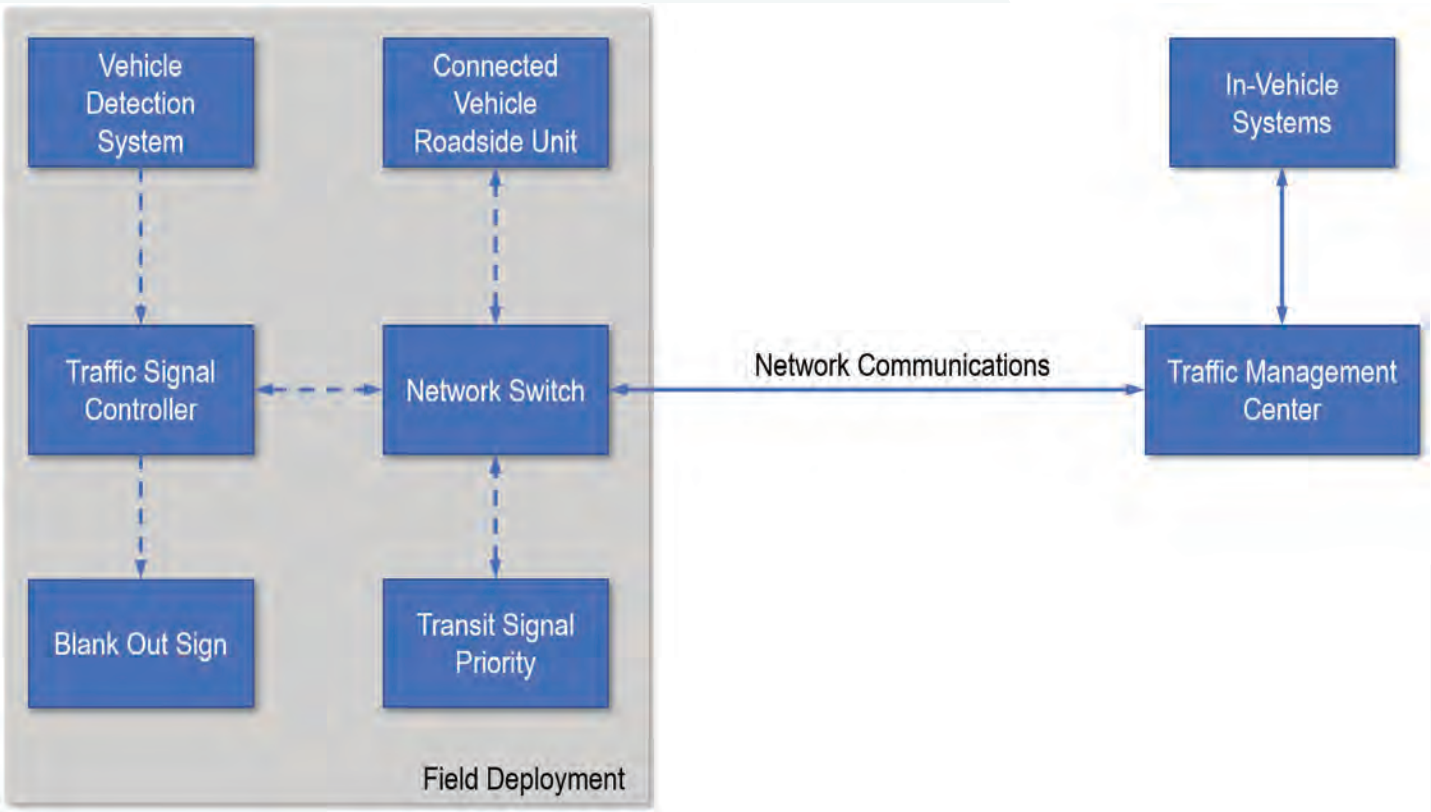


Technology deployed in transit vehicles will function with a direct correlation to infrastructure deployed along identified route corridors, including roadside locations and signalized intersections. Route-based infrastructure will ensure increased operational efficiency of the transit system by assisting transit operators to maintain schedules.

Potential route-based infrastructure systems include:

- CV RSUs (e.g., TSP, Vehicle Turning Right in Front of Bus)
- TSP
- Vehicle Detection System
- Blank Out Signs (e.g., "NO RIGHT TURN IN FRONT OF BUS")
- Signal Retiming/Phase Modifications (e.g., coordination, TSP)
- Communications (e.g., fiber optics, wireless, cellular)

Figure 4-27: High-Level Block Diagram of Transit—Route-Based Infrastructure Project

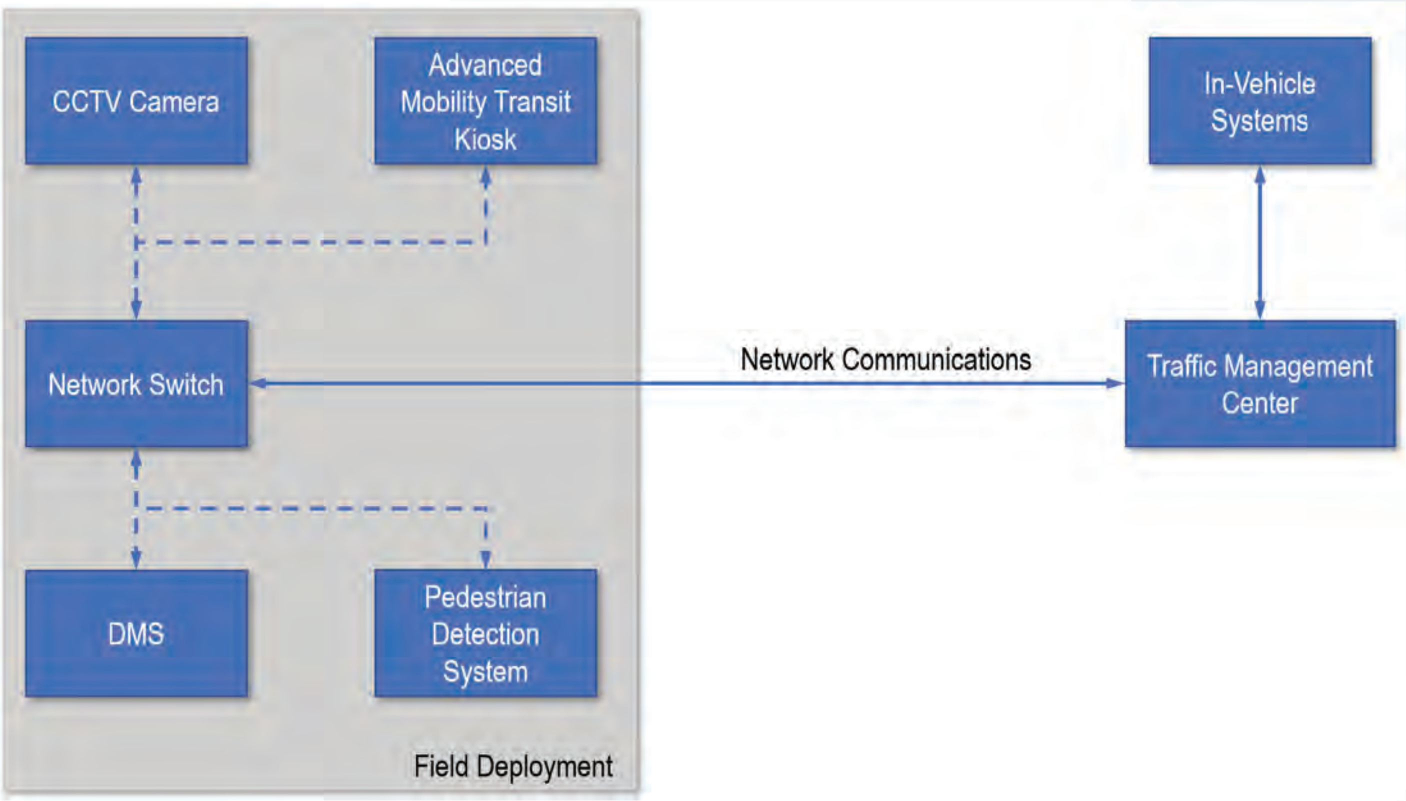


Technology deployed at transit stops provides the agency an opportunity to deliver real-time information to potential users to drive multimodal decisions (e.g., best route options to destination). Additionally, capturing granular data like how many individuals are accessing transit stops, from which locations, at what time, and to what destination allows the agency to tailor service based on the patterns and needs of the end users.

Technologies available for deployment at transit stop locations include:

- Advanced Mobility Transit Kiosks with interactive map GUI
- Pedestrian Detection System
- CCTV Camera
- DMSs (e.g., single-line ticker with next arrival, scheduling information)
- Communications (e.g., fiber optics, wireless, cellular)

Figure 4-28: High-Level Block Diagram of Transit—Transit Stop Project



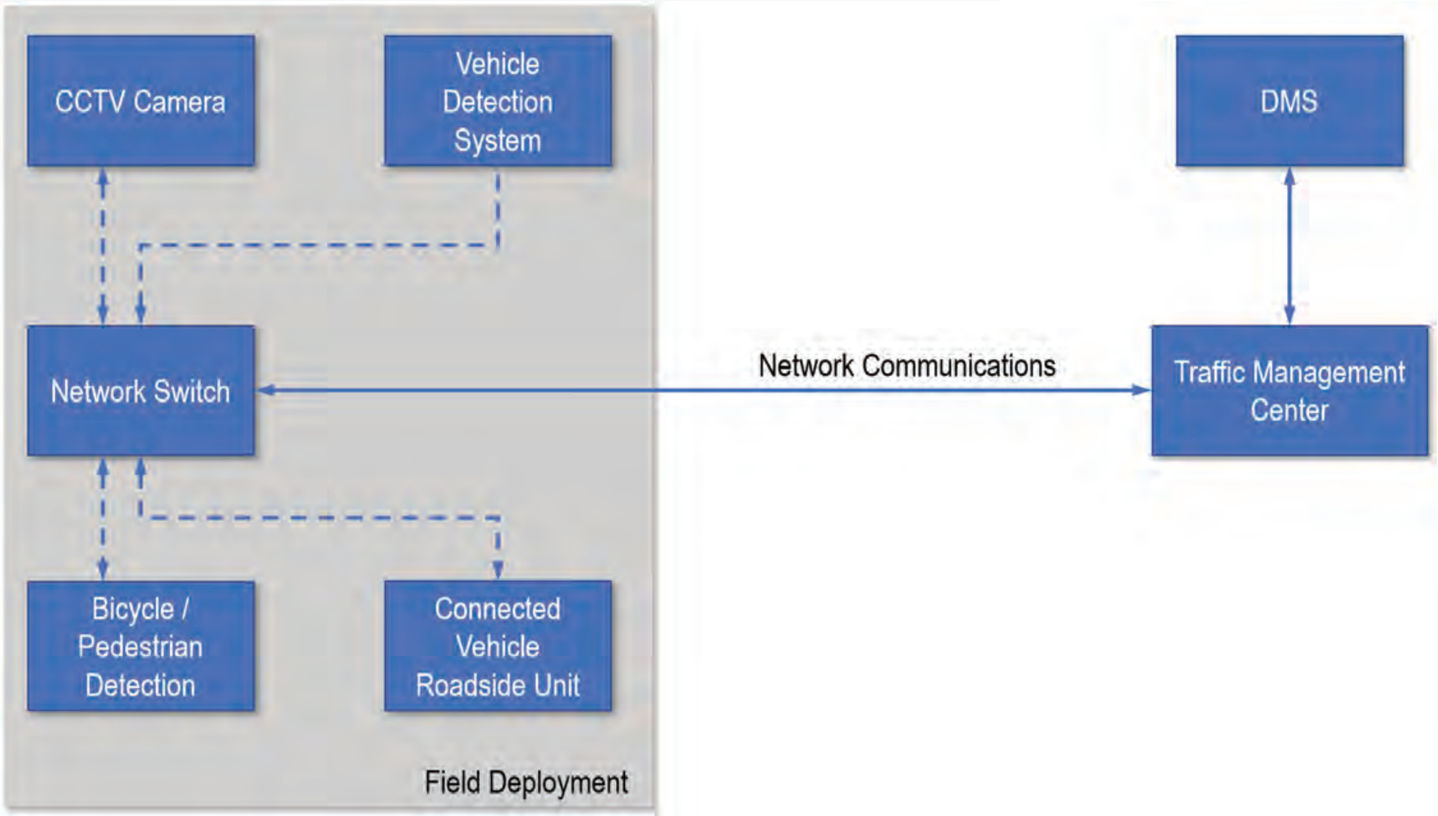
Automatic Incident Detection Projects

Automatic Incident Detection (AID) projects leverage the ability to fuse hardware (e.g., CCTV cameras, vehicle detection systems) and machine-learning software to identify potential events without manual intervention. Events are identified based on customizable business logic and may include crashes, stalled vehicles, debris on roadway, pedestrian on limited-access freeway, wrong way driving, and more. Typical AID systems are software-based solutions built on the capabilities of other hardware systems (e.g., video imaging feeds) with the intent of improving the operational staff's ability to quickly and efficiently identify safety concerns and possible disruptions to traffic patterns. This technology can be deployed on either limited-access freeways or arterial corridors.

Potential technologies involved in this project include:

- CCTV Cameras
- Vehicle Detection Systems
- Bicycle/Pedestrian Detection Systems
- DMSs
- CV RSUs (e.g., RSA)
- Communications (e.g., fiber optics, wireless, cellular)

Figure 4-29: High-Level Block Diagram of Automated Incident Detection Project

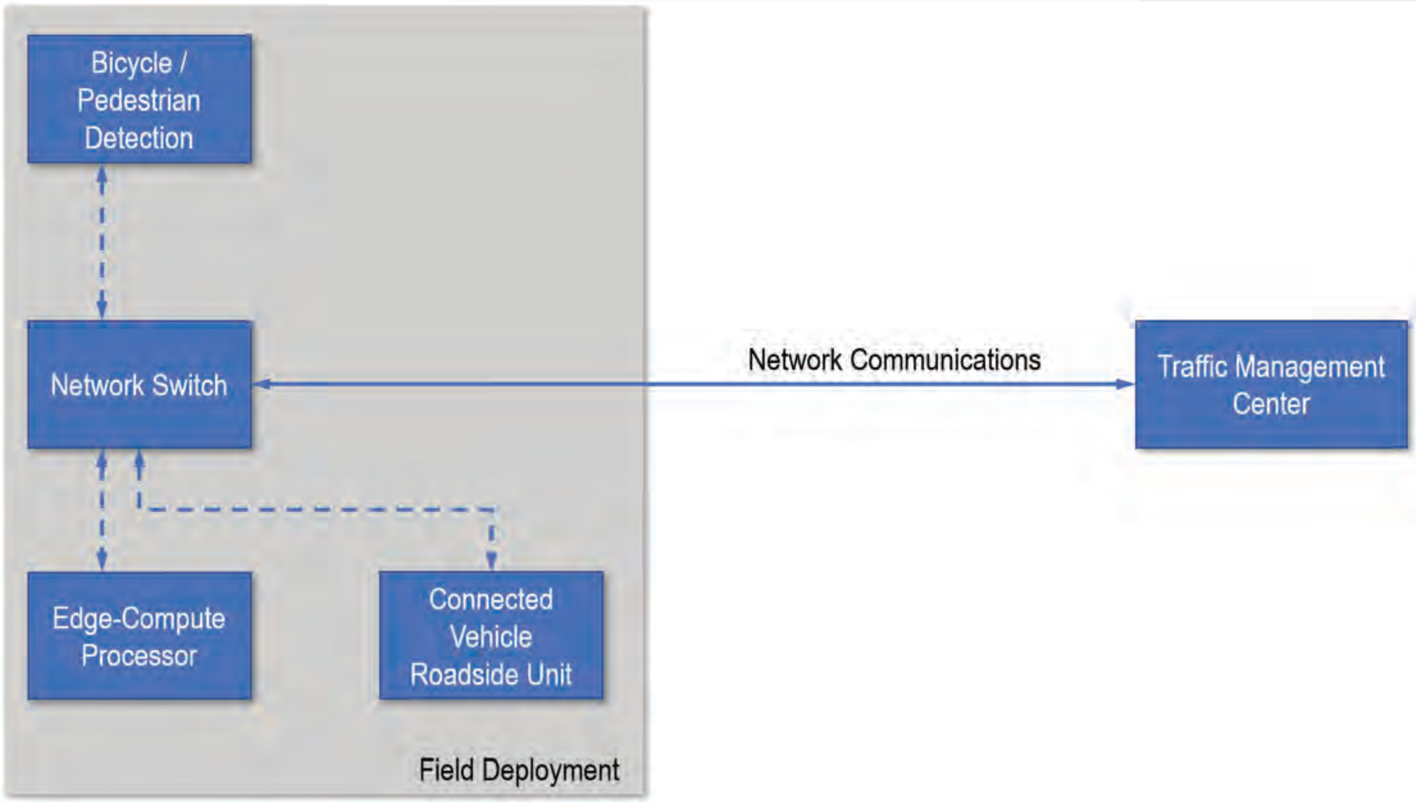


Bicycle/Pedestrian Projects

Bicycle and Pedestrian projects were identified in response to the recently adopted Vision Zero Florida Plan and associated analysis of the high-injury network and high-volume crash locations. Multiple technologies are available to be applied in areas of high pedestrian and/or bicycle crashes or potentially near-miss locations. This type of project is suggested for areas of significant safety concerns for vulnerable road users (e.g., mid-block pedestrian crossings) and should not be considered as a regional solution.

Advanced detection sensors (e.g., video imaging, thermal imaging, LiDAR) will provide inputs on vulnerable road users such as position, heading, and speed to edge-computing systems capable of performing real-time processing of large data sets. Leveraging the edge-computer system, advanced safety functions (e.g., CV applications) can be customized to detect and alert both vulnerable road users and motorists of potentially dangerous situations.

Figure 4-30: High-Level Block Diagram for Bicycle/ Pedestrian Project



Operational Policy/Programmatic Approach

Supplementing technology-based solutions—or those readily available as "off-the-shelf" products—are the operational strategies and policies that support the overall system functionality and vision. These programmatic strategies have been grouped into four categories based on the identified stakeholder needs:

1. Operations
2. Maintenance
3. Incident Management and Response
4. Data and Information Management

Operations

The programmatic approach for operations includes the development of policies and procedures for the regional operations of arterial corridors (e.g., signal retiming). This includes the identification of methods for collecting and applying real-time data to optimize the regional transportation network (e.g., adaptive traffic signals, active arterial management). The following strategies should be considered as part of the continuous operations efforts:

- Originally proposed in 2015, the organization of a Regional Consortium comprised of representatives from each local maintaining agency, as well as the Florida Department of Transportation District Five, Space Coast Area Transit (SCAT), and other regional stakeholders, is an important step in providing structure and decision making for future implementation of the regional master plan. The Consortium also will provide a forum to enhance interagency coordination and cooperation to facilitate knowledge transfer and regional strategies.

- Active Arterial Management (AAM), defined by the Federal Highway Administration (FHWA), is the active prioritization of objectives and collection of information to efficiently manage traffic signal infrastructure and control devices to maximize safety and throughput while minimizing delays. This includes personnel monitoring and managing arterial corridors in real time; identifying incidents, changes in traffic patterns, and necessary maintenance efforts; and more. The working definition of traffic signal maintenance is the preventative and responsive activities to preserve traffic signal infrastructure and control devices necessary for the safe and efficient utilization of arterial, collector, and local roadways. This strategy uses sensors and ATSC on major arterials to collect data, coordinated with TMC operations to adapt signal control by responding to conditions. Regular signal timing also will play an important role in the success of AAM.
- Automated Traffic Signal Performance Measures (ATSPMs), included in the FHWA Every Day Counts technology initiative, is defined as a suite of performance measures, data collection, and data analysis tools to support objectives and performance-based approaches to traffic signal operations, maintenance, management, and design to improve the safety, mobility, and efficiency of signalized intersections for all users. The appropriate understanding and implementation of ATSPM will provide operational staff with additional granular data at the intersection level to optimize traffic flow. The Florida Department of Transportation District Five has already begun the process of incorporating regions of Central Florida into the ATSPM system, including limited signals within Brevard County. (Source: *https://atspm.cflsmartroads.com/ATSPM/*)
- Performance Measures (e.g., Travel Time Index, Reliability) provide detailed real-time and historical data about the operation of arterial corridors and signalized intersections. Performance measures can be used in real-time operations by comparing historical baseline information to current data to identify anomalies before citizen complaints are received (e.g., failed detector). This will allow operations staff to quickly understand the root of the perceived problem and mobilize the appropriate response (e.g., repair the signal, adjust the signal timing).

Additionally, performance measures can be used to identify system improvements over a specified period of time. For example, comparing travel time reliability across a 12-month period will provide a data analytics-driven picture of the measured improvements of the system to determine other key metrics, such as cost-benefit ratio. A customized data dashboard can be developed to display performance measures in a quick, easy-to-understand visual format. This strategy offers tremendous value in reducing the required manpower and resources needed to actively monitor and review the performance of local systems and operations. There is an opportunity to partner with the Florida Department of Transportation District Five to implement and further enhance this strategy.

Figure 4-31: Operations Systems

Maintenance

The programmatic approach for maintenance includes the development and support of maintenance efforts through funding and training resources, as well as the development of policy to support these goals. This was identified by stakeholders and Space Coast Transportation Planning Organization (SCTPO) staff as a critical need within the region. There are many strategies currently in place, either from local agencies or from the Florida Department of Transportation; example strategies include:

- Development of policy for the recruitment, retention, and development of maintenance personnel, including continuous funding sources and formalized training programs. Qualified signal maintenance technicians are a commodity within the industry, often lending to regional shortcoming in the ability to properly staff maintenance shops. Ensuring the availability of resources for funding and training personnel will provide a deeper pool of talent from which local agencies can draw, providing increased capacity to properly maintain the existing systems. Currently, the Florida Department of Transportation District Five is developing a formalized training curriculum and hands-on training facility (e.g., STROZ) for use by local maintaining agencies with expected launch in the Fall or Winter of 2021.
- Implementation of a structured preventative maintenance program for the existing traffic signalization and ITS deployments within each local maintaining agency will extend the overall life cycle of equipment while also minimizing public complaints. This requires the development of policy, planning efforts, and acquisition of maintenance funding. Additionally, updates and revision to the existing Traffic Signal Maintenance and Compensation Agreements (TSMCAs) will be required to ensure proper reimbursement is being provided to each agency based on the total number and type of assets. Memoranda of Understanding (MOUs) may also need to be developed for agencies that cannot self-perform the necessary traffic signal maintenance efforts and will need to rely on partner stakeholders.
- Implementation of an asset management platform to record and track signalization and ITS equipment through the asset's life cycle, from procurement to end-of-life. Currently, the Florida Department of Transportation has a number of efforts underway that may be leveraged, including the ITS Facility Management (ITSFM), NOEMI, and Signalized Intersection Inventory Application (SIIA) efforts.
    - ITSFM is a Geographical Information System (GIS) web-based application that provides modeling of fiber optic networks, facilities, and connected devices, as well as electrical systems. (Source: https://www.fdot.gov/traffic/itsfm/newusersagencies/about-itsfm)

   - NOEMI provides a snapshot of the status of each signalized intersection and its progress toward upgrading to the District's "smart" signal criteria. The system compares the existing signalization equipment against the following five criteria: (1) connection to a network, (2) generation of ATSPM data, (3) generation of intersection movement count data, (4) installation of an ATC-model controller, and (5) wiring for optimal stop bar and advanced detection. (Source: https://noemi.cflsmartroads.com/)
   - SIIA provides construction and maintenance staff with a mechanism to create and update signalized intersections, identify intersection-specific details, and create and update associated approaches and devices in a user-friendly web-based platform. All field-collected data is imported into the Maintenance Information Management System (MIMS) for maintenance and inventory tracking purposes. (Source: *https://mims.cflsmartroads.com/siia/#/login*)
- Development of a maintenance ticketing system to create, assign, and track preventative and emergency maintenance activities necessary for the upkeep of traffic signalization and ITS components (e.g., MIMS).
- Smart Work Zones are the application of advanced sensor and communication technology within active roadway construction project limits to supplement existing maintenance of traffic to maintain traffic flow and increase work safety. Work zone management is an important component of a successful traffic management system. As areas grow, roadwork is nearly constant, creating work zones that must be managed properly to ensure the workers' safety and the continued effectiveness of local roadways. This process can be assisted using advanced technology. ITS technology can provide traffic monitoring and management, information to travelers, incident management, and increased safety in work zone areas. Technology like messaging signs can be used to alert drivers to work zones ahead, portable speed sensors can warn drivers to slow down in work zones, and roadway sensors can be used to warn workers when a vehicle is entering the work zone. All these tools can provide major improvements in the process of work zone management. While inclusive of technology, this strategy requires regional policy to determine if this practice will be included into all future construction projects, modification to existing technical specifications, and policy for the utilization of smart work zone data.

Figure 4-32: Maintenance Systems

Incident Management and Response

The programmatic approach for incident management and response includes establishing a coordinated, regional strategy for handling planned (e.g., space launch, sporting events) and unplanned (e.g., traffic incidents) events, as well as emergency (e.g., hurricane evacuation) events. This includes interagency coordination and mobilization of the appropriate response to increase road user safety and reduce disruptions to traffic flow. Example strategies include:

- TMCs serve as the command and control center for the transportation network's signalization and ITS deployment. Establishing policy for the development of a fully functional TMC with operational staff is an important step toward the proper operation and management of both arterial and limited-access corridors. At a minimum, TMCs should provide staff capable of operations for both morning and afternoon peak periods, but some agencies elect to staff facilities 24 hours a day, 365 days as year (e.g., FDOT District Five). Policy developed for the implementation of a regional TMC should include considerations for funding, operational staff estimates, training schedules, capital costs for backend software and hardware, and more.
- Establishing center-to-center (C2C) connections between regional stakeholders and partner entities—including TMCs, Emergency Operations Center (EOC), law enforcement and emergency responders, and local maintaining agencies—will provide the ability to transfer information between partners for a regionalized operational approach.
- Development of response plans that traverse jurisdictional boundaries across the region. By incorporating feedback from multiple stakeholders, response plans can be tailored for each event type and provide seamless services to road users regardless of where the incident might occur.
- Development of Standard Operating Guidelines (SOGs) will provide the operational staff the instructions, procedures, requirements, and expectations for each position in response to a variety of situations. Establishing standardization will not only provide guidance to operational staff, but also maintain a reliable level of service to road users regardless of time of day, weather conditions, operational personnel, and other variable factors. Each TMC should develop SOGs specific to the roles, functions, and geography of the specific jurisdiction; however, coordination between all regional stakeholders should occur for a regionalized approach.
- Implementation of a regional Traffic Incident Management program will provide timely and appropriate incident response from first responders coordinated by operational staff within the TMC. Available as a software-based solution, this strategy provides basic public safety call-receipt with dispatch services and includes emergency vehicle equipment, equipment to receive and route calls, and wireless communications to enable safe and rapid deployment of appropriate resources to an incident. This software also provides information to support dynamic routing of responder vehicles for quicker on-scene arrivals. Traffic information, road conditions, and weather advisories are all examples of information provided to enhance emergency vehicle routing.
- Deployment of an incentive-based Rapid Incident Scene Clearing (RISC) program will provide a mechanism for operational staff to quickly deploy trained operators and specialized equipment (e.g., wreckers) to clear major crashes causing lane closures or significant travel delays.
- Formalized procedures to ensure Incident Scene Safety will ensure first responders are able to perform the necessary duties with limited risk to the well-being of themselves and the motoring public. This strategy requires responders to have adequate training in emergency traffic flow management, proper use of traffic control devices, emergency lighting, proper emergency vehicle positioning, and appropriate personal protective equipment.

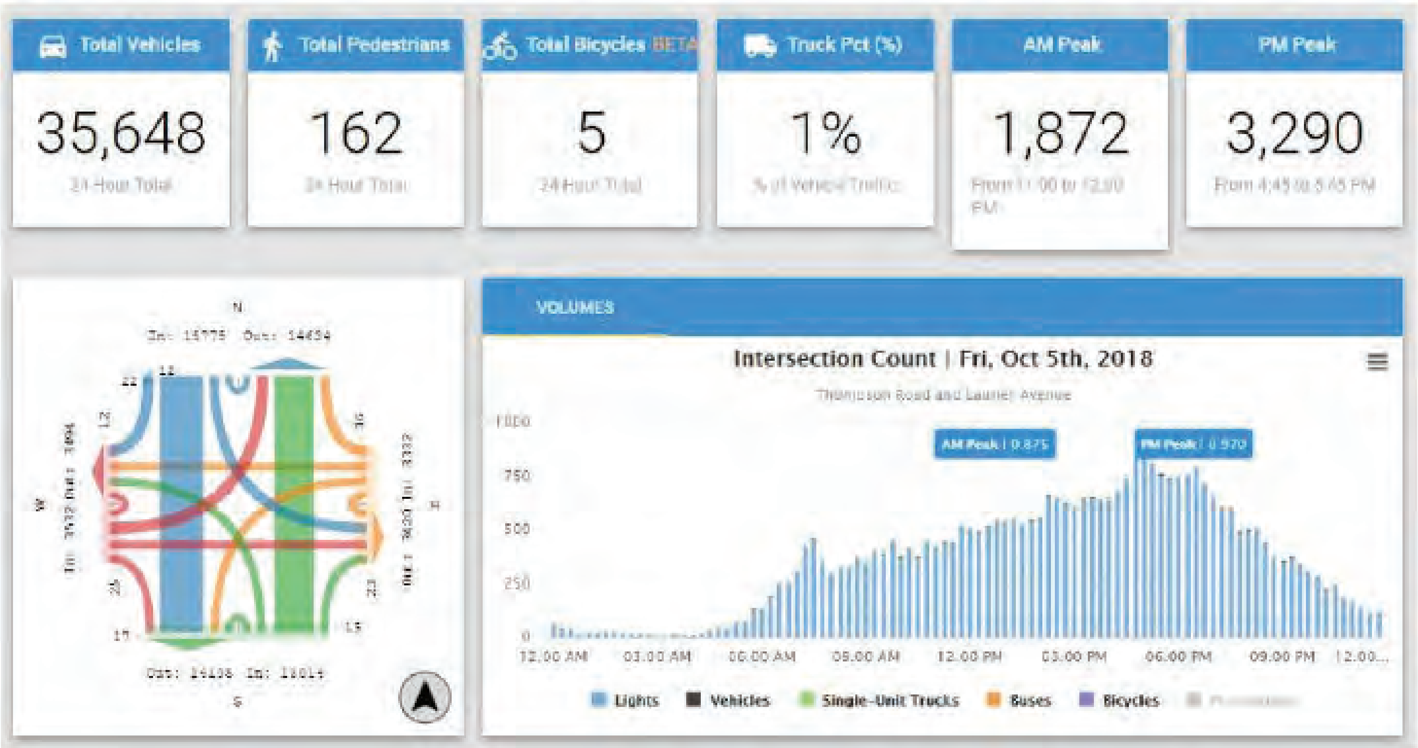
Figure 4-33: Incident Management and Response Systems

Data and Information Management

The programmatic approach to data and information management enables the transmittal and receipt of data in a variety of ways from a multitude of stakeholders and third-party sources. This includes the development of policy to govern data sources, provide network security, and determine access rights. The ability to share data between partner entities allows real-time management and response across agencies. This strategy also supports the aggregation and analysis of data and performance metrics at the regional level. Potential strategies for data and information management include:

- Expand Traffic Data Management (e.g., travel time, speed, and volume) by using information collected from detectors and sensors, CVs, and operational data feeds from centers to support performance monitoring and other applications of "big data," including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data obtained from vehicles in the network to determine transportation system performance measures, or information collected from vehicles and processed by the infrastructure (e.g., environmental data and infrastructure conditions monitoring data). Additional data to be collected include accident data, road condition data, road closures, and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures.
- C2C communications established between TMCs, partner agencies, and local maintaining agencies for the transfer of and access to both real-time and historical information.
- Data-sharing agreements (e.g., public, private) that allow data to be shared between both public agencies and private-sector companies (e.g., WAZE, HERE.com, INRIX, Wejo, Streetlight Data). Supplementing field sensor data with third-party sources such as probe data will provide additional granularity for both real-time and historical analysis of the transportation network. This strategy requires the development of policy to identify potential data partners, as well as potential licensing fees (e.g., annual), access restrictions, intellectual property constraints, and more.
- Development of policy and an approach to using "big data" for either real-time or historical applications and performance metrics. Real-time data can be organized into dashboards for easy-to-interpret snapshots of the system for operational and planning

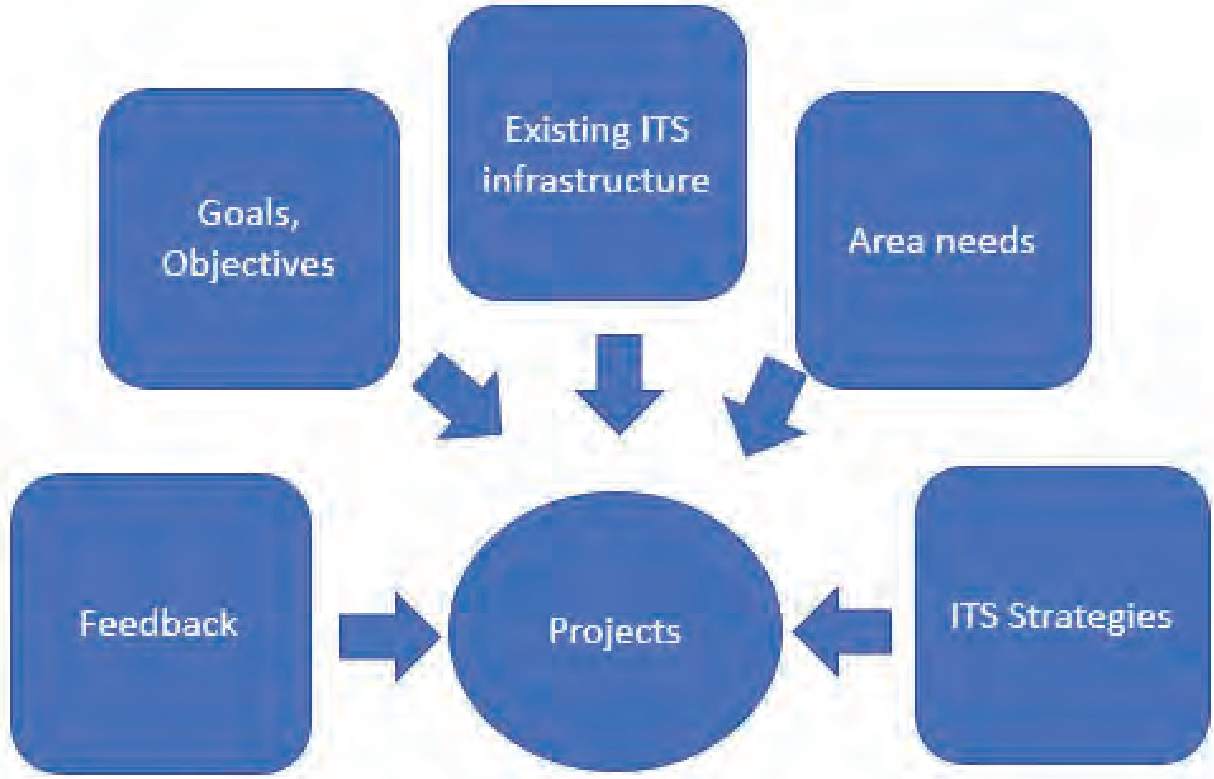
Figure 4-34: Data and Information Management Systems



purposes with a variety of metrics (e.g., Travel Time Index, Travel Speed). Conversely, historical databases can store data for long periods of time to enable analysis of trends and patterns over time (e.g., access management, reduction of crashes). Policy will need to address data storage requirements, necessary hardware and software, data access and restrictions, and more.

- Establishing a policy for cyber security will protect the usability and integrity of the overall network and associated data. This includes the development of protocols for network security (e.g., access privileges, multi-layer access configuration), as well as software and hardware systems to provide the ability to monitor and manage the network.
- Use of Freight Advanced Traveler Information System (FRATIS), which is a bundle of applications that provides freight-specific "big data," including dynamic travel planning and performance information to optimize drayage operations, such that load movements are coordinated between freight facilities to reduce empty-load trips. (Source: https://www.its.dot.gov/research-archives/dma/bundle/fratis-plan.htm)
- Launch of public information and outreach campaigns to promote the exchange of information concerning changes in transportation facilities, upcoming construction projects and work zones, and performance analytics of the overall system (e.g., reduction in crashes, improvements to travel time reliability). The ability to disseminate information to the general public through a host of media—including social media (e.g., Twitter, LinkedIn, Instagram), traditional media outlets (e.g., television, radio, newspaper), billboards, and mailers—allows individual agencies and regional stakeholders to promote branded messages concerning roadway user safety and operational improvements.

Figure 4-35: ITS Project Selection Process



Proposed Projects

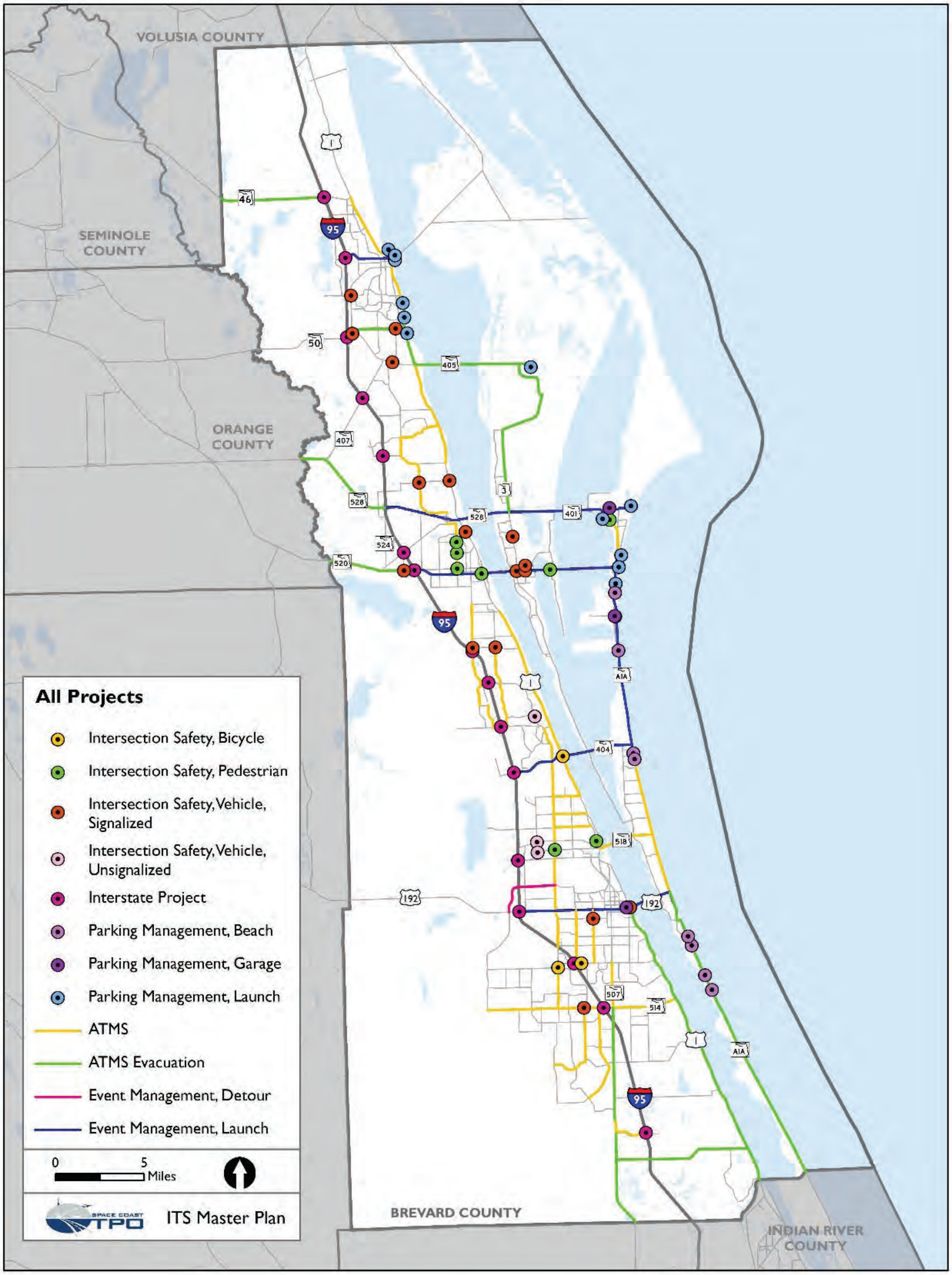
This section summarizes the projects identified based on GIS analysis and stakeholder feedback. A project is defined as the deployment of the appropriate combination of devices to address an identified challenge at a location. The team developed a list of projects that respond to the needs identified in earlier tasks. The process is illustrated in Figure 4-35.

The project identification process is a direct result of goals development and an understanding of the needs. The goals and objectives lay the foundation and also provide a way to measure progress. Strategies were developed in response to the needs. Projects were developed that responded to the needs. Stakeholder feedback was used to refine the projects. The projects and technology for each project shown in Figure 4-36 and listed below were identified to meet the goals and objectives developed for this plan.

Additional analysis was done related specifically to devices and proposed locations. While it would be rare to install the 298 proposed Bluetooth/RSU devices as a stand-alone project, understanding the overall technology needs are important, so devices were considered both as part of projects and as needed throughout the County. The existing ITS infrastructure also was used to develop projects to expand remote communication (fiber or radio), CCTV cameras, and Bluetooth travel time devices.

All identified proposed projects are shown in Figure 4-36. A complete project list and the evaluation criteria can be found in Appendix A. The list of evaluation criteria is discussed in the following section to understand how the projects meet SCTPO and plan goals.

Figure 4-36: Proposed Projects



Project Evaluation

The following criteria were developed to allow for evaluation of the proposed projects. These criteria reflect the SCTPO project prioritization process and have been reviewed and ranked by stakeholders to help determine application.

Table 4-1: Evaluation Criteria

Performance Measure	Description	Data Inputs	Scoring System
Safety	A measure incorporating corridor and intersection crash severity for vehicles, bike/ped, and motorcycles	High Injury Networks	Project is on 2+ High injury Networks, Project is on 1 high injury network, project is on no high injury networks
Congestion Management	Targets high-congestion corridors	SOS	Volume-to-capacity ratio (V/C) V/C > 0.85: green V/C > 0.75: yellow V/C < 0.75: red
Connectivity/ Economic Significance	A qualitative measure of project effect to roads impacting regional economy	Roads data	Direct connection to Beaches, SpacePort, Port Canaveral, Brevard Zoo, Merritt Island National Wildlife Refuge/Canaveral National Seashore, MLB Airport: green Adjacent to: yellow No connection: red
System Reliability	A measure of system reliability for vehicles, trucks, and buses	Project description, Roadway functional classifications, SCAT map	Improved travel time: green Improved consistency: yellow Neither: red
Resiliency	Promotes redundancy/sustainability of infrastructure to withstand shocks/stressors	Evacuation routes, existing fiber, detour route projects	System redundancy: green Evacuation route: yellow Neither: red Detour route: 5 points
Project Cost	Initial planning, design, and construction cost		Low—Projects are estimated to cost between $0 and $4 million Medium—Projects are estimated to cost between $4 million and $7 million High—Projects are estimated to cost more than $7 million
Operations and Maintenance	Ongoing cost to operate and maintain		Low—0-40 maintenance activities anticipated for the project. The impact on operating expenditures is anticipated to be minimum. No additional overtime, seasonal staff, purchased services, and/or equipment upgrades may be required to operate and maintain the capital assets once completed. Medium—40-160 maintenance activities anticipated for the project. One to two additional technicians may be required to operate and maintain the resulting capital asset. High—161+ maintenance activities are anticipated for the project. Two to three additional technicians may be required to operate and maintain the resulting capital asset.
Timing	Anticipated implementation timing		0-5 years = short term 5-10 years = medium term 10+ years = long term

Safety. Safety is a critical focus of the SCTPO. This measure helps ensure that projects are meeting SCTPO safety goals.

Improves Congestion. This measure focuses on corridors where the volume-to-capacity ratio (V/C) is greater than 0.85. The existing volume is known as the volume to capacity (v/c) ratio, which is one way to identify recurring congestion. Points for any project that is projected to improve congestion and is located on a highly congested corridor. This ties to LRTP Goals 1 and 4.

ITS solutions are particularly effective in relieving recurring congestion along a corridor.

Connectivity/Economic Significance. This measure acknowledges the importance of the roadway network to the tourist economy. Projects along roads that facilitate direct access will receive points. Roads connecting to beaches, SpacePort, Port Canaveral, Brevard Zoo, Merritt Island National Wildlife Refuge/Canaveral National Seashore, and Orlando Melbourne International Airport are the focus.

System Reliability. This measure is related to the System Performance/Freight/CMAQ Performance Measures Final Rule (PM3 rule) that requires TPOs to set targets for a variety of performance measures.

System Performance/Monitoring Improvement. This measure is about managing system performance and ensuring that identified projects improve conditions for facility users throughout the County.

- Monitoring by System—These projects include devices that support monitoring by the system (CCTV, RSU) and facilitate the back-end data flow.
- Messaging to the Traveling Public—These projects include devices that convey information to the traveling public, including message boards and in-vehicle information.

Resiliency. Resiliency is a critical focus because the roadway network must withstand major weather events and facilitate safe passage as needed. Resiliency and reliability are also some of the Federal Planning Factors. This measure will assess if the project improves system resiliency based on redundancy, security, reliability, etc.

- Redundancy. System redundancy is critical to traffic operations management during weather events.
- Evacuation. ITS strategies can help better manage congestion and traffic during times of emergency and help direct travelers to identify hurricane evacuation routes and inform travelers of changes to travel routes.

Project Cost. This criterion assesses the overall cost of the proposed project, including planning, design, and construction. Planning level costs have been developed for each project and details can be found in Appendix B

Operational and Maintenance Costs. Costs related to a capital project that might have an impact on current and/or the expected operational impact of each capital improvement project. Such assessments are established by calculating the number of maintenance activities associated with the project. The operations and maintenance cost calculation tool can be found in Appendix C.

Project Evaluation

Because the projects cover a wide range of categories doing an “apples to apples” comparison to evaluate the projects was not possible. For example, an intersection project has different goals and end results than an ATMS project. As a result, it was decided that the ATMS projects would be prioritized into groups by duration, with the focus being on the ability to implement within a certain timeframe based on building out the network and taking advantage of prior investments. Each of those projects is evaluated by the criteria, illustrated by colored gears. Each gear can be assigned a point value if prioritizing the projects within each timeframe is desired.

Other categories, including the Interstate, Intersection Safety, and Parking Management categories, will be “boxed” and available for implementation during any timeframe, either as stand-alone projects or included in other projects. Because of the stand-alone nature of these types of projects, it is recommended that agencies identify opportunities to integrate with planned projects, such as resurfacing, to increase the opportunities for implementation. Regardless, all projects have been evaluated against the criteria described above to ensure they meet SCTPO strategic and plan goals. The evaluated project list can be found in Appendix A. Maps of these projects can be found in Technical Memo 7. A sample of the evaluation can be found in Figure 4-37.

Figure 4-37: A Sample of the Evaluation Criteria Applied

Space Coast TPO ITS Master Plan Proposed Project List

							HIN 2+ Networks=Green (3) HIN 1 Network=Yellow (2) HIN 0 Networks=Red (1)	V/C > .85 = Green (3) V/C > .75 = Yellow (2) V/C < .75 = Red (1)	Direct Connect = Green (3) Indirect = Yellow (2) No connection = Red (1)	Improved Time = Green (3) Improved Consistency = Yellow (2) Neither = Red (1)	+Monitoring = Green (3) Some monitoring = Yellow (2) None = Red (1)	Redundancy = Green (3) On Evac Route = Yellow (2) Neither = Red (1)
							SAFETY LRTP Goal 1	CONGESTION MANAGEMENT LRTP Goal 1, 4	ECONOMIC SIGNIFICANCE LRTP Goal 2, 3	SYSTEM RELIABILITY LRTP Goal 3	SYSTEN PERFORMANCE LRTP Goal 3	RESILIENCY LRTP Goal 4
Project Number	Project Type	Jurisdiction	Maintaining Agency	Corridor	Start	End	Level project may impact corridor identified in VZ HIN	Targets high congested corridors	Provides improved access to high tourism/high employment zones	Improves travel time reliability	Improves ability to monitor performance of system	Promotes redundancy/sustainability of infrastrucute to withstand shocks/stressors
101	ATMS	Cape Canaveral Cocoa Beach FDOT	Brevard County/Cocoa Beach/FDOT	SR A1A	Minutemen Causeway	SR 401	Green	Green	Green	Green	Green	Yellow
102	ATMS	Cocoa Beach County FDOT	Brevard County/Cocoa Beach/FDOT	SR 520	Milford Point	SR A1A	Yellow	Green	Green	Green	Green	Yellow
103	ATMS	Cocoa/County	Brevard County/Cocoa Beach/FDOT	SR 501 (Clearlake Rd)	SR 520 (King St)	Industry Rd	Green	Green	Yellow	Green	Green	Green
104	ATMS	Titusville	Titusville/FDOT	SR 50	South Street	US 1 (Washington Ave)	Yellow	Yellow	Red	Green	Green	Green
105	ATMS	Titusville / County	Titusville/Brevard County/FDOT	US 1	Camp Rd	SR 406 (Garden St)	Yellow	Red	Yellow	Green	Green	Green
106	ATMS	Melbourne / County	Melbourne/Brevard County/FDOT	Pineda, Eau Gallie, and 192	US1	A1A	Green	Green	Green	Green	Green	Green

2021 Intelligent Transportation Systems Master Plan Update

Regional ITS Architecture

SPACE COAST
Transportation Planning Organization

Introduction

The Florida Department of Transportation (FDOT) District 5 Regional Intelligent Transportation Systems (ITS) Architecture (RITSA) is a roadmap for transportation systems integration for Florida District 5 services over a 10-year time horizon. FDOT recently completed an update to the statewide and regional ITS architectures to reflect upgrades in recent years and to identify potential requirements to support and address the transportation needs over the next 10 years. The revised architectures comply with the Federal Highway Administration (FHWA) 23 Code of Federal Regulations (CFR) Rule 940 requirements and are compatible with the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) software, Version 8.3.

Each of the stakeholders has their own portion of the RITSA with their own market packages and data flows detailing how they receive and provide information and/or data to other agencies. The final version of the RITSA and more information can be found at the following website:

https://local.iteris.com/fdotarch/architectures/d5/html/stakeholders/sh34.html.

The statewide and regional ITS architectures have a time horizon of 10 years, with particular focus on those transportation elements likely to be implemented in the next three years. The RITSA covers the broad spectrum of ITS, including Traffic Management, Transit Management, Traveler Information, Maintenance and Construction, Emergency Management, and Archived Data Management over this time horizon. The architecture content supports the quickly emerging and evolving Connected and Automated Vehicle (CAV) environment. CAV presents greater integration and interoperability challenges, and the need for institutional cooperation makes the ITS architecture a valuable tool to discuss and plan these complex implementations.

Details on the following projects can be found on the website.

- ATTAIN Central Florida: This is a collection of projects in FDOT District 5 that includes three interrelated programs, which connect through an ongoing FDOT initiative, SunStore. Those three interrelated programs are PedSafe, GreenWay, and SmartCommunity.
- Brevard County ITS—Evacuation Route: This project aims to upgrade dynamic message signs (DMSs) to provide the public with evacuation and transit-related information.
- Brevard County ITS Phases—ITS Expansion Priority Projects: This includes projects that address closed-circuit television (CCTV), Travel Time System, Road Weather Information System (RWIS), Microwave Vehicle Detection System (MVDS), signal upgrades (adaptive), and Florida 5-1-1 (FL511) plug-ins.
- FDOT Active Arterial Management System (Brevard County): The project will adjust signal timing related to predictable traffic conditions, especially during special events or construction. Traffic information will be provided to drivers via DMS, FL511, and a website. The existing FL511 website includes traveler information on freeways and will now be expanded to include arterials.

Figure 5-1 and Figure 5-2, below, represent the Brevard County ITS—Evacuation Route project. The first figure is an interconnect diagram that shows what elements are connected to each other. The second figure is an information flow diagram that shows the information flowing between the interconnected elements.

Figure 5-1: Brevard County ITS—Evacuation Route Interconnect Diagram

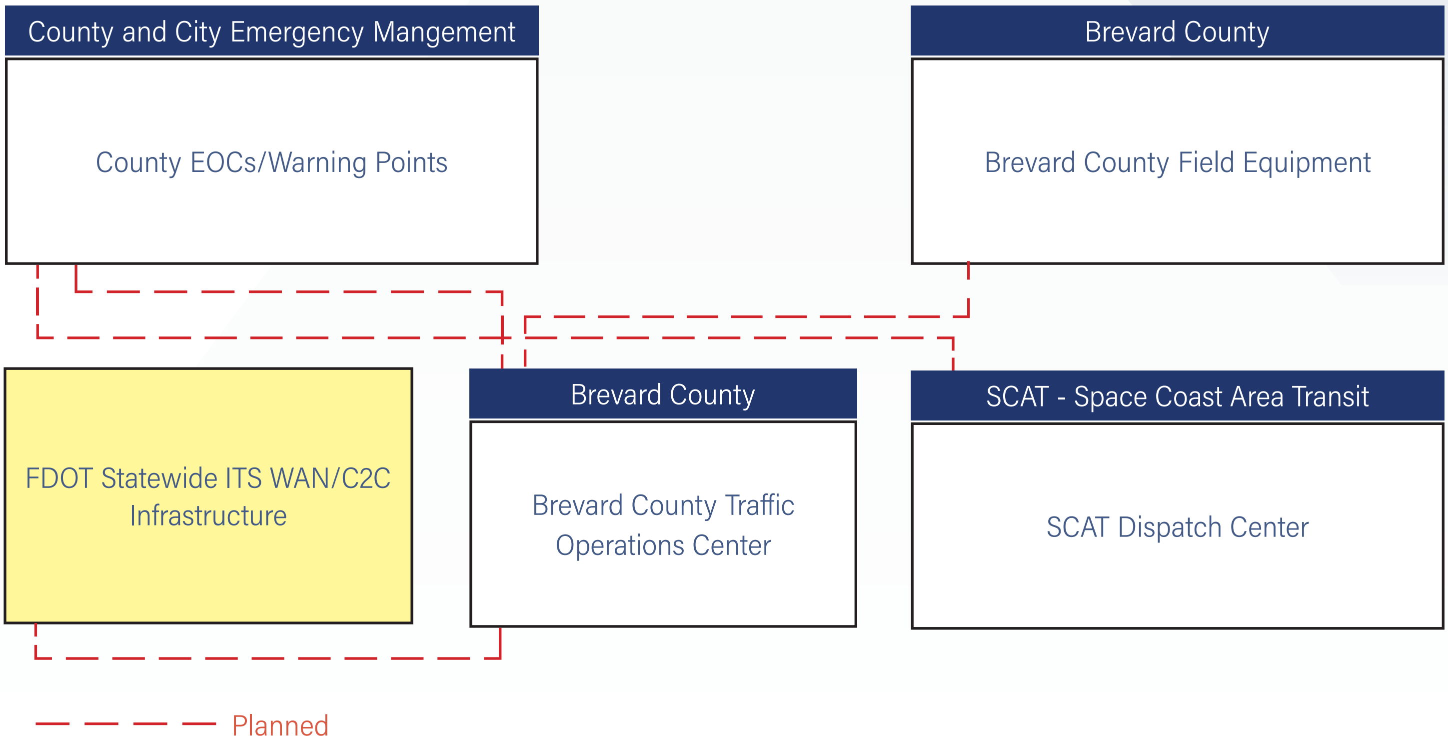


Figure 5-2: Brevard County ITS—Evacuation Route Information Flow Diagram

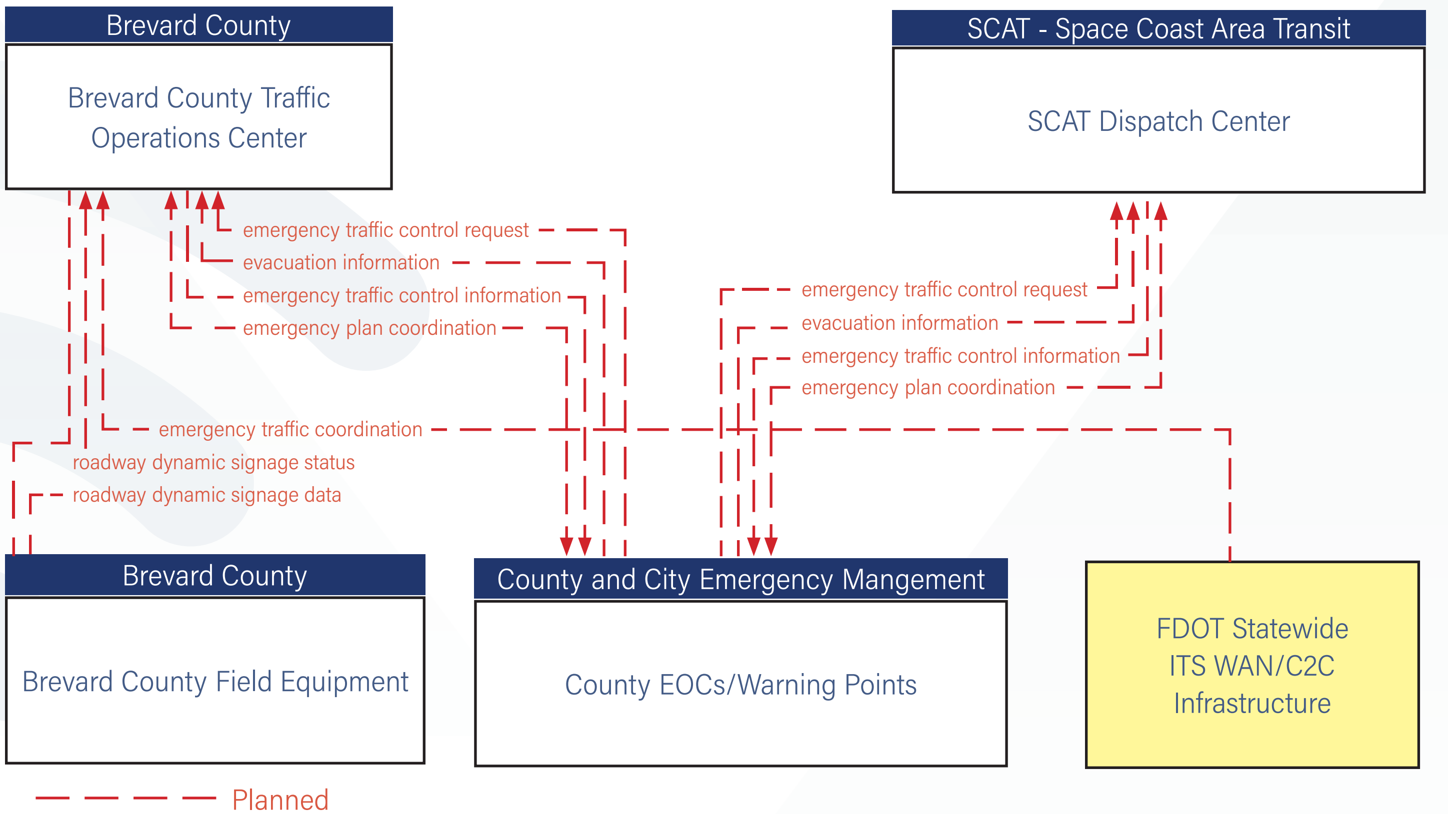


Figure 5-3, below, illustrates the data flow between the City of Melbourne Traffic Operations Center (TOC) traffic signals and other associated traffic management devices.

Figure 5-3: City of Melbourne Traffic Operations Center Interconnect Diagram

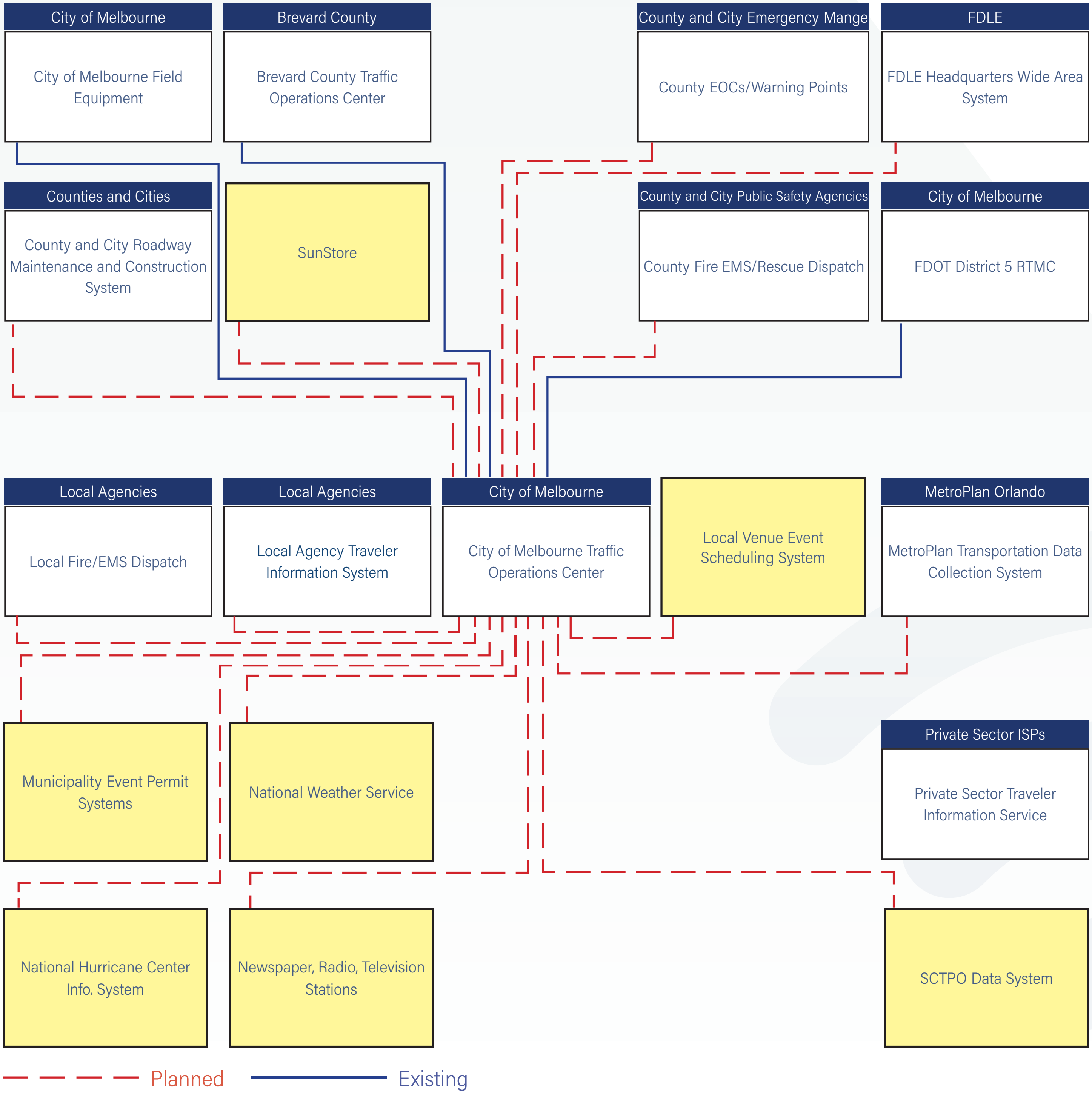
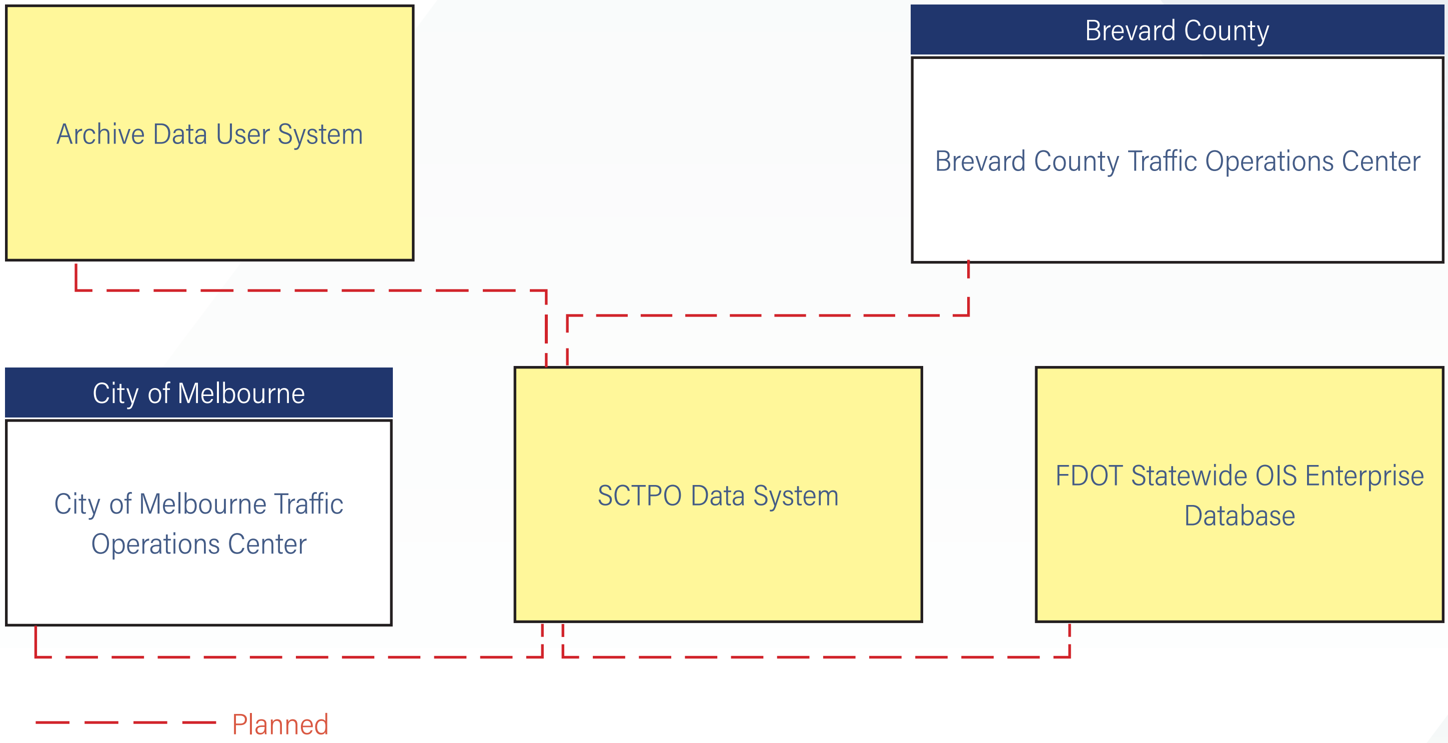


Figure 5-4: SCTPO Data System Interconnect Diagram



Architecture Conformance

Stakeholder needs for this project were outlined in Task 3. Table 5-1, below, indicates the identified stakeholder needs and the applicable service packages in the current regional architecture. These needs were matched with current service packages to identify any gaps in the current system architecture. Several needs identified in Task 3 do not pertain to service packages.

Table 5-1: Identified Stakeholder Needs and Applicable Service Packages

Identified Need	Applicable Service Package
Communications	DM01; MC06; MC09
Expand Existing Traffic Operations Communications	PS13; TI01; TM01; TM02; TM03; TM04; TM06; TM07; TM08; TM09
Traffic Operations and Management	TM06; TM07; TM08
TMC Operations	MC06; PM04; PS13; TM01; TM02; TM03; TM07; TM08; TM09;
Improve Pedestrian/Bicycle Safety	ST04; TM01; TM03; TM04; VS12; VS13
Expand Video Surveillance	TM01
Automated Traffic Signal Performance Measures (ATSPM)	TM01; TM03; TM07; TM09; DM02
Expand Traffic Data Management (Travel Time, Speed, and Volume)	TM01; TM09; DM02
Reduce Interstate Congestion—Off-Ramps	TM01; TM02; TM03; TM04; TM05; TM09
CAV Signal Systems	TM04; VS13
Electric Vehicle (EV) Infrastructure	ST05
Traveler Information	TI01; TI02; TI04; TM04; TM06; TM08
DMS Installation	TM06; TM08; TM12
Dynamic Detour Route Development and Management	TI03; TM06; TM07; TM08; TM09
Parking Management	PM01; PM02; PM03; PM04
Advanced Railroad Crossing Technology	TM13; TM14
Incident Management	MC06; SU03; TM08; TM09
Interagency Incident Management (Traffic Incident Management/Rapid Incident Scene Clearance [TIM/RISC])	MC06; TM08; TM09
Incident Scene Safety	MC06; TM06; TM08; TM09
Public Transit Management	PT01; PT02; PT03; PT06; PT07; PT08
Transit Signal Priority (TSP) Support/Queue Jumps	PT09; TM03; TM04
Automatic Vehicle Location (AVL) and Automatic Passenger Counter (APC)	PT01; PT02; PT03; PT07; PT08
Passenger Advisory System	PT07; PT08
Emergency Management	PS10; PS11; PS12; PS13; PS14
Remote Monitoring/Information Sharing	DM01; SU03; TM07
Automatic Incident Detection	TM01
Evacuation Planning	PS12; PS13; PS14
Information/Data Management	DM01; SU03
ITS Data Warehouse, Data Distribution	DM01; SU03
Core Authorization, Security, and Credentials Management	SU08
Maintenance and Construction	MC06; MC07; MC08
Infrastructure Monitoring	MC09
Performance Monitoring	DM02

Required Changes

The majority of the needs identified in this section are already included in the final District 5 Major Update Report (Version 1.0). The following summarizes the changes required based on the architecture review. Future needs should be documented in the new service packages and submitted to the Change Management Board for approval.

The following list identifies modifications to the existing service packages and/or new service packages to be added to the RITSA:

- Add DM02: **Performance Monitoring**
- Add MC07: **Work Zone Safety Monitoring**
- Add ST04: **Roadside Lighting**
- Add ST05: **Electric Charging Stations Management**
- Add SU08: **Security and Credentials Management**
- Add TI03: **Dynamic Route Guidance**
- Add VS12: **Pedestrian and Bicyclist Safety**

2021 Intelligent Transportation Systems Master Plan Update

Master Plan - Proposed Projects

SPACE COAST
Transportation Planning Organization

Introduction

This Intelligent Transportation System (ITS) Master Plan has been developed in conjunction with Space Coast Transportation Planning Organization (SCTPO) staff and regional partners based on an understanding of existing conditions and future needs. The following sections describe a variety of recommendations that will advance the program while continuing to build on previous successes. Example recommendations include implementation of new devices, regional-level Traffic Management Center (TMC) planning, corridor-specific projects, revisions and updates to policy, and staffing strategies.

As projects transition from this Master Plan into the feasibility and planning phases, note that the Federal Highway Administration (FHWA) requires projects seeking federal assistance for ITS deployments to use a Systems Engineering Plan (SEP) to qualify for financial assistance. The Project Systems Engineering Management Plan (PSEMP) documents tasks to be performed for the coordination and control of all ITS device deployments on a project-specific basis. The projects presented in this Master Plan will need to be submitted to the SCTPO project prioritization process and selected for funding before development of the SEP.

Device Recommendations/ITS Expansion

The Space Coast region has benefited greatly from extensive expansion of the ITS infrastructure. As it enters the next phase of implementation, the approach must include consideration for operations and maintenance in the project inception phase. In Florida, as in many states, the common practice is to build, then figure out how to operate and maintain the equipment after the fact. This outdated approach resulted in vast capital improvements with insufficient resources to manage the deployments, resulting in unrealized benefits of these systems. As the agencies of the Space Coast look to expand their ITS coverage, the funding, standards, and staffing resources to address operations, maintenance, and life cycle replacement costs of ITS equipment should be well established prior to any installations.

Furthermore, if the region is to be truly successful and maximize the potential of its current and future systems, the issue of interagency jurisdictional operational boundaries must continue to be addressed. Whether through a Joint Participation Agreement (JPA) or a similar Memorandum of Understanding (MOU), the maintaining agencies of Brevard County must act as one cohesive unit, particularly regarding operations activities on the arterials. They must clarify areas of shared responsibility, roles, and duties of partnering agencies while striving for a common regional goal as the foundation of an optimal system.

Fiber Optic and Wireless Communications

Establishing a reliable and robust communications network is the backbone from which regional ITS deployments can grow. Providing network connectivity to all field devices will ensure the highest dividends for operational benefits and provide future scalability and capabilities of the overall system.

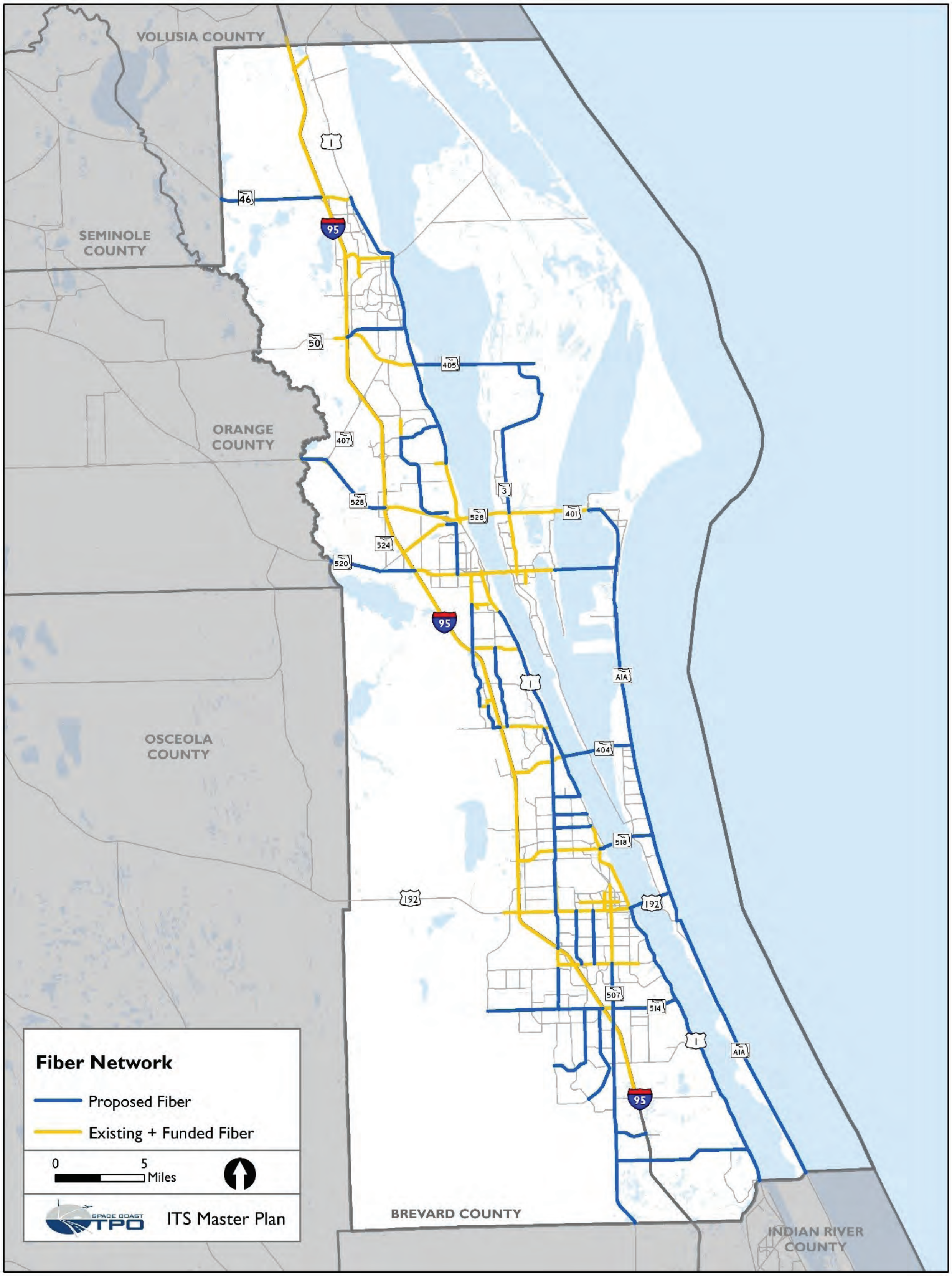
Installed along the region's limited-access facilities—Interstate 95 (I-95) and State Road 528 (SR 528)—District Five maintains a redundant Layer 2/3 network using a 72-count single-mode fiber optic trunkline supported by a series of microwave radio towers communicating between field devices and the Regional Traffic Management Center (RTMC) in Sanford, Florida. This trunkline connects all end devices on the FDOT-maintained facilities, but also provides redundant communication pathways between local agencies through fiber-sharing agreements.

Additional fiber optic communications have been deployed along many of the arterial roadways within the Space Coast region connecting the existing signal system and field ITS devices to the appropriate TMC (e.g., District Five, Brevard County, City of Melbourne). The existing infrastructure uses a mixture of fiber optic cables, ranging from hybrid 24-count single-mode/12-count multi-mode cables to 72-count single-mode trunkline cables. While most of the existing communications are installed on strategic eastwest corridors providing connections to I-95 or north-south spurs, there is currently not a fully redundant network providing fail-proof communications.

Moving forward, the proposed improvements within the region will continue to expand on the previous deployment of fiber optics, including new roadways and evacuation routes. New installations of fiber optic communications will aim to provide redundancy to the network through the development of network rings, as well as provide scalability for future devices and connectivity to corridors currently not tied to the network. Additionally, legacy infrastructure—such as hybrid single-mode/multi-mode cabling—should be replaced with new, larger-capacity cabling (e.g., 96-count single-mode). Deploying the proposed communications expansion in dedicated underground conduit and infrastructure will provide for additional hardening of the network against storms and damage-causing outages. Figure 6-1 shows the overall proposed and existing County fiber/wireless network.

Certain corridors face geographic challenges that may ultimately prevent the installation of fiber optic cabling or, at the very least, make the project costly (e.g., crossing the intercoastal waterway). For these locations, point-to-point wireless systems may prove a viable alternative. While these systems may result in reduced capital costs, concerns for maintenance and reliability tend to increase. Additionally, isolated locations or those requiring temporary network connectivity (e.g., ongoing construction) may be provided network connectivity through cellular modems, allowing them to communicate effectively in the same manner as a standard mobile phone.

Figure 6-1: Future Fiber Map

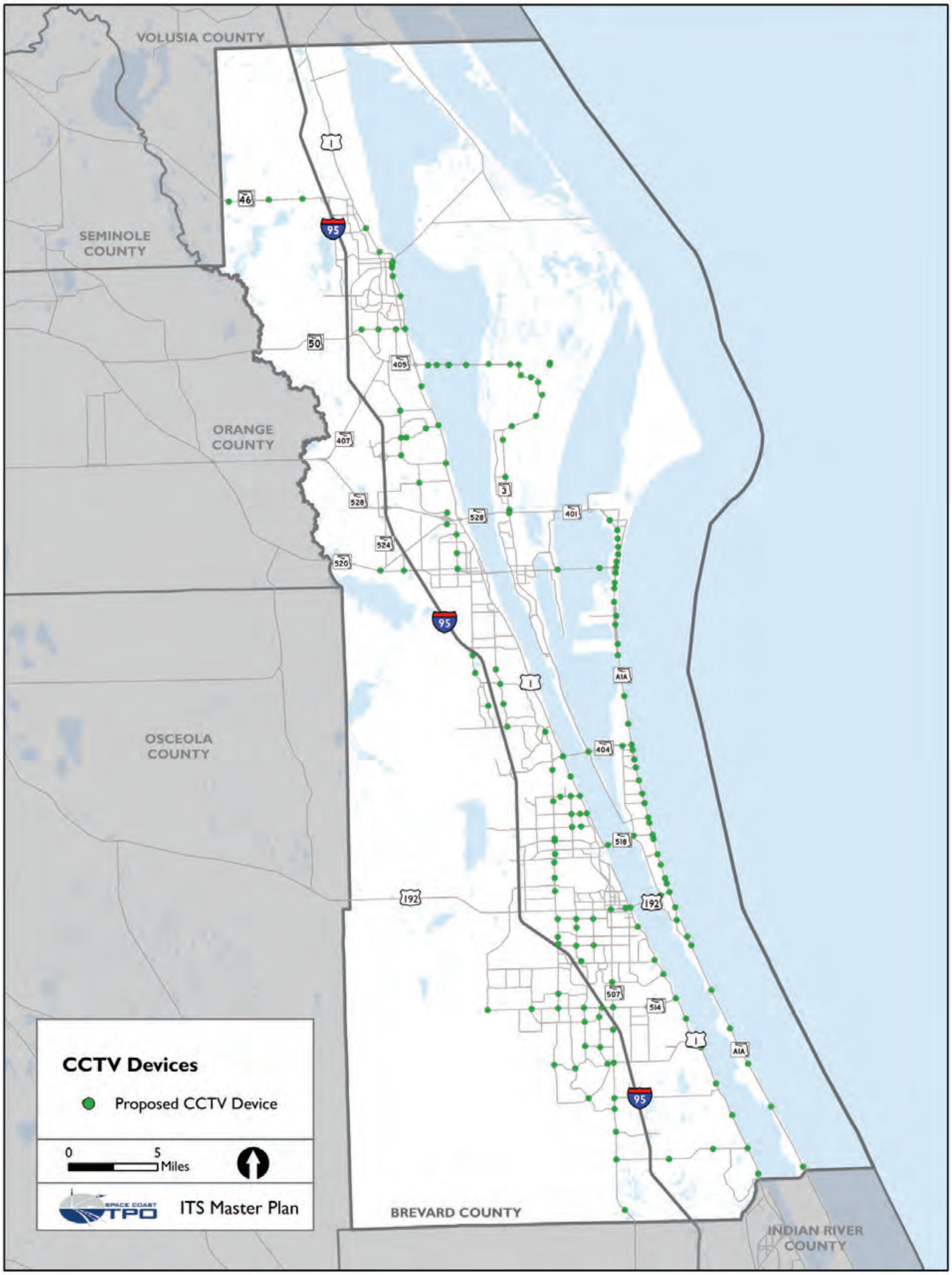


CCTV Cameras

Continued surveillance of the arterial roadway network will help improve incident response times, eliminate dangerous secondary crashes, and minimize delays caused by congestion. There are approximately 308 miles of arterial roadway covered by pan-tilt-zoom closed-circuit television (CCTV) cameras currently, including deployments owned and operated by Brevard County and the City of Melbourne. As identified during the existing conditions evaluation, there are still evacuation routes without CCTV coverage, as well as additional opportunities identified for Advanced Traffic Management Systems (ATMS) and Event Management type projects. In total, more than 180 additional CCTV cameras are proposed within projects, providing supplemental arterial coverage for real-time traffic and roadway conditions across the County. The new overall CCTV deployment suggested by the ITS Master Plan is shown in the Figure 6-2.

180 additional CCTV cameras proposed

Figure 6-2: Proposed CCTV Device Locations



DMS and Blank-Out Signs

Within the Space Coast region, there are currently a total of 102 Dynamic Message Signs (DMSs) installed on both limited-access highways and arterial corridors providing up-to-date traffic conditions, wayfinding information, and safety messaging to road users. Operated by District Five of the Florida Department of Transportation (FDOT), DMSs located along the limited-access corridors are typically full-color, full matrices capable of posting a combination of text and graphical messaging. Conversely, the existing deployments of DMSs along the arterial roadways tend to be smaller, monochrome displays capable of text-only messages constrained to three lines and they present visibility limitations due to text height. New installations of DMSs should include full-color, full matrix displays sized to accommodate the large elderly population that use the region's roads to ensure messages are visible. This will likely require the replacement of existing structures.

In total, 53 new DMSs are proposed along key arterial roadways within the region strategically located at key decision points—including major intersections, evacuation routes, entry and exit points for Brevard County, and more. Additionally, single-line embedded DMS displays are proposed within specific parking lot guidance signs to indicate the availability of parking stalls at facilities during large-scale events, such as beach and space launch parking. Refer to Figure 6-6 for proposed locations for additional DMS deployments.

Proposed: 53 new DMS signs

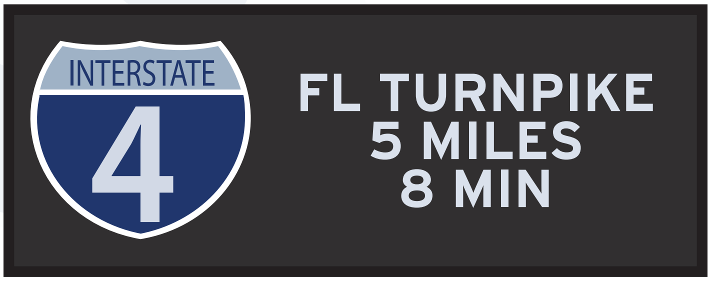
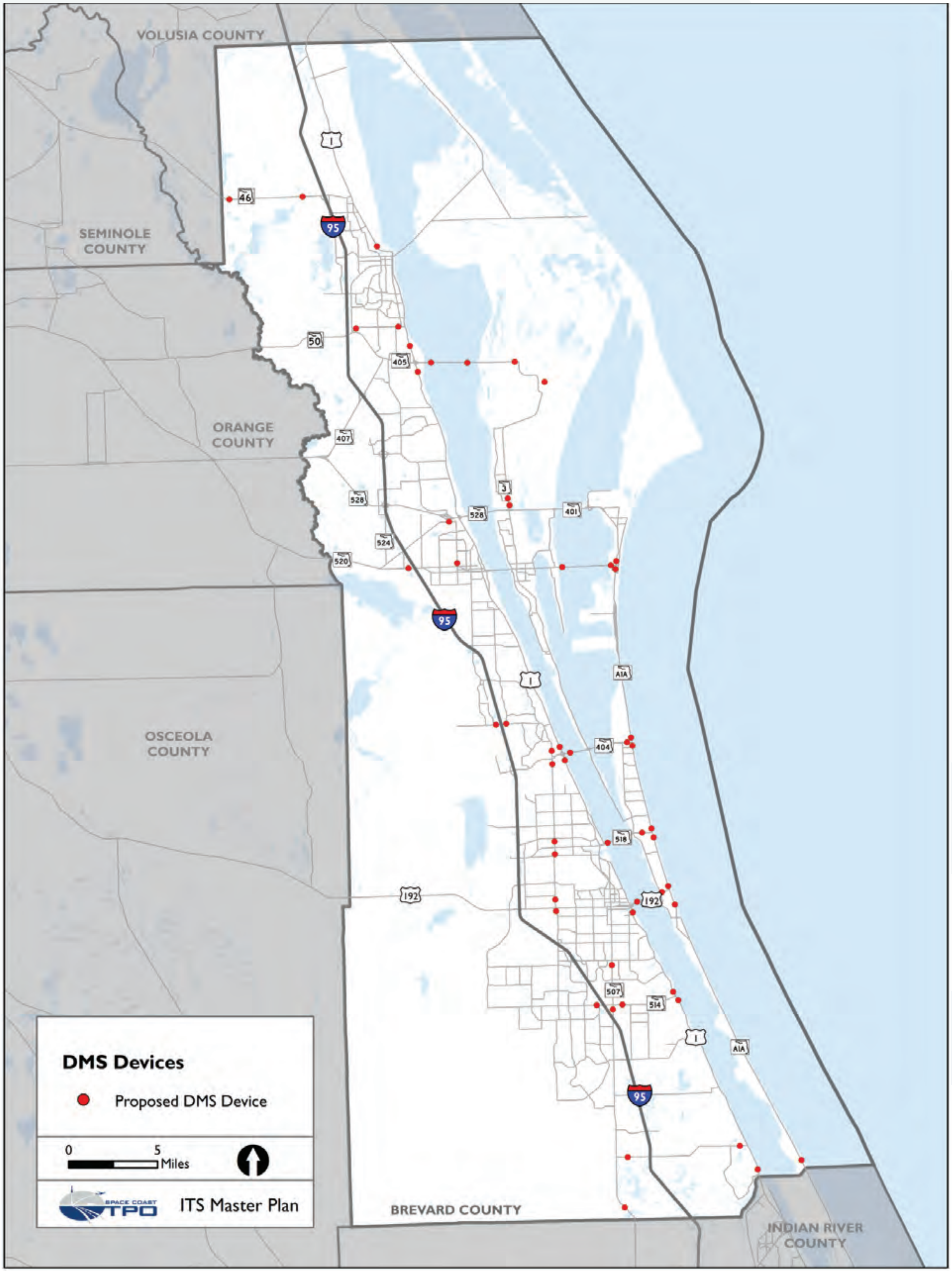


Figure 6-3: New full color DMS sign

Figure 6-4: Older DMS sign

Figure 6-5: Single line embedded DMS display

Figure 6-6: Proposed DMS Device Locations



While DMSs provide the greatest opportunities for flexibility of messaging, they are not always the most appropriate technology for deployment. Oftentimes, the necessary information provided to the driver is limited and can be achieved through simple text or graphics. This is particularly true at signalized intersections. These scenarios lend themselves well to the deployment of blank-out signs, which typically are cheaper and result in a smaller structural load than a DMS. This ITS Master Plan proposes blank-out signs to deliver a variety of messaging to road users, including pedestrian and bicyclist warning, wayfinding for event management and parking, and safety applications.

MVDS and Bluetooth Readers

Goal No. 1 of this ITS Master Plan identifies the need to improve traffic mobility across the region. To accomplish this objective, there is a need to collect real-time traffic information—including volume, lane occupancy, and travel time—to analyze performance and provide actuation for the implementation of appropriate responses (e.g., alternative timing plans and travel options). The two primary technologies to be deployed for the collection of real-time traffic data are Microwave Vehicle Detection Systems (MVDS) and Bluetooth Readers.

MVDS sensors provide raw data on a lane-by-lane basis, including vehicle presence, lane occupancy, travel time, and travel speed. Installing these systems at mid-block locations provides the data necessary to better operate arterial corridors in real time, perform pattern recognition and historical analytics, and identify anomalies or incidents (e.g., crashes). Currently, the only MVDS deployed within the region is maintained and operated by FDOT District Five on the limited-access facilities; however, the proposed deployment includes systems located at strategic mid-block locations to provide the real-time traffic conditions for key arterial corridors throughout Brevard County. Additionally, this technology can be employed in parking availability systems programmed to record the total number of incoming and outgoing vehicles.

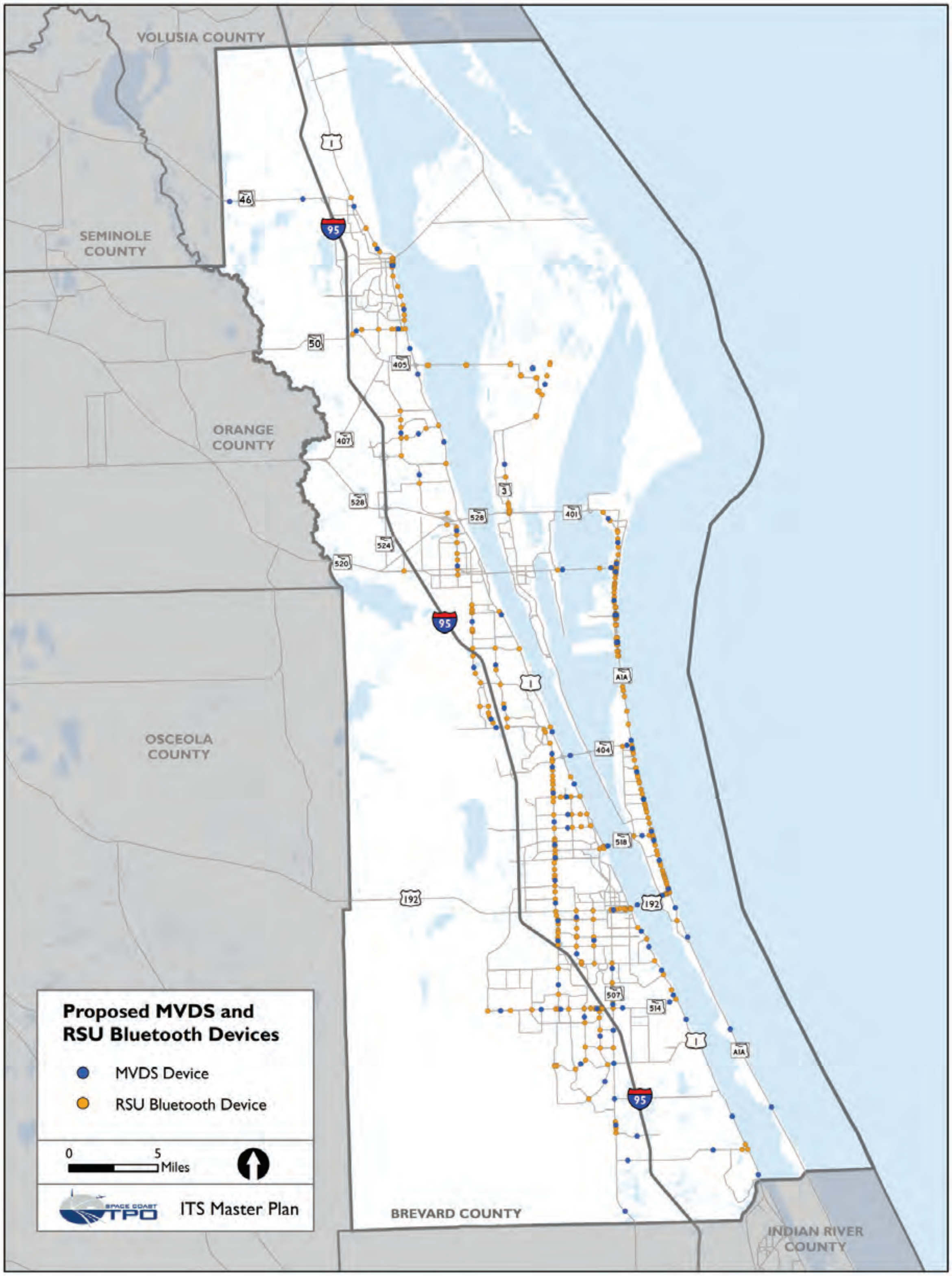
Figure 6-7: MVDS operated by FDOT (Source:FDOT)

Figure 6-8: Wireless bluetooth reader

Bluetooth Reader systems match current and historical data, including travel time, travel speed, and origin-destination information. The existing deployment of Bluetooth Readers is centered around critical corridors across the region. Continuing to expand this deployment will provide additional analytics and datasets for real-time operation and historical analysis efforts, such as long-range planning. Future deployments also may include additional technologies rolled into a single unit—for example, Wi-Fi Readers and Connected Vehicle Roadside Units (RSUs)—to maximize vehicle data penetration and the available applications. This also will create opportunities to increase the density of Bluetooth Reader deployment locations from mid-block locations to key signalized intersections.

This ITS Master Plan includes new deployments of MVDS as well as supplemental Bluetooth Reader technology installations, as shown in Figure 6-9.

Figure 6-9: Proposed MVDS and Bluetooth location map



Connected Vehicle Technology

Deploying the latest in the ever-changing technology available to transportation agencies will ensure that motorists within the Space Coast region can maximize the roadway network with safe, reliable experiences. Connected Vehicle technology provides the opportunity to communicate information directly to in-vehicle systems with better efficiency and speed than ever before. The deployment of RSU devices at signalized intersections will provide the ability to directly connect motorists with infrastructure to provide real-time information specific to their location and heading—such as signal phase and timing information, safety warnings (e.g., "Pedestrian in Crosswalk", "No Right Turn in Front of Bus), and roadway conditions. Additionally, RSUs can be deployed at mid-block locations along limited-access and arterial corridors to supplement in-vehicle messaging typically provided by DMS (e.g., "Lane Closed Ahead, Use Alternative Route").

Outfitting public vehicles (e.g., transit buses, emergency vehicles) with On-Board Units (OBUs) will allow for vehicles to communicate directly to one another to promote safety applications by providing speed, trajectory, and heading for collision avoidance. Furthermore, in-vehicle systems will be capable of providing information to roadside infrastructure for operational applications, including transit signal priority or emergency vehicle preemption.

Operations and Maintenance

Traffic Management Center

At the very heart of an ITS deployment—acting as the overall logistics, communications, command, and control element—is the TMC. Within the Space Coast region, there is currently not a unified TMC to facilitate provincial operations; however, Brevard County is in the process of designing and constructing one such facility to be located in Palm Shores, Florida, with available space for personnel from multiple local agencies. To date, the following agencies each maintain their own version of a TMC to operate and manage their ITS field devices and/or signal system:

- FDOT District Five RTMC—located in Sanford, Florida; manages all ITS field devices located on limited-access facilities (e.g., I-95, SR 528) and a portion of arterial roadways within Brevard County; staffed 24 hours a day, 7 days a week
- Brevard County TMC—located in Viera, Florida; manages a portion of ITS field devices and signal systems within Brevard County; staffed 9 hours a day, 5 days a week
- City of Melbourne TMC—located in Melbourne, Florida; manages a portion of ITS field devices and all signal systems within the City limits; staffed 9 hours a day, 5 days a week

The proposed Space Coast TMC will need to include state-of-the-art technology necessary to monitor, operate, and manage the entirety of the arterial roadway network within Brevard County regardless of jurisdictional boundaries. By providing available space for personnel from all local signal maintaining agencies and other governmental entities (e.g., first responders, transit agency), a collaborative approach to regional operations will be feasible to maximize the benefits of the existing and proposed ITS deployments for the traveling public. Each agency will not only need to be provided with the physical space—such as operator workstation(s)—but also the equipment, software packages, and access necessary to perform daily operational tasks effectively. The proposed plan for the regional TMC will need to consider, at a minimum, all of the following:

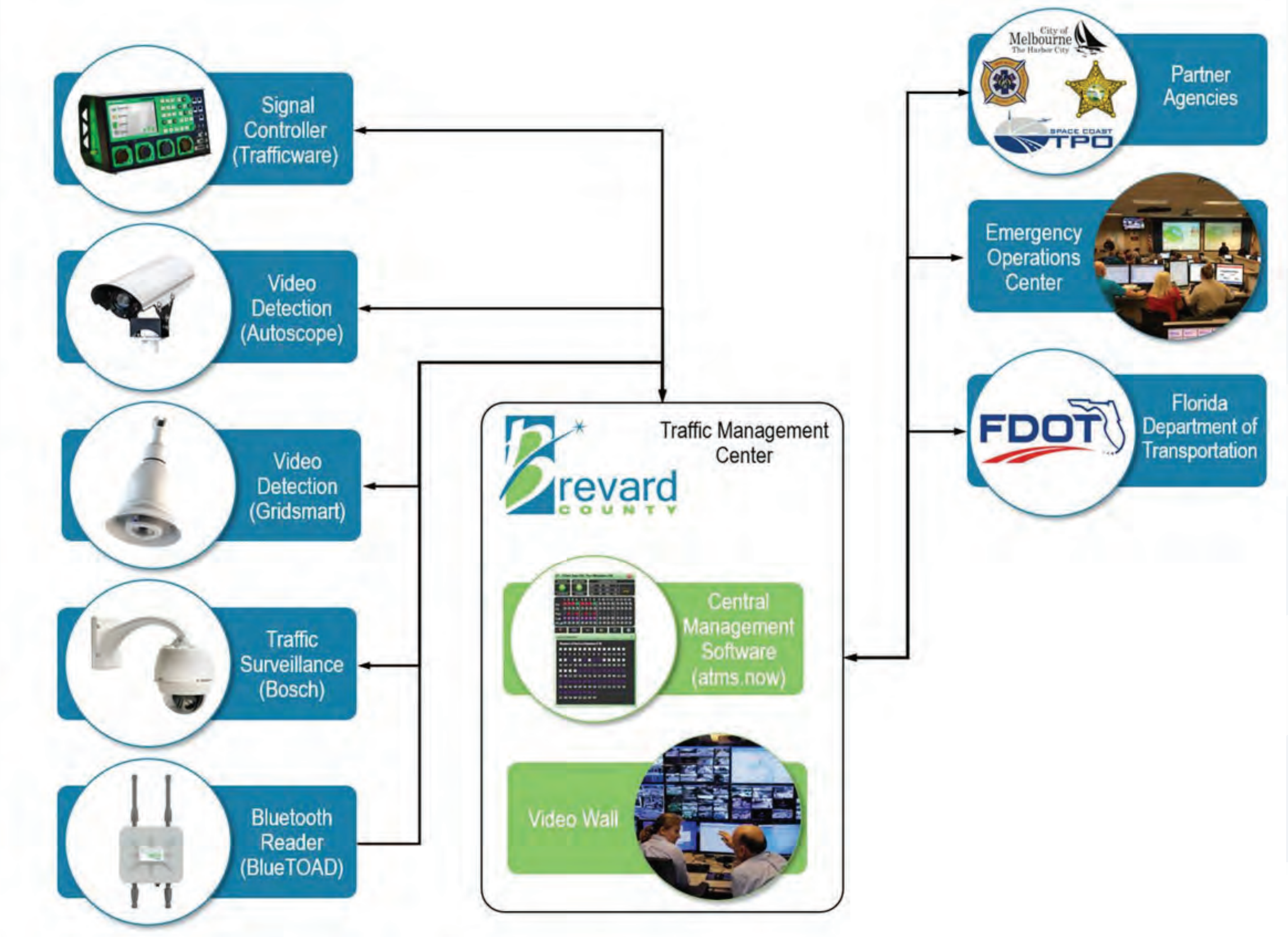
- State-of-the-art technology (e.g., video wall with configurable display options, high-power workstation computers, glare-resistant monitors)
- Functionality (e.g., dedicated server room, raised flooring for cable management, media viewing room, office and conference meeting space)
- Flooring plan options (e.g., number of workstations per agency, strategic placement of agencies to facilitate collaboration based on geographic limits)
- Emergency preparedness (e.g., redundant communication systems, duplicative power systems,

back-up generators)

- Ergonomics (e.g., sightlines from operator workstations to video wall, adjustable standing desks, circular arrangement of monitors, adjustable lighting levels, sound dampening materials)
- Staff accommodations (e.g., dedicated personnel lockers, breakroom with full kitchen, showers)

Additionally, considerations for center-to-center connectivity will be necessary to provide the ability to communicate seamlessly with partner agencies that may not be collocated within the regional Space Coast TMC. As shown in Figure 6-10, establishing center-to-center communications with District Five will allow for seamless response and operation of the entire region's transportation system, including interstate and arterial roadways, as well as multimodal options (e.g., transit). These connections will allow for the transfer and receipt of data during normal operations hours and also will provide the ability to transfer operational tasks to the District remotely during non-operational periods (e.g., overnight). Similar connections will be necessary to each of the local maintaining agency networks within the Space Coast, first responders, transit agencies, and even agencies located outside of but immediately adjacent to Brevard County (e.g., Indian River, Volusia, and Orange Counties; FDOT District Four).

Figure 6-10: Communication with the TMC



TMC Operations Software

To successfully perform the day-to-day operational functions of each entity within the regional Space Coast TMC, multiple software packages likely will be required. Providing a centralized management platform (e.g., SunGuide-ActiveITS) will allow operators to record, monitor, and resolve incidents via a graphical user interface. Typically, this interface is a map-based view that provides traffic condition information in real-time. Additionally, this centralized management platform may be used to control and operate the various ITS field devices—including CCTV cameras, DMS, MVDS, Bluetooth Readers, Connected Vehicle technology, and more—from one source rather than multiple proprietary products. Additional features to be performed by this centralized management platform include management and control of incoming video feeds, video wall configuration, video and data sharing, development of real-time and historical reports, and maintenance of the center-to-center connections. The centralized management platform will be capable of being used by personnel from all local agencies within the TMC, sharing data seamlessly between users.

Operation of the existing signal systems will require licenses for the appropriate proprietary ATMS software (e.g., ATMS. now) provided by the vendor of the traffic signal controller. Currently, each local maintaining agency hosts a unique licensed instance of the ATMS software, which is expected to continue in the collocated TMC. From this platform, each entity will be provided the ability to update signal timing remotely, revise coordination and time-of-day plans, identify system alarms and failures, run diagnostic reports, and more.

Additional logistics and support software packages also should be considered for monitoring and maintenance of the overall system, including network diagnostics, infrastructure security, firewall, maintenance ticketing systems, social media platforms, and more.

TMC Staffing for Operations

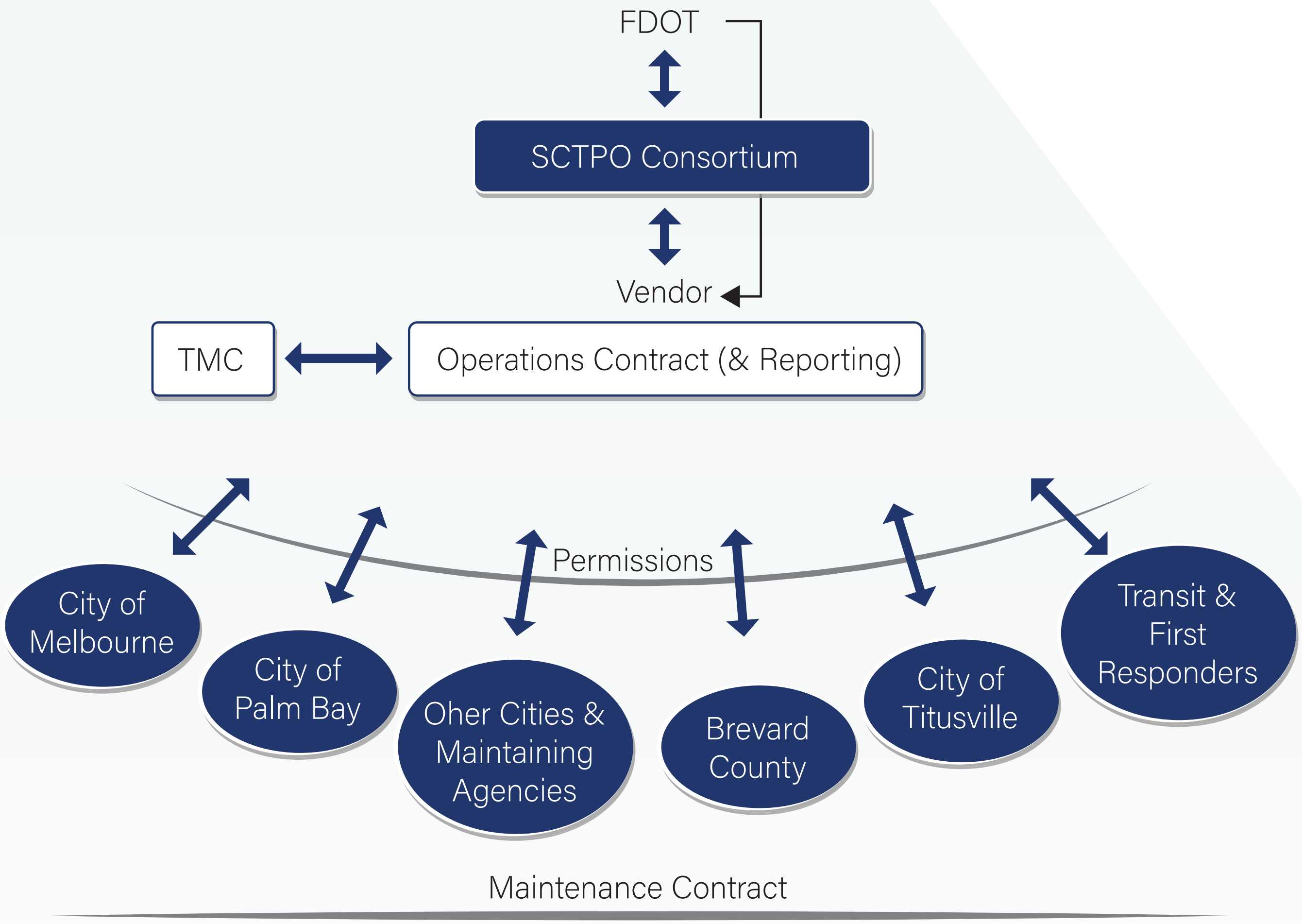
The proposed Space Coast TMC should be staffed adequately to handle both AM and PM peak periods of traffic throughout the region. In most cases, standard operating hours for an arterial operation center are between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday, with weekend staffing to be provided for special events (e.g., space launch), holidays, peak-season (e.g., beach traffic), or other as-needed occurrences. Collocating multiple local agencies within one facility provides the opportunity for work sharing and configuration of overlapping shifts, thus eliminating the need for each agency to staff the entire 12-hour window. For example, the regional TMC could deploy three shifts—morning, midday, afternoon—with overlapping windows to allow for the agencies staffing the early shifts to cover the roles and responsibilities of the jurisdictions who only staff the later shifts, and vice versa. Operation of the system could be augmented by sharing responsibility with the District Five RTMC through center-to-center connectivity to handle situations occurring outside of the standard operating hours.

Staffing within the Space Coast TMC will likely include multiple roles—including Floor Manager, Supervisor, Operator, Signal Timing Engineer—sharing responsibilities including, but not limited to, identifying incidents; mobilizing appropriate responses; recognizing recurring congestion or anomalies; optimizing the arterial signal system; coordination with local stakeholders; identifying devices or systems in disrepair and logging maintenance tickets; disseminating information to the general public, and more.

County Consortium

A county consortium was a key recommendation from the 2015 ITS Master Plan and continues to be critical when planning for future success. To successfully implement, operate, and maintain this ITS Master Plan in Brevard County, a regional consortium is proposed to provide structure and decision making. The proposed consortium structure establishes regional partnerships between local agencies to achieve the goal of safe, efficient mobility on the Brevard County transportation network. As planned, the stakeholders establish and agree to the roles and responsibilities of each agency, including data information exchange, permissions, and requirements to support an integrated operations center. The proposed structure is displayed in Figure 6-11.

Figure 6-11: Illustration of the Proposed Local Consortium



The proposed structure gives the agencies the general responsibilities listed below:

- FDOT—Supports contract management and possibly provides program funding (as available)
- SCTPO—Acts as a coordination umbrella and is a liaison between FDOT and the TPO Consortium
- TPO Consortium—Would decide on Task Work Orders for the overall system, with input from the agencies
- Vendors—Brevard County would operate the system with guidance from the Consortium. One vendor would facilitate sharing of data between agencies. A second vendor would provide maintenance services.
- Local Agencies—Would have permissions to the ITS system and also hold maintenance contracts within their municipal boundaries

This structure is based on an operations and maintenance core principle. The goal of the structure is to focus on Maintenance (Level 1) and Basic Operations (Level 2) to establish the foundation of the ITS system. Operations and maintenance need to be accomplished to build infrastructure appropriately, and the capital improvements are based on the operations and maintenance needs/limitations. Operations and maintenance plans are a proactive way to maintain a healthy system and these plans prevent reactive equipment fixing when elements of the system break. Level 3 (TMC Operations) and Level 4 Active Arterial Management (AAM) would come after the maintenance and basic operations are established.

Consortium Structure Levels

The Consortium is proposed to be structured in three levels:

- Level 1: Operator/Maintainer Stakeholders
- Level 2: Other Stakeholders
- Level 3: First Responders

Level 1 includes the operators/maintainers of the ITS within Brevard County. The members included in Level 1 would meet quarterly to discuss any issues observed with the ITS and approve any actions the vendor needs to perform. This group also would be responsible for day-to-day operations, requesting/approving a system maintenance plan to include preventive maintenance, developing and maintaining an operations plan to review existing system status, reviewing performance measures based on vendor reports, reviewing the annual budget and expenses, and reviewing the quality of the vendor's work. A financial level also is present within this structure. The proposed structure would give the Consortium permission to manage and establish an annual budget with the assistance of FDOT.

The Level 2 stakeholders provide valuable input on issues observed within the system but cannot vote on the operations/maintenance plans or approve actions the vendor needs to perform. Level 3 includes first responders and the TMC. Level 3 members are the on-the-ground eyes and ears of the system, providing feedback from the street level about operations or maintenance issues. The ITS standards outlined in the Concept of Operations Memorandum developed for this ITS Master Plan facilitate interoperability and integration of ITS devices and systems. The proposed Consortium will analyze the impact of adoption of standards within the deployment cycles for the future ITS.

Consortium Agreements

To fully accomplish the operational concept, interface, and data flows among the public and private sectors, formal agreements among stakeholders would be necessary to create parameters for sharing agency information. There would be no change to the legislative agreements or existing agreements based on the new Consortium agreements. Common agreement types can include but are not limited to:

- Memorandum of Understanding (MOU)—An MOU demonstrates general consensus or willingness to participate as part of a particular project, but it usually is not very detailed. Allows organizational commitments. This would be a non-binding document, able to be modified as the ITS Master Plan evolves during implementation.
- Data Sharing Agreement—These agreements between agencies within the Consortium provide continuous parameters, guidelines, and policies for the implementation of any ITS deployment projects.
- Funding Agreement—This document lays out the funding (budgeting) arrangement for any ITS deployment projects.
- Performance Requirement—This document describes how any vendors selected for any of the four functional areas may be scored/analyzed based on multiple criteria previously established by stakeholders. This also may include penalties and report reviews.

Functional Requirements of Operations and Maintenance Vendors

The final piece to the overall Consortium structure is the role of the vendors. The vendors' jobs are to establish trust with the Consortium that the recommendations they are making are appropriate for the system. The vendors are required to care for the functional requirements of a TMC, by the following pre-determined permissions:

1. Recommend/remotely control traffic signal controllers
2. Collect traffic signal controller data from the field
3. Maintain traffic signal coordination

Policies

The following policies were identified in previous chapters and are included here because they support needs identified by stakeholders. They also represent opportunities to continue to partner with FDOT and support these efforts.

- Automated Traffic Signal Performance Measures (ATSPMs), included in the FHWA Every Day Counts technology initiative, is defined as a suite of performance measures, data collection, and data analysis tools to support objectives and performance-based approaches to traffic signal operations, maintenance, management, and design to improve the safety, mobility, and efficiency of signalized intersections for all users. The appropriate understanding and implementation of ATSPM will provide operational staff with additional granular data at the intersection level to optimize traffic flow. FDOT District Five has already begun the process of incorporating regions of Central Florida into the ATSPM system, including limited signals within Brevard County. (Source: https://atspm.cflsmartroads.com/ATSPM/)
- Performance Measures (e.g., Travel Time Index, Reliability) provide detailed real-time and historical data about the operation of arterial corridors and signalized intersections. Performance measures can be used in real-time operations by comparing historical baseline information to current data to identify anomalies before citizen complaints are received (e.g., failed detector). This will allow operations staff to quickly understand the root of the perceived problem and mobilize the appropriate response (e.g., repair the signal, adjust the signal timing).

  Additionally, performance measures can be used to identify system improvements over a specified period of time. For example, comparing travel time reliability across a 12-month period will provide a data-driven picture of the measured improvements of the system to determine other key metrics, such as cost/benefit ratio. A customized data dashboard can be developed to display performance measures in a quick, easy-to-understand visual format. This strategy offers tremendous value in reducing the required manpower and resources needed to actively monitor and review the performance of local systems and operations. There is an opportunity to partner with FDOT District Five to implement and further enhance this strategy.

Staffing Needs and Estimates

Adequate numbers of well-trained staff is a key element for the expansion of the overall regional ITS program. Over the course of the development of this plan, the need for staff was a consistent theme. Without it, the regional benefits will be limited, and the full envisioned benefits will never be realized. Each new project added requires analysis of staff capacity and additional staffing will be needed to support the implementation of this plan. To assist with the understanding of staffing needs, analysis was done on a per-device basis as well as a maintenance basis to understand the project maintenance needs going forward.

Criteria for Staff Increases

In addition to an hourly maintenance recommendation, this plan references the recommendations of FDOT's *District 5 Districtwide ITS Master Plan*. This FDOT plan provided criteria for agencies operating both traffic signals and ITS devices with a TMC. The criteria recommended staff levels for each position based on the combined number of signals and ITS devices. These criteria are shown in Table 6-1.

Table 6-1: FDOT Staff Estimates for Numbers of Signals

Position	Number of Signals + ITS End Devices				
	<100	<200	<350	<700	<1,400
Traffic Engineering Operations Manager	0	1	1	1	1
Traffic Signal Engineer	0-1	2-3	1-2	2-3	2-3
Traffic Signal Analysts/Technician	1-3	8-16	4-10	8-16	15-30
Traffic Signal Maintenance/ITS Fiber Technician	*	1-2	1	1-2	2-3
Network Specialist	*	1-2	1	1-2	2-3
Electronics Specialist (L2 Network Tech)	0-1	1-3	1	1-3	2-7
TMC Manager	*	1	1	1	1-2
Supervisor **	*	1-2	1	1-2	2-3
TMC Operations **	0-1	2-4	1	2-4	4-6

* This position is desirable but not necessarily required. ** This position is required 14 hours a day (Weekdays only). Note that FDOT and the City of Orlando are 24 hours a day/7 days a week/365 days a year.

At the time of this writing, sufficiency of agency staffing varies. There is an ongoing need to understand system needs and review staffing plans. Table 6-2, below, lists the additional staffing needed for the proposed projects. This does not include existing staffing deficiencies. According to the by the number of devices that could be added if all the identified projects per time frame were implemented based on the guidance shown in Table 6-1. An estimate by hours per project can be found in Appendix A.

Table 6-2: Additional Staff Needed by Phase

Position	0-5 years, proposed 519 devices	5-10 years, 522 proposed devices	10+ years, 160 proposed devices
Traffic Engineering Operations Manager	1	1	1
Traffic Signal Engineer	2-3	2-3	2-3
Traffic Signal Analysts/Technician	8-16	8-16	8-16
Traffic Signal Maintenance/ITS Fiber Technician	1-2	1-2	1-2
Network Specialist	1-2	1-2	1-2
Electronics Specialist (L2 Network Tech)	1-3	1-3	1-3
TMC Manager	1	1	1
Supervisor	1-2	1-2	1-2
TMC Operations	2-4	2-4	2-4

Table 6-3, below, lists the device totals by time frame and the estimated hours to maintain the devices.

Table 6-3: Estimated Maintenance Hours by Tier

0-5 years		5-10 years		10+ years	
Devices	**Hours**	**Devices**	**Hours**	**Devices**	**Hours**
519	1,760	522	1,712	160	550

These staffing projections should be reviewed and revised as needed as projects are implemented. Information provided in Table 6-2 should be used to understand possible staff needs if projects are implemented and can be used to forecast and support budget requests.

Projects

This ITS Master Plan identifies opportunities to expand on an established foundation of ITS technology and a history of agency collaboration. The following maps and tables depict the ITS Master Plan recommendations for the SCTPO area. Generally, projects were considered by timeframe (0-5, 5-10 and 10+ years) where appropriate. In some cases, no timeframe is suggested because projects may be driven by other agency timelines or are more likely to be included in other projects than stand-alone.

Figure 6-12 illustrates all the identified projects. A complete tabular listing can be found in Appendix D and cost information for each project can be found in Appendix B..

Figure 6-12: All Identified Projects

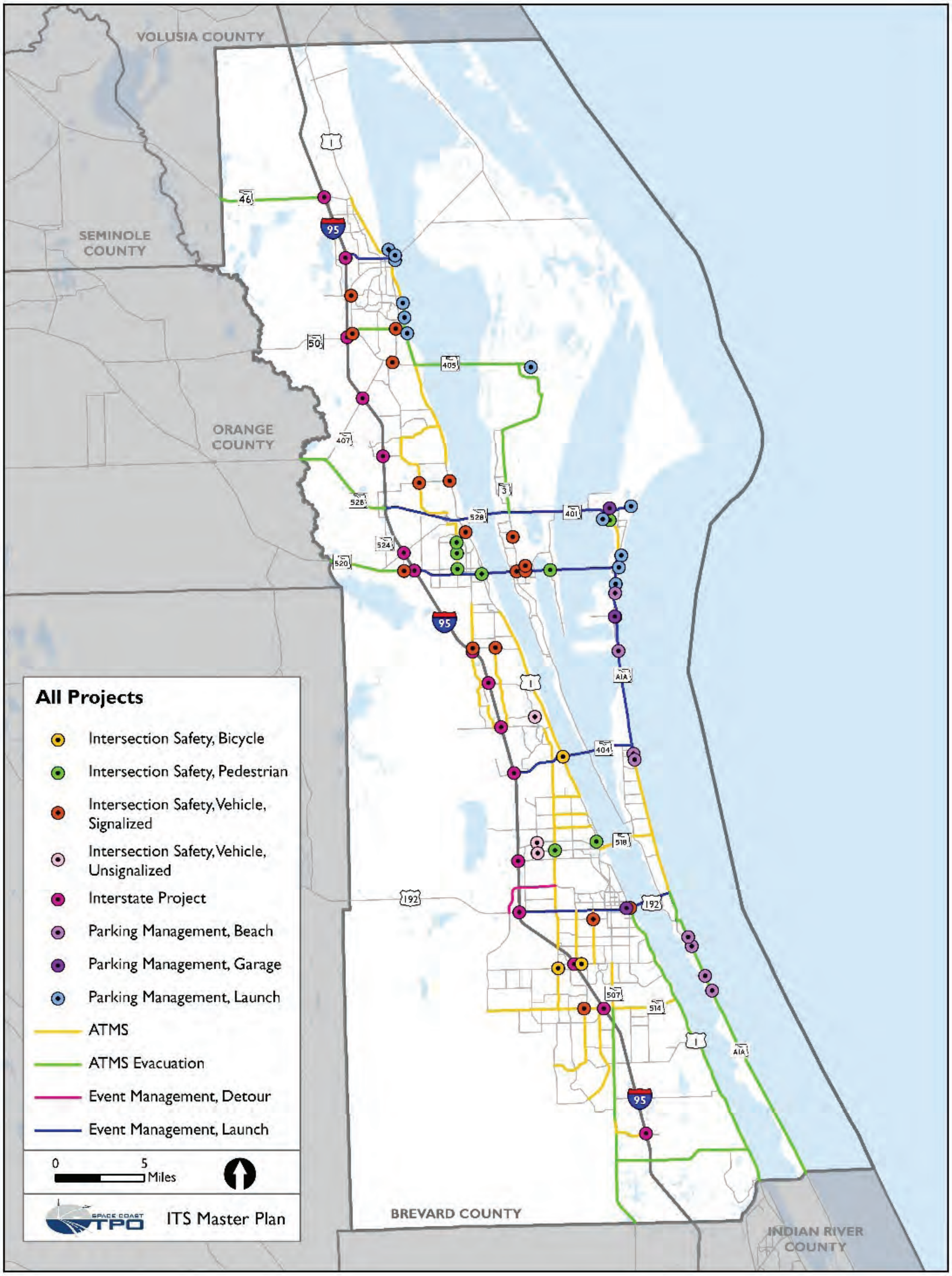


Figure 6-13 illustrates ATMS projects and the ATMS projects specifically identified for evacuation routes. Proposed projects are listed in Table 6-4. Additional information on these projects can be found in Appendix D.

Figure 6-13: ATMS and Evacuation Route Projects

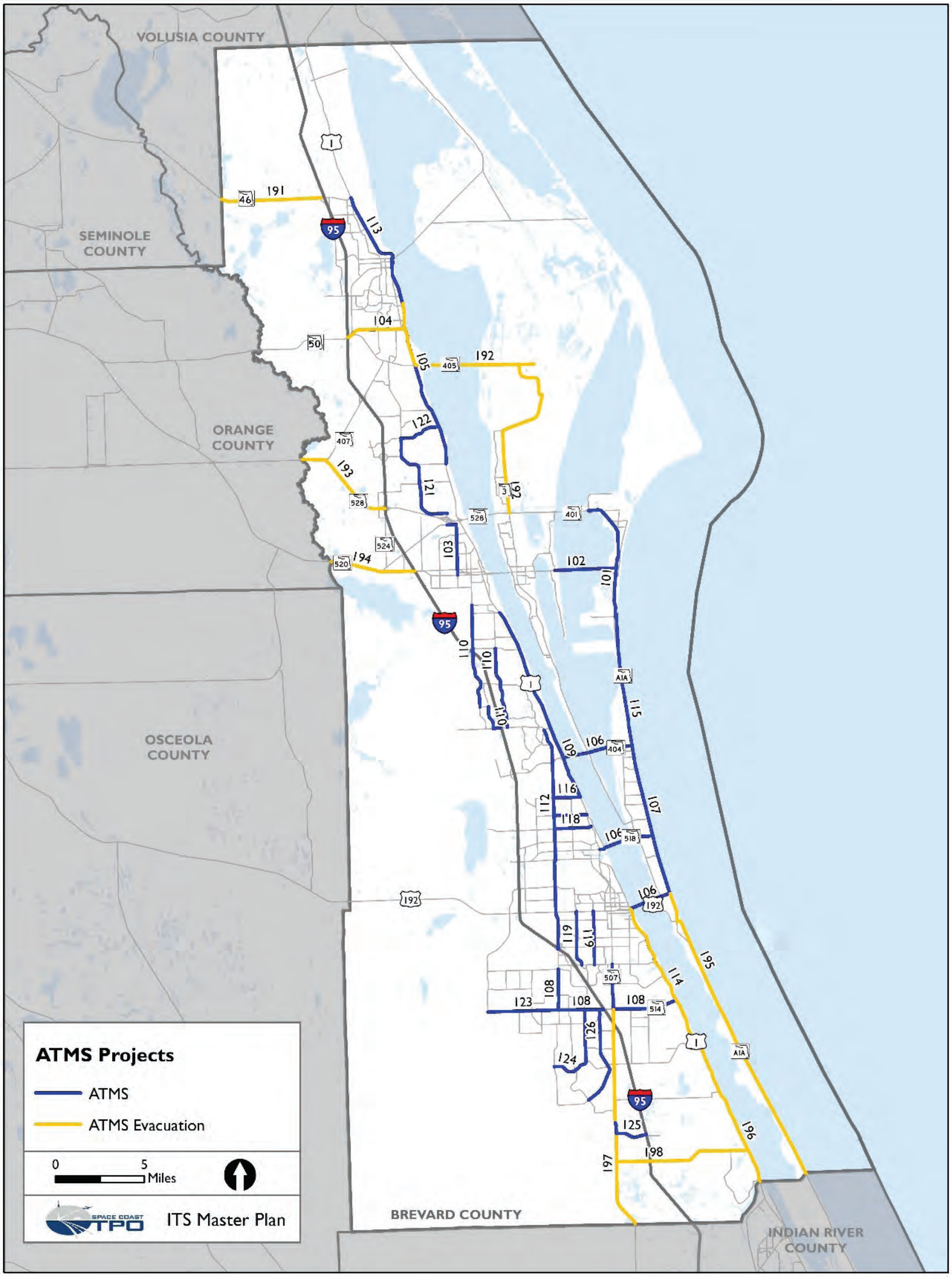


Table 6-4: ATMS Projects by Timeframe

Project #	Corridor	Start	End	0-5, 5-10, 10+ years
ATMS				
101	SR A1A	Minutemen Causeway	SR 401	0-5
103	SR 501 (Clearlake Rd)	SR 520 (King St)	Industry Rd	0-5
115	SR A1A	SR 404 (Pineda Causeway)	Minutemen Causeway	0-5
102	SR 520	Milford Point	SR A1A	0-5
109	US 1	Post Rd	Eyster Blvd	0-5
106	SR 404, SR 518, and US 192	US 1	SR A1A	0-5
114	US 1	SR 514 (Malabar Rd)	E University Blvd	0-5
107	SR A1A	US 192	SR 404 (Pineda Cswy)	0-5
113	US 1	SR 406 (Garden St)	SR 46 (Main St)	0-5
105	US 1	Camp Rd	SR 406 (Garden St)	0-5
121	Grissom Parkway	Industry Rd	Fay Blvd	5-10
122	Fay Blvd	Homestead Ave	US 1	5-10
112	Wickham Rd	Minton Road	Suntree Blvd	5-10
116	Post Rd	Wickham Rd	US 1	5-10
117	Parkway Drive	Wickham Rd	US 1	5-10
118	Lake Washington Rd	Wickham Rd	US 1	5-10
108	SR 507 (Babcock) Minton Rd, SR 514 (Malabar)	Malabar Rd/Minton Rd	Palm Bay Rd/Emerson Rd/US 1	5-10
110	Rockledge Loop	Judge Fran Jameson Way/ Wickham Rd	Barton Blvd/Judge Fran Jamieson Way/Barnes Blvd	5-10
104	SR 50	South Street	US 1 (Washington Ave)	5-10
119	Hollywood Blvd	Palm Bay Rd	US 192	5-10
120	Diary Rd	Palm Bay Rd	US 192	5-10
123	Malabar Rd	St John's Heritage Parkway	Minton Rd	10+
124	Emerson Drive	Degroodt Rd	Malabar Rd	10+
125	St John's Heritage Parkway	Interchange	Maraloma On South Babcock St	10+
126	San Filippo Drive	Cogan Dr	Malabar Rd	10+
ATMS Evacuation				
192	SR 3 (Courtenay Pkwy)	SR 528	SR 405 (NASA Cswy)	0-5
191	SR 46	Brevard-Seminole County Line	Carpenter Rd	5-10
193	SR 528 (Beachline Expy)	Brevard-Orange County Line	I-95	5-10
194	SR 520	Brevard-Orange County Line	I-95	5-10
195	SR A1A	Brevard-Indian River County Line	US 192	5-10
196	US 1	Brevard-Indian River County Line	Malabar Rd	10+
197	Babcock St	Brevard-Indian River County Line	SR 514 (Malabar Rd)	10+
198	Micco Rd	Babcock St	US 1	10+

Event Management

Event management projects include devices such as DMS, CCTV, and parking signage. Project locations are illustrated in Figure 6-14 and are listed in Table 6-5. Additional information on these projects can be found in Appendix D.

Figure 6-14: Proposed Event Management Projects

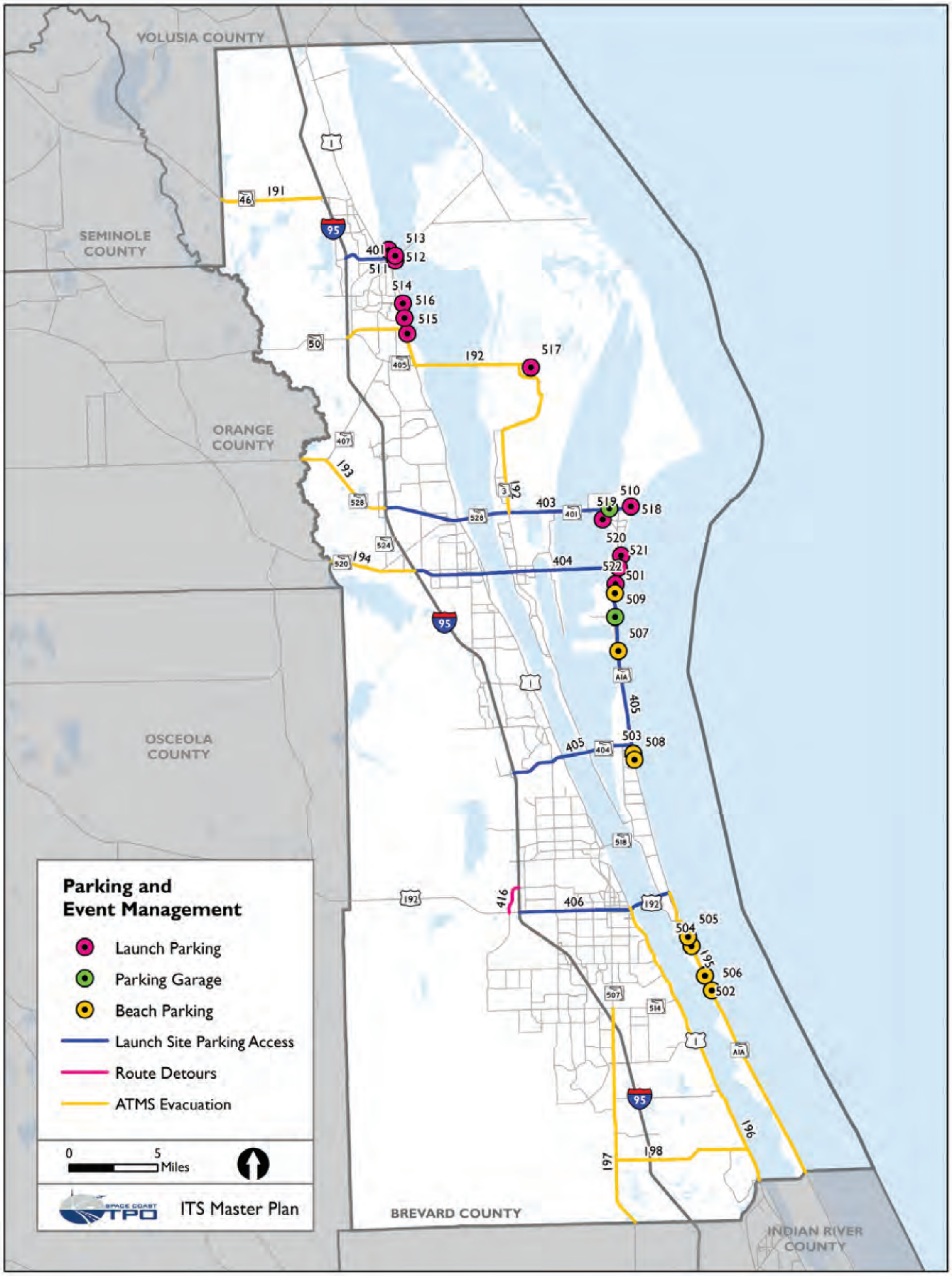


Table 6-5: Event Management Projects by Timeframe

Project #	Corridor	Start	End	0-5, 5-10, 10+ years
403	SR 528	W of I-95	SR A1A	5-10
404	SR 520	W of I-95	SR A1A	5-10
406	US 192	I-95	SR A1A	5-10
405	SR 404 (Pineda Cswy)	US 1	SR A1A	5-10
401	SR 406 (Garden St)	I-95	US 1	5-10
416	St John's Heritage Parkway	US 192	Ellis Rd	10+
415	Ellis Rd	I-95	Wickham Rd	10+

Interstate Projects

Interstate projects will utilize technology to alleviate congestion on either the mainline or arterial corridor as a result of queuing or "spillback". Example deployments include ramp signal systems, queue warning systems, wrong way driving systems, and automated truck warning systems. Interstate project locations are illustrated in Figure 6-15 and are listed in Table 6-6. Additional information on these projects can be found in Appendix D.

Figure 6-15: Proposed Interstate Projects

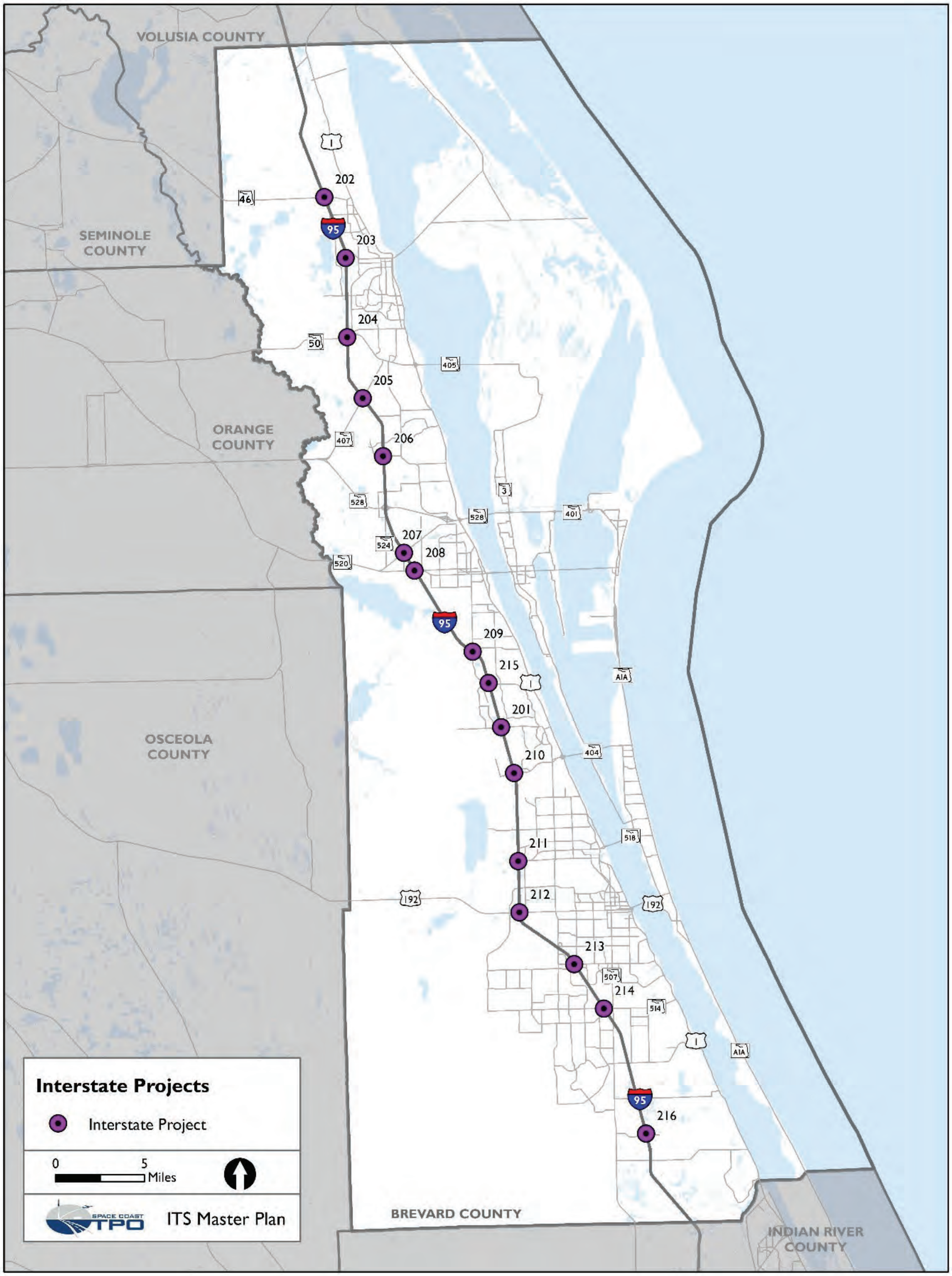


Table 6-6: Interstate Project Locations

Project #	Location
216	@ St Johns Heritage Pkwy
214	@ SR 514 (Malabar Rd)
213	@ Palm Bay Rd
212	@ US 192 (New Haven Ave)
211	@ SR 518 (Eau Gallie Blvd)
210	@ SR 404 (Pineda Causeway)
201	@ Wickham Road
215	@ Viera Boulevard
209	@ SR 519 (Fiske Blvd)
208	@ SR 520
207	@ SR 524
206	@ Port St. John Expressway
205	@ SR 407 (Challenger Memorial Highway)
204	@ SR 50 (Cheney Highway)
203	@SR 406 (Garden St)
202	@ SR 46 (Main St.)

Intersection Safety Projects

The need for projects that specifically address intersection safety is based on the recent Vision Zero Plan and the increased focus on road user safety in Brevard County. Possible locations were identified based on a review of the Vision Zero crash data for all users. Because the needs of each user group are different, "kits" or different groupings of technology and/or strategies were developed. It is recommended that each location be analyzed during the project design phase to ensure appropriateness of the technology for the context. Kits may be deployed as stand-alone projects, but it also is recommended that opportunities to integrate with planned projects be identified to increase the opportunities for implementation. Because of the complex nature of high-crash intersections, kits include both technology and infrastructure strategies to consider. When developing costs for the kits, only the technology was considered. The following describes the different kits.

Kit A, primarily for vehicles at unsignalized intersections, includes:

- Vehicle detection (e.g., installed on minor street to actuate Advanced Motorist Warning Systems)
- Light-emitting diode (LED) highlighted signs (e.g., "STOP," "STOP AHEAD," "YIELD," "INTERSECTION AHEAD")
- Standard flashing beacons with static sign panels
- Connected Vehicle RSUs (e.g., Traffic Information Management, (TIM), Roadside Alert (RSA))
- Signalization of the intersection (if warranted)

Kit B, primarily for vehicles at signalized intersections, includes:

- Signal retiming/phase modifications (e.g., protected vs. permissive, split phase)
- Vehicle detection (e.g., advanced or "dilemma" zone)
- Adaptive signal control technology
- Red light enforcement (e.g., tattletale light, red light violation camera by local law enforcement agency)
- Connected Vehicle RSUs (e.g., Signal Phase and Timing (SPAT), red-light violation warning)
- Advanced motorist warning system (e.g., flashing beacon, LED-highlighted signs located upstream of intersection and actuated by red phase)

Kit C, primarily for bicycles, includes:

- Signal retiming/phase modifications (e.g., protected vs. permissive)
- Blank out signs (e.g., "YIELD TO BICYCLE")
- Bicycle detection
- Advanced motorists warning system (e.g., Rectangular Rapid Flashing Beacon (RRFB))

- Connected Vehicle RSUs (e.g., TIM, RSA)
- Intelligent lighting (e.g., adaptive lighting)

Kit D, primarily for pedestrians, includes:

- Signal retiming/phase modifications (e.g., leading pedestrian interval, pedestrian only phases)
- Pedestrian detection (e.g., passive pedestrian detection, accessible pedestrian detection)
- CCTV cameras (e.g., near-miss analytics)
- Blank out signs (e.g., "YIELD TO PEDESTRIAN")
- Advanced motorists warning system (e.g., RRFB)
- Connected Vehicle technologies (e.g., TIM, RSA, Pedestrian in X-Walk)
- Intelligent lighting (e.g., lighted crosswalks, adaptive lighting, in-road lighting)

Intersection safety project locations are illustrated in Figure 6-16 and are listed in Table 6-7. Additional information on these projects can be found in Appendix D.

Figure 6-16: Proposed Intersection Safety Locations

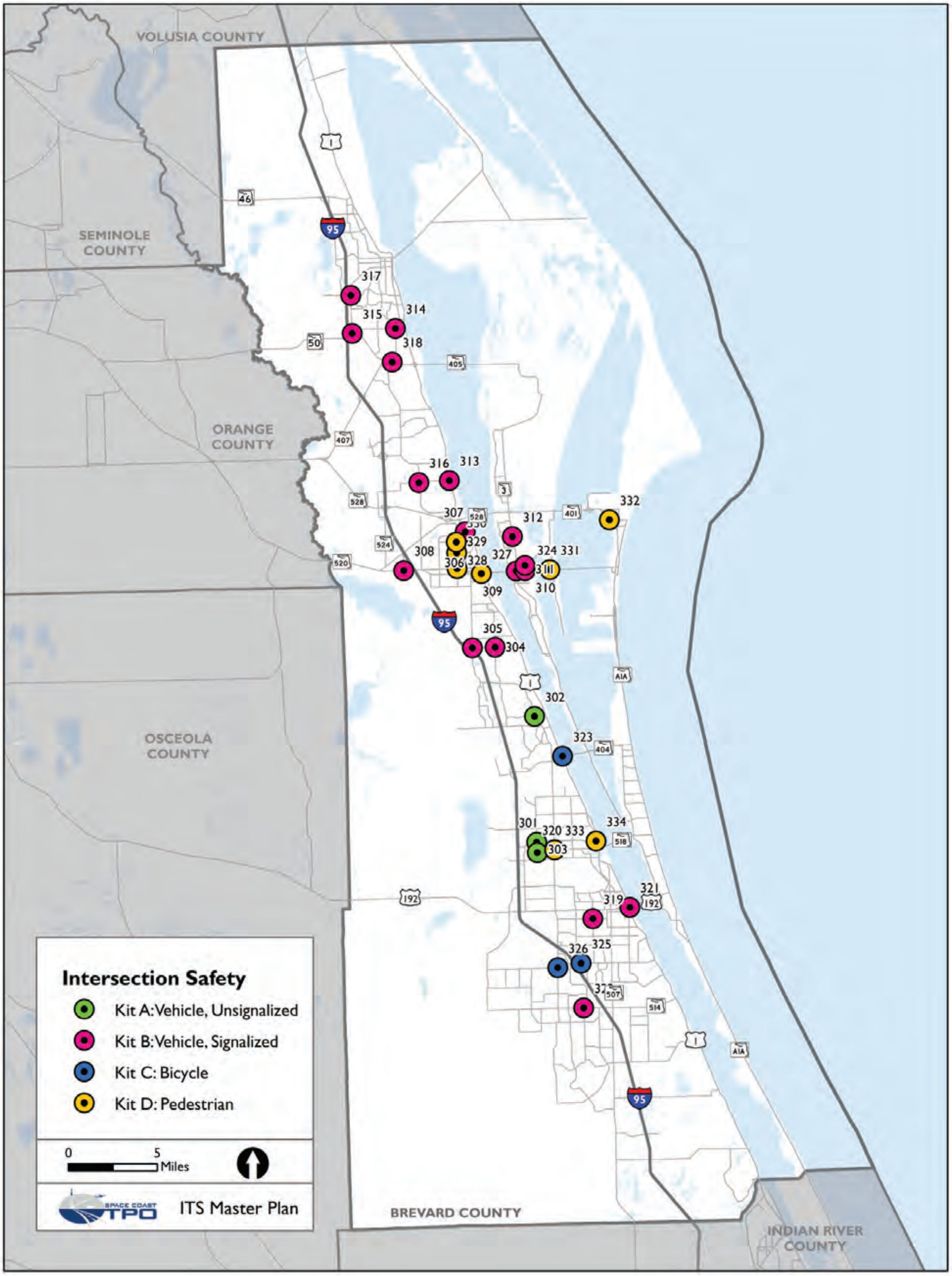


Table 6-7: Intersection Safety Project Locations

Project #	Corridor	Location / Start
323	US 1	@ SR 404 (Pineda)
324	SR 520	@ Newfound Harbor Drive
325	Palm Bay Rd	@Hollywood Boulevard
326	Minton Road	@ Emerson Drive
327	US 1	@ SR 520
328	SR 501 (Clearlake Rd)	@ Lake Drive/School St
329	SR 501 (Clearlake Rd)	@ Dixon Boulevard
330	SR 501 (Clearlake Rd)	@ Roseline/Tate Street
331	SR 520	@ Newfound Harbor Drive
332	SR A1A	@ Central Blvd.
333	SR 518 (Eau Gallie Blvd)	@ Wickham Road
334	US 1	@ Aurora Road
304	Barnes Blvd.	@ Murrell Road
305	SR 519 (Fiske Blvd)	@ Barnes Boulevard
306	501 (Clearlake Road)	@Roseline/Tate Street
307	US 1	@ Range Road
308	SR 520 (King Street)	@ Friday Road
309	SR 520	@ SR 3(Courtenay Parkway)
310	SR 520	@ Plumosa Street
311	Merritt Ave	@ Plumosa Street
312	SR 3 (Courtenay Pkwy)	@ Diana Boulevard
313	US 1	@ Canaveral Groves Boulevard
314	SR 50	@ Sisson Road/Alpine Lane
315	SR 50	@ SR 405
316	Grissom Parkway	@ Canaveral Groves Boulevard
317	SR 405 (South St)	@ Fox Lake Road/Harrison Street
318	SR 405 (South St)	@ Sisson Road
319	Dairy Road	@ Edgewood Drive
320	SR 518 (Eau Gallie Blvd)	@ Wickham Road
321	US 192	@ US 1
322	Malabar Rd	@ Emerson Drive
301	Aurora Road	@ Turtle Mound Road
302	Pinehurst Avenue	@ Spyglass Hill Road
303	SR 518 (Eau Gallie Blvd)	@ Turtle Mound Road

Parking Management

Parking management projects can deploy various technologies to detect and display information on available parking stalls at parking facilities (e.g., garages, surface lots, on-street parking). Deployed technologies include, but are not limited to:

- Communications (e.g., fiber optics, wireless, cellular)
- Parking detection systems (see Figure 6-17, below)
- Motorist information systems (e.g., DMS, embedded message boards, mobile applications)

Figure 6-17: Example Parking Detection System

Parking management project locations are illustrated in Figure 6-18 and listed in Table 6-8. Cost and timing information can be found in Appendix D.

Figure 6-18: Proposed Parking Management Projects

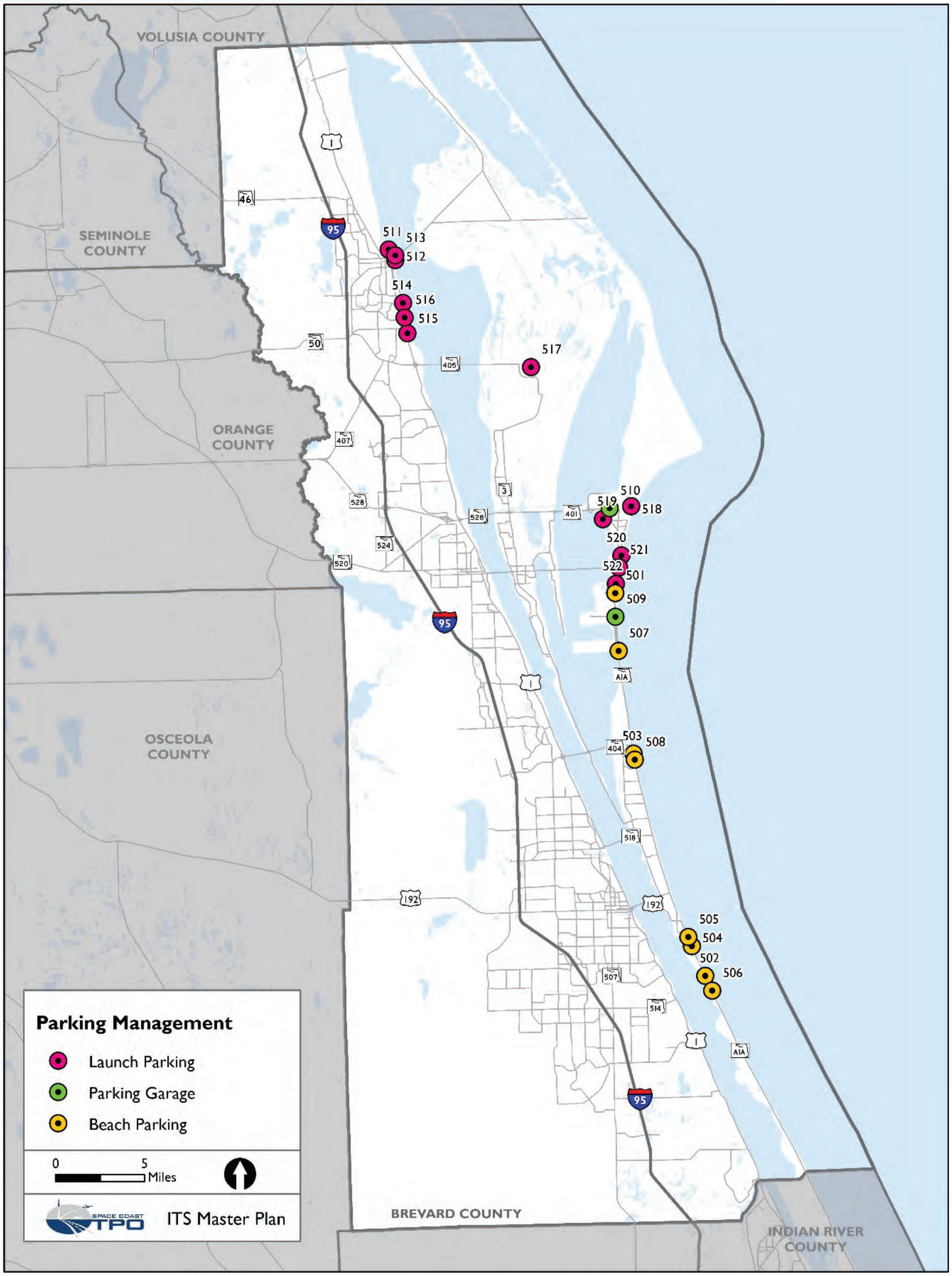


Table 6-8: Parking Management Project Locations

Project #	Location
501	Lori Wilson Park
502	Coconut Point Park
503	Seagull Park
504	Spessard Holland Beach Park (South)
505	Spessard Holland Beach Park (North)
506	Juan Ponce de Leon Landing
507	Robert P Murkshe Memorial Park
508	South Patrick Residents Association Park
509	City of Cocoa Public Garage
510	Port Canaveral
511	Marina Park
512	Space View Park
513	Sand Point Park
514	William J. Manzo Memorial Park
515	Kennedy Point Park
516	Rotary Riverfront Park
517	Kennedy Space Center Visitor Complex
518	Jetty Park
519	Banana River Park
520	Westgate Cocoa Beach Pier
521	Shepard Park
522	Sidney Fischer Park
528	City of Melbourne City Hall
529	Downtown/City Hall

Bicycle and Pedestrian Projects

Bicycle and pedestrian projects can consider the following elements:

- Leverage FDOT District Five PedSafe pilot deployment using LiDAR/Connected Vehicle technology for an advanced pedestrian safety application (Figure 6-19)
- Investigate alternative detection systems (e.g., video analytics)
- Consider employing safety concepts for areas with high concentrations of pedestrian/bicycle incidents (e.g., SR A1A)
- Use overlapping video coverage with video analytics to detect vulnerable road users entering roadway
- Disseminate Connected Vehicle message/warning to motorists upstream (e.g., TIMs)
- Share the bicycle/pedestrian projects map

Figure 6-19: PedSafe Pilot Elements

Bicycle and pedestrian project locations are illustrated on Figure 6-20 and are listed in Table 6-9. Additional information on these projects can be found in Appendix B.

Figure 6-20: Proposed Bicycle and Pedestrian Project Locations

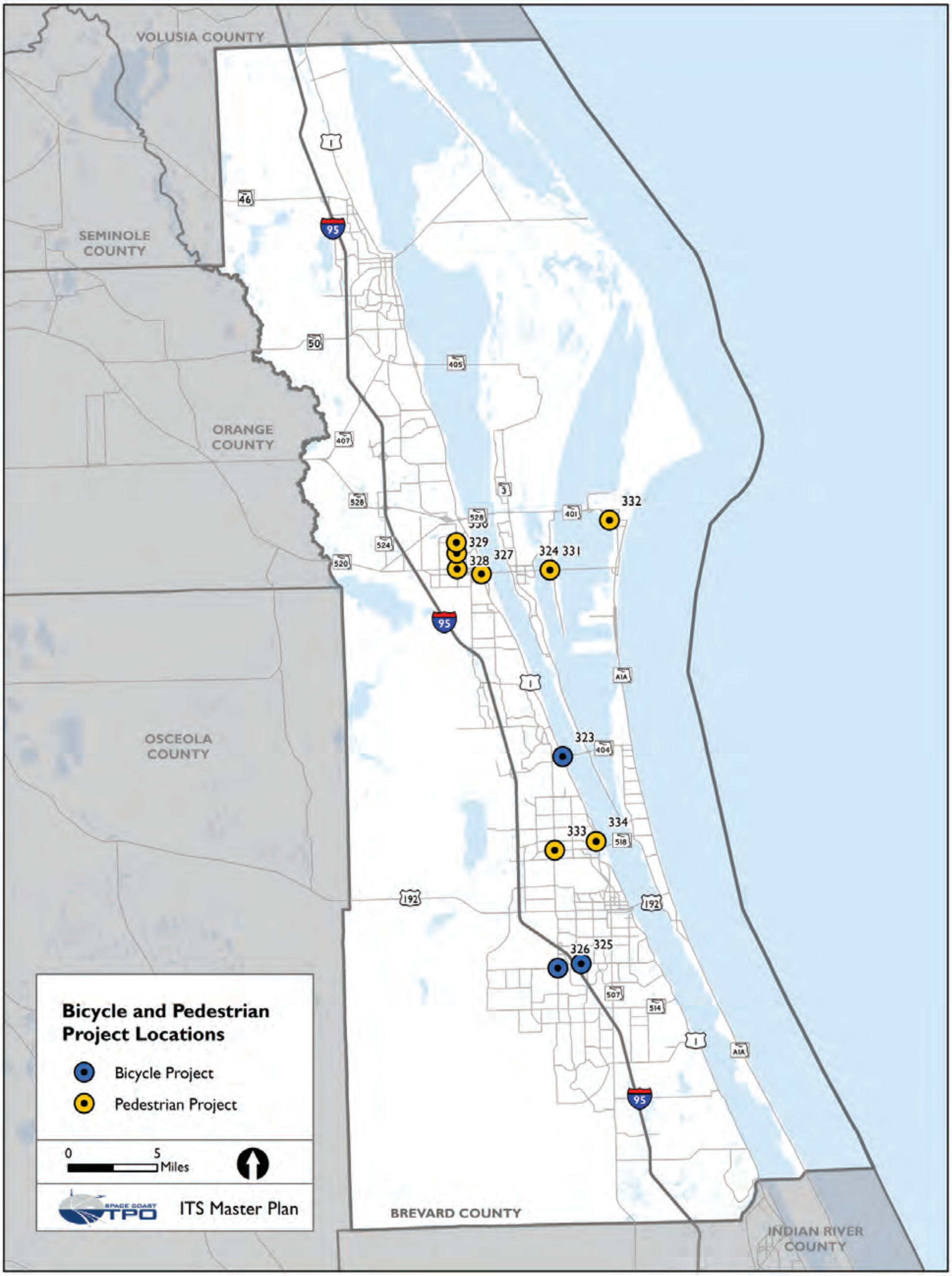
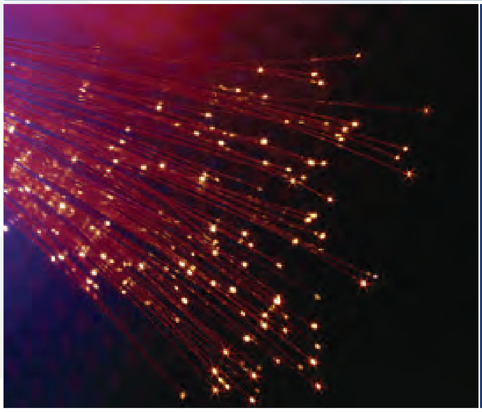


Table 6-9: Proposed Bicycle and Pedestrian Intersection Projects

Project #	Project Type	Corridor	Location/Start	Years
323	Bicycle	US 1	@ SR 404 (Pineda)	0-5
324	Bicycle	SR 520	@ Newfound Harbor Drive	0-5
325	Bicycle	Palm Bay Rd	@ Hollywood Boulevard	0-5
326	Bicycle	Minton Road	@ Emerson Drive	0-5
327	Pedestrian	US 1	@ SR 520	0-5
328	Pedestrian	SR 501 (Clearlake Rd)	@ Lake Drive/School St	0-5
329	Pedestrian	SR 501 (Clearlake Rd)	@ Dixon Boulevard	0-5
330	Pedestrian	SR 501 (Clearlake Rd)	@ Roseline/Tate Street	0-5
331	Pedestrian	SR 520	@ Newfound Harbor Drive	0-5
332	Pedestrian	SR A1A	@ Central Blvd.	0-5
333	Pedestrian	SR 518 (Eau Gallie Blvd)	@ Wickham Road	0-5
334	Pedestrian	US 1	@ Aurora Road	0-5

Equity Analysis

Transportation disadvantaged and Environmental Justice are two important lenses through which the TPO evaluates projects. Environmental Justice (EJ) addresses fairness of federal actions in regard to disadvantaged persons, particularly low-income and minority populations. Transportation disadvantaged populations are ones that rely more heavily on alternative modes of transportation. The analysis helps equitably distribute transportation infrastructure investments to avoid disproportionate impacts to particular groups. EJ and TD analysis was performed to identify the number of ITS projects that are located within or intersect the EJ and TD areas in Brevard County. EJ areas were defined as census block groups with 30 percent or more households below the poverty level (as defined by the Federal Government), or 20 percent or more zero-car-households. This plan uses the base information developed for the 2045 LRTP. The following maps were developed to understand the implications of the proposed projects. In both cases, it's shown that ATMS and evacuation projects have been identified in both transportation disadvantaged areas and environmental justice areas. Figure 6-21 illustrates the relationship of the transportation disadvantaged areas and the existing and proposed ATMS projects. Figure 6-22 illustrates the relationship of environmental justice areas to existing and proposed ATMS projects.



There are approximately 20 fiber projects within or adjacent to EJ areas. All of the identified EJ areas (100%) have an ITS project serving that area.

Figure 6-21: Proposed and existing fiber network and transportation disadvantaged areas

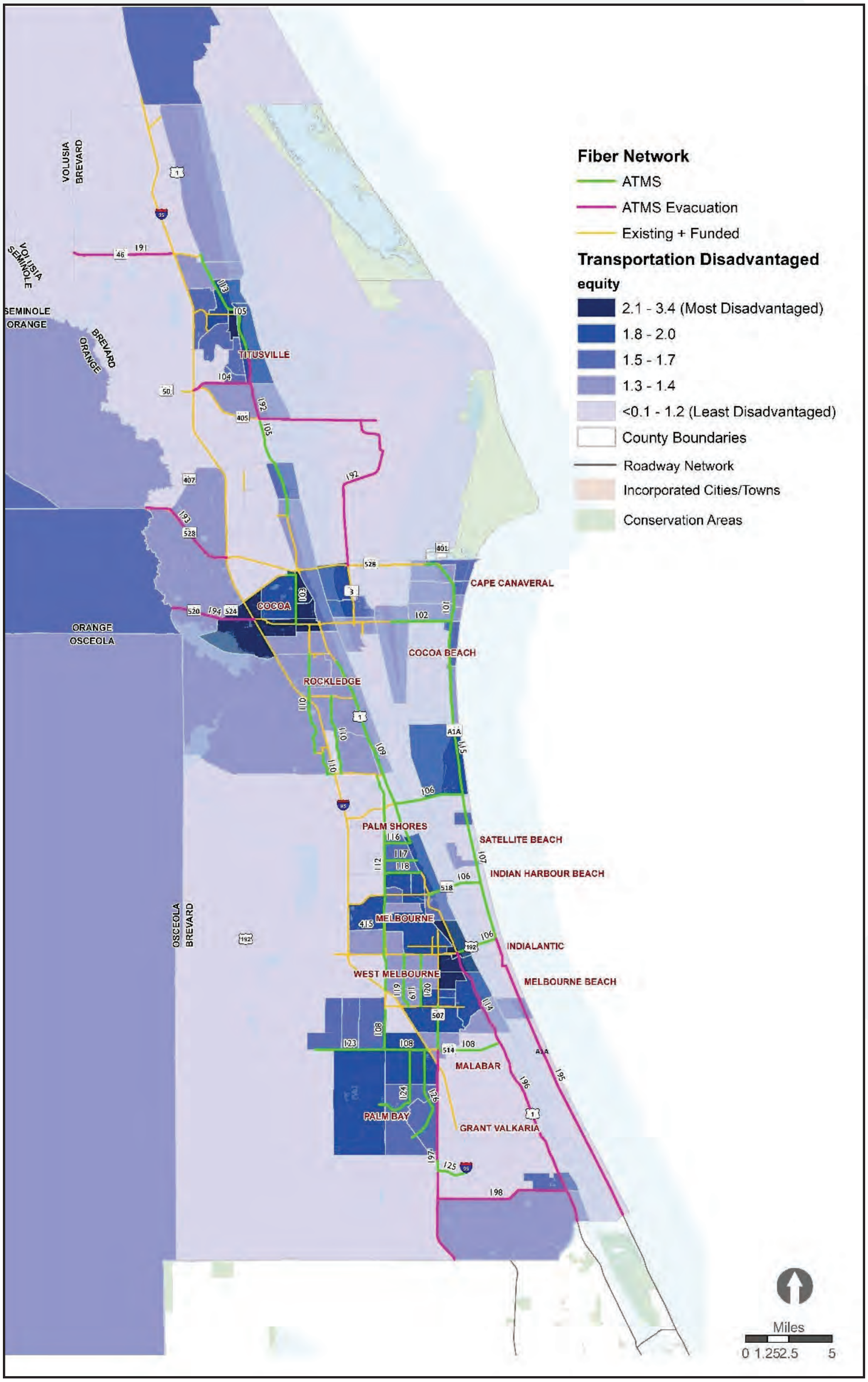
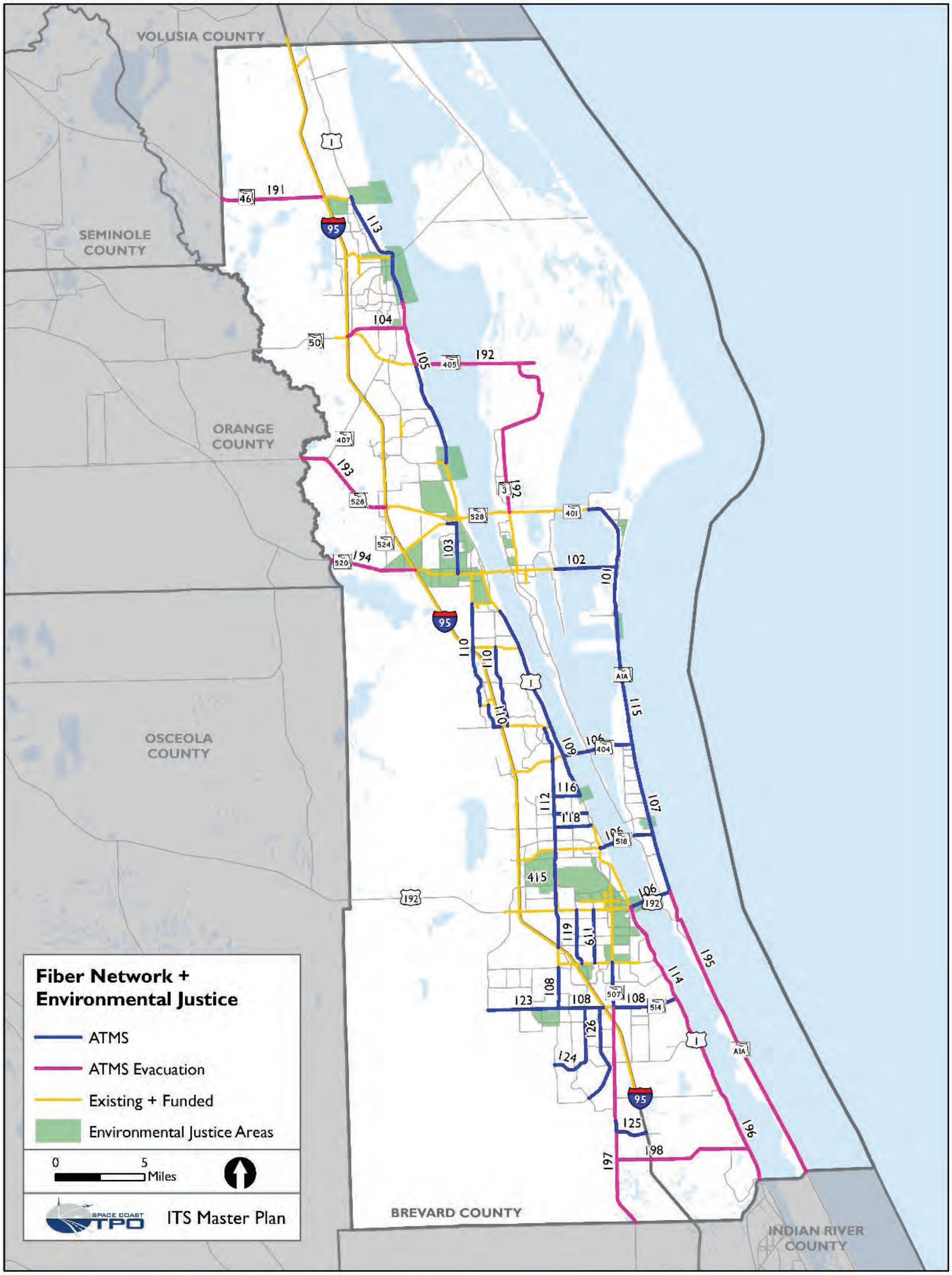


Figure 6-22: Proposed and existing fiber network and environmental justice areas



Operational Strategies and Policies

Operational strategies and policies were developed to support the overall system functionality and vision. The strategies were grouped into four categories as described in the Strategies Memo and summarized below.

- Operations strategies include Active Arterial Management and Automated Signal Performance Measures.
- Maintenance is recognized as a critical component in this overall ITS program. As such, recommendations include the development of a policy for the recruitment, retention, and development of staff, the implementation of a preventative maintenance program, as well as an asset management and maintenance ticketing system to help streamline the maintenance of the system.
- Incident Management and Response allows for the minimization of delay by facilitating efficient response to both planned and unplanned events. The TMC is the "brain" of the operation, allowing for system monitoring and, as the new regional TMC comes online, agency collaboration, which will enable the system to work to maximum benefit. Other recommendations include developing response plans that cross jurisdictional boundaries, developing Standard Operating Guidelines, continuing to support incident response such as Road Rangers, and formalizing procedures to ensure that first responders are not put at unnecessary risk.
- Data and Information Management is critical to keeping the system flowing. Data collection and data sharing will ensure that the information collected can be used to develop solutions. Development of policies and approaches to using "big data" and cyber security will protect data integrity and allow for its use as a trusted resource.

Opportunity Costs

To quantify the specific problems that can be improved by implementing additional funding to incorporate the proposed ITS Master Plan, the opportunity cost must first be defined. In this case, the opportunity cost is defined as the value of a choice that is not chosen—that is, the implementation of the ITS Master Plan. In other words, this is the projected amount of money that the traveling public is expected to pay should the ITS Master Plan's funding not be implemented. The opportunity cost of this project was developed after the AAM document created for the statewide project. The probable benefit is likely higher when safety and parking improvement projects are factored in but those benefits are harder to quantify.

The opportunity costs considered in this study include:

- Traffic Signal Detector Failure Opportunity Cost
- Signal Retiming Opportunity Cost
- Arterial Management Opportunity Cost
- Adaptive Technology Opportunity Cost
- Crash Reduction Opportunity Cost

The total opportunity cost for the traveling public is $59,850,293 per year. This is equivalent to a 10-year savings of $655,344,018. Note that the cost includes 2-percent inflation per year. See Appendix F for the opportunity cost breakdown amounts.

Benefit/Cost Ratio

The benefit/cost ratio is a measure to determine the viability of any effort when using public funding. It quantifies the public benefit, in dollars, that the public receives for every public dollar spent. Therefore, any value greater than 1 indicates a value to the public. The corresponding benefit/cost for Brevard County is the ratio of the total opportunity cost and the cost to implement the ITS Master Plan. This only includes the benefit/cost of ATMA and evacuation projects. The probably benefit is likely higher when safety and parking projects are factored in but those benefits are harder to quantify.

The benefit/cost ratio based on a 10-year plan is: $655,344,018/$95,077,080 = ~ 7/1

Conclusion

This ITS Master Plan represents a collaborative vision for the future of the ITS Program in the Space Coast region. The projects identified are specific technology solutions to recognized challenges and implementing them will make the transportation network more efficient and reliable. This plan also is one piece of a larger effort by the SCTPO to approach solutions from many perspectives. The plan leans heavily on the ongoing Transportation Systems Management and Operations (TSMO) effort, acknowledging that any of these solutions require more than just the devices; they require collaboration and maintenance as well as coordination to get the maximum benefits. This plan is one of many that work in conjunction to advance transportation in the region.

This plan used many inputs, including the State of the System (SOS) report and the Vision Zero Action Plan. The SOS provides valuable insight into how things are functioning currently, and this helped the team envision the future. The Vision Zero Plan provides the focus on safety and was the basis for the development of specific responses for the most challenging intersections. The plan encompasses sustainability and resiliency in accordance with the SCTPO strategic goals and uses resiliency as one of the measures by looking system redundancy. It also acknowledges that the continuing economic growth of the region depends on a reliable and future-looking transportation network that includes ITS as infrastructure. Important steps that can be taken now are to include ITS in early project planning phases and to consider maintenance and staffing in budget development. It is also important to update this plan regularly to be able to respond to advances in technology.

ITS and TSMO provide both the technology and the approach to develop short- and long-term solutions. Identifying challenges allows for the development of solutions, including Action Programs. Using this framework allows for the verification of problems, development of solutions, and—importantly—communication to decision makers and to the public who need to know that proactive measures are being taken.

2021 Intelligent Transportation Systems Master Plan Update

Concept of Operations

SPACE COAST
Transportation Planning Organization

Notice

This document and its contents have been prepared and are intended solely as information for the Space Coast Transportation Planning Organization's use in relation to the 2021 ITS Master Plan Update.

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Overview

Identification

This document will serve as the high-level Concept of Operations (ConOps) for the Intelligent Transportation Systems (ITS) within the Space Coast Transportation Planning Organization (SCTPO) planning area, including both new and existing devices, subsystems, and systems, and modifications to them. This document will identify the appropriate partner agencies; existing systems; proposed deployment of field devices, subsystems, and systems; and operational scenarios, as well as the interfaces, roles, and responsibilities of each stakeholder.

Document Overview

This ConOps document includes the proposed environment of the system and the system utilization by stakeholders and regional partners. This document specifically describes the ITS components that exist or are being proposed for future deployment within the Brevard County, Florida, region to support the needs of the agencies and the general motoring public.

This document is organized as follows:

- Section 1—Overview
- Section 2—Current System Situation
- Section 3—Change Justification
- Section 4—Concepts for the Proposed System
- Section 5—Operational Scenarios

The development and management of the SCTPO ITS Concept of Operations is based on a number of guidelines and it builds on planning, reports, and documentation developed prior to the development of this Concept of Operations, including:

- State and federal guidelines
- Project planning reports
- FDOT Transportation Systems Management and Operations (TSMO) Strategic Plan
- Local agency plans
- Space Coast TPO Master Plan

This Concept of Operations and other project management materials were developed in accordance with guidelines and information presented at the Florida Department of Transportation's (FDOT) Systems Engineering Management Plan (SEMP) website, which can be found at the following link:

https://www.fdot.gov/traffic/ITS/Projects-Deploy/SEMP.shtm

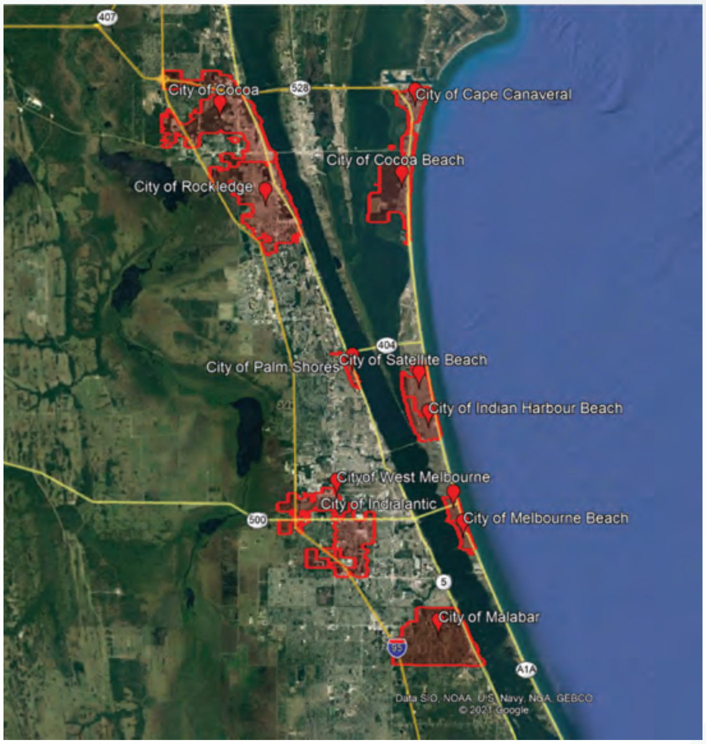
- U.S. Department of Transportation Federal Highway Administration (FHWA), Systems Engineering for Intelligent Transportation Systems, January 2007. *(https://ops.fhwa.dot.gov/publications/seitsguide/)*
- Florida Department of Transportation (FDOT), Deliverable 1-10: Technical Memorandum, Florida's Statewide Systems Engineering Management Plan, Version 2, March 7, 2005. *(https://www.fdot.gov/docs/default-source/traffic/its/projects deploy/semp/pdf/050315 D1-10 V2.pdf)*

High-Level System Overview

Within the Space Coast region, the existing and proposed systems are a collaborative effort providing the ability to monitor, operate, and manage both limited-access and arterial corridors. Deployments along limited-access facilities (e.g., Interstate 95) are owned and operated by FDOT District Five and managed from the Regional Traffic Management Center (RTMC) in Sanford, Florida. Conversely, arterial corridor systems are operated and managed by the respective local maintaining agency based on location. Some entities—including the City of Melbourne, City of Palm Bay, and City of Titusville—operate and maintain their own facilities, while many agencies rely on Brevard County to provide the required operations and maintenance efforts (see Figure 7-1 and Figure 7-2).

Through the existing and proposed field devices, subsystems, and systems, agencies will be able to manage traffic more effectively and proactively throughout the County. Leveraging various types of communication systems, the local agency operations centers will be able to communicate to the field devices, both receiving and transferring data and video images, while also controlling the devices. Each subsystem will provide benefit to both the operations center personnel and the motoring public. Operations personnel will use the devices to find areas of congestion, identify the cause of incidents, provide motorists with traveler information, and dispatch the appropriate coordinated response (e.g., emergency responders, tow trucks). These actions will decrease congestion within the area of the incident, improve emergency responder notification and arrival times, decrease incident durations and causation (e.g., lane and road closures), and result in more accurate and reliable travel times throughout the region.

Figure 7-1: Jurisdictional Limits of Cities Maintained by Brevard County (top) and City of Melbourne (bottom)



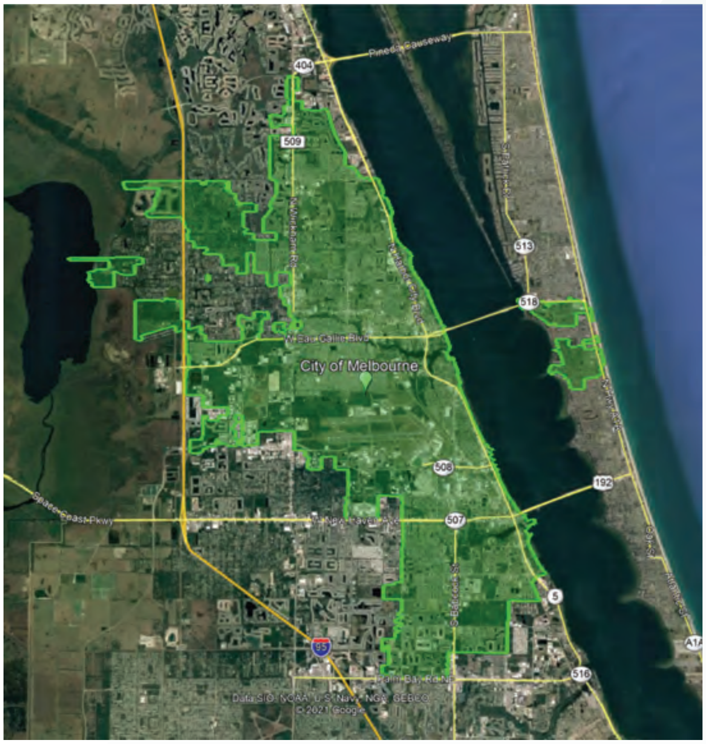
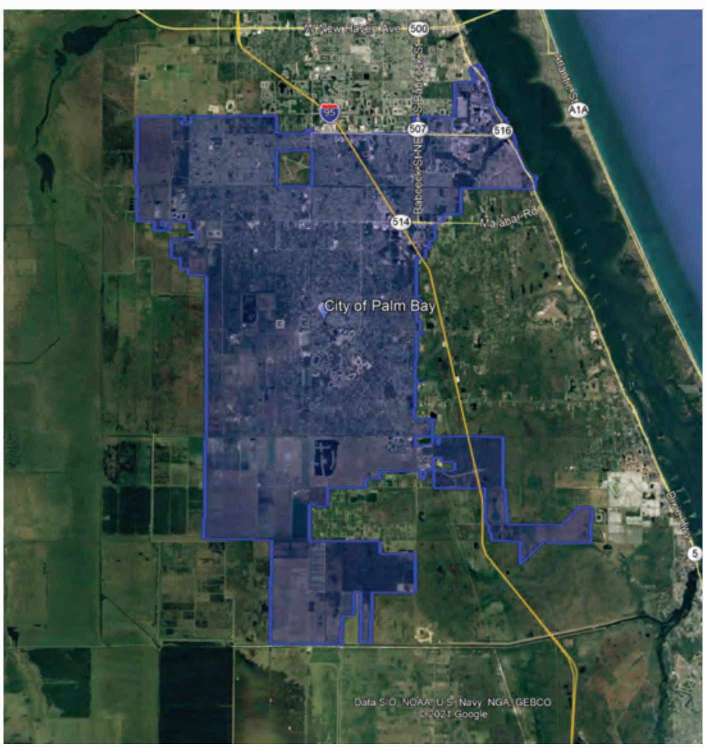


Figure 7-2: Jurisdictional Boundary for the City of Titusville (top) and City of Palm Bay (bottom)



Stakeholders

The following outlines the stakeholders and their roles and responsibilities for the system:

- Project Sponsors—Agencies that are involved in funding the system and defining the system goals, objectives, and requirements for the Brevard County area. The Sponsors include:
  - FDOT, District Five
  - SCTPO
  - Brevard County Department of Public Works
  - City of Melbourne
  - City of Palm Bay
  - City of Titusville
  - Space Coast Area Transit (SCAT)

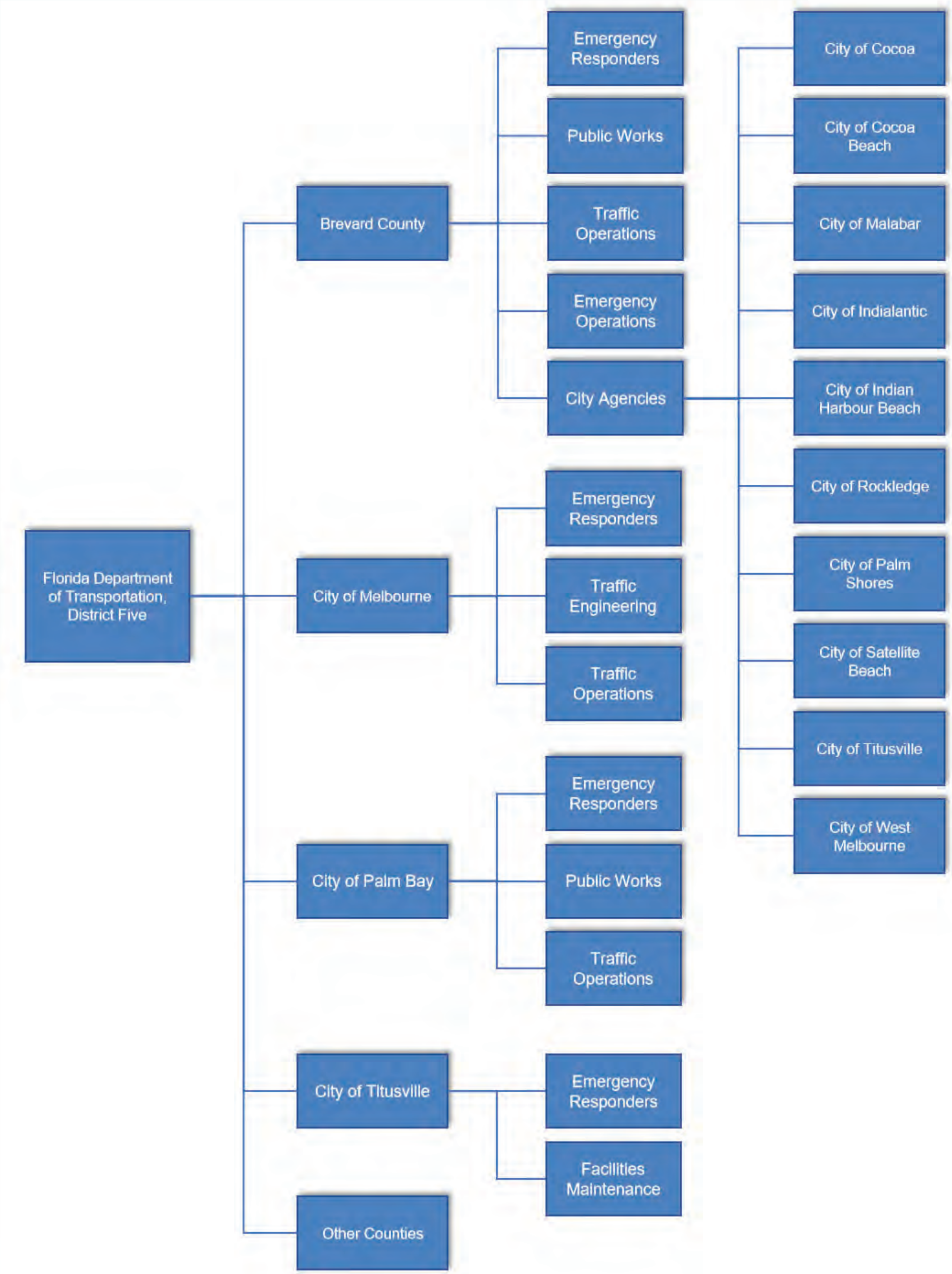
- User Agencies—Agencies that will use the devices and infrastructure installed under this system for traffic monitoring, congestion management, traffic incident management, performance measures and data collection, and roadway improvement. The User Agencies include:
  - FDOT, District Five
  - Brevard County
  - SCAT
  - SCTPO
  - Brevard County Department of Public Works
  - Brevard County Emergency Operations Center
  - City of Titusville
  - City of Melbourne Traffic Engineering
  - City of Palm Bay

    - County and Local Emergency Responder Agencies
    - Canaveral Port Authority
    - Space Florida
    - National Aeronautics and Space Administration (NASA)

- Maintenance and Support Agencies—Agencies that will be responsible for maintaining the system equipment and infrastructure. The Maintenance and Support Agencies include:
    - FDOT, District Five
    - Brevard County Department of Public Works
    - City of Titusville
    - City of Melbourne Traffic Engineering
    - City of Palm Bay

- Operating Centers—Facilities that will perform central command operations using central software, local software, and hardware that will control the ITS devices implemented as part of this project. The Operations Centers associated with this system are as shown in Figure 7-3, below, and include:
    - FDOT, District Five
    - Brevard County Traffic Management Center (TMC)
    - Brevard County Emergency Operations Center
    - City of Titusville
    - City of Melbourne Traffic Engineering
    - City of Palm Bay

Figure 7-3: Overview of Brevard County and Partner



Agency Contact Information

- Florida Department of Transportation, District Five
  719 S. Woodland Blvd.
  DeLand, Florida 32720-6800
  Phone: (800) 780-7102

- Brevard County Department of Public Works
  2725 Judge Fran Jamieson Way, A211
  Viera, Florida 32940-6605
  Phone: (321) 617-7202

- Brevard County Traffic Operations
  580 Manor Drive
  Merritt Island, Florida 32952
  Phone: (321) 455-1440

- Brevard County Emergency Operations Center
  1746 Cedar Street
  Rockledge, Florida 32955
  Phone: (321) 637-6670

- City of Melbourne—Engineering, Traffic Engineering
  2901 Harper Road
  Melbourne, Florida 32904
  Phone: (321) 608-7360

- City of Palm Bay—Public Works, Traffic Signs and Signals
  1050 Malabar Road
  Palm Bay, Florida 32907
  Phone: (321) 952-3437

- City of Titusville Facilities—Maintenance Division
  445 South Washington Avenue
  Titusville, Florida 32796
  Phone: (321) 567-3820

- Space Coast Area Transit (SCAT)
  401 South Varr Avenue
  Cocoa, Florida 32922
  Phone: (321) 633-1878

References

The following references, of the exact issue shown (see Table 7-1), form a part of this document to the extent specified herein. In the event of a conflict between the contents of the documents referenced herein and the contents of this ConOps, this document will supersede. Additionally, noted documents will be developed in support of, or in conjunction with, the preparation of and definitions in this ConOps document.

Table 7-1. Documents Supporting this Concept of Operations

Document	Date	Contact
Florida Statewide ITS Architecture (SITSA) (LINK)	Last Updated 12/14/2020	Florida Department of Transportation Intelligent Transportation Systems Office 605 Suwannee Street, M.S. 90 Tallahassee, Florida 32399-0450 (850) 410-5600
Florida's District Five Regional ITS Architecture (RITSA) (LINK)	Last Updated 12/14/2020	Florida Department of Transportation Intelligent Transportation Systems Office 605 Suwannee Street, M.S. 90 Tallahassee, Florida 32399-0450 (850) 410-5600
FDOT District Five ITS Master Plan (LINK)	Version 1.3, Last Updated 10/31/2016	Florida Department of Transportation 719 S. Woodland Blvd. DeLand, Florida 32720 (800) 780-7102
Space Coast Transportation Planning Organization (SCTPO) Modification to ITS Master Plan—Spaceport, NASA Causeway, and Space Commerce Way (LINK)	Last Updated 6/1/2020	2725 Judge Fran Jamieson Way, Bldg B Viera, Florida 32940 (321) 690-6890
Traffic Signal Maintenance and Compensation Agreement (TSMCA) (Brevard County)	Last Updated 2016	Florida Department of Transportation 719 S. Woodland Blvd. DeLand, Florida 32720 (386) 943-5329
Traffic Signal Maintenance and Compensation Agreement (TSMCA) (City of Melbourne, City of Palm Bay, City of Titusville)	Last Updated 2016	Florida Department of Transportation 719 S. Woodland Blvd. DeLand, Florida 32720 (386) 943-5329
Brevard County Advanced Traffic Management System (ATMS) Project Systems Engineering Management Plan (LINK)	Version 2.5, Last Updated 2/25/2013	Florida Department of Transportation 719 S. Woodland Blvd DeLand, Florida 32720 (800) 780-7102
FDOT and Brevard County Fiber Sharing Agreement	Last Updated 7/1/2012	Brevard County Public Works Engineering 2725 Judge Fran Jamieson Way, Bldg A211 Viera, Florida 32940-6605 (321) 633-2077
Brevard County ITS Strategic Plan	Version 4.0, Last Updated 7/28/2008	Brevard County Public Works Engineering 2725 Judge Fran Jamieson Way, Bldg A211 Viera, Florida 32940-6605 (321) 633-2077
Brevard County Advanced Traffic Management System (ATMS) Concept of Operations (LINK)	Version 1.2, Last Updated 10/9/2012	Florida Department of Transportation 719 S. Woodland Blvd. DeLand, Florida 32720 1-800-780-7102

Local Agreements

In addition, local agreements currently executed between regional stakeholders are defined below:

- *Traffic Signal Maintenance and Compensation Agreement*—The Traffic Signal Maintenance and Compensation Agreements (TSMCA) established between FDOT District Five and other agencies is the governing document outlining the roles and responsibilities of each entity as it pertains to the maintenance of signalized intersections. This agreement includes all definitions of work related to all, " traffic signals, traffic signal systems (central computer, cameras, message signs, and communications interconnect), school zone traffic control devices, intersection flashing beacons, illuminated street name signs, and the payment of electricity and electrical charges incurred in connection with operation of such traffic signals and signal systems". Furthermore, the TSMCA defines the reimbursement funding to be provided from the state to the local entities for completion of the defined work, based on the number and types of devices maintained.
- *FDOT and Brevard County Fiber Sharing Agreement* This executed memorandum of understanding (MOU) outlines the roles, responsibilities, and limitations shared between the two parties (FDOT District Five and Brevard County) as related to the collocated fiber optic communications network in Brevard County. Additionally, this agreement identifies the process and requirements for installing new fiber optic communication within the right of way of each agency.

Current System Situation

Background, Objectives, and Scope

The existing ITS deployments within the SCTPO regional planning area consist of infrastructure, field devices, subsystems, and systems providing the ability to monitor, manage, control, and operate the arterial and limited-access facilities for each appropriate maintaining agency. Existing systems are comprised of communication systems (e.g., fiber optics, copper, wireless), field devices, and back-end hardware and software necessary to achieve end-to-end functionality.

Operational Constraints

Albeit considerable is breadth and number of services provided, the existing systems are not sufficient to ease congestion throughout many areas of the County. Additional roadways require instrumentation and existing corridors that already have ITS deployments require upgrades to expand mobility and safety capabilities. Furthermore, operational concerns (e.g., safety "hot spots") and changes to traffic patterns (e.g., space launches) necessitate new subsets of technology to solve a variety of issues unaccounted for in the initial deployment.

Examples of necessary improvements are outlined below:

- Gaps in communications network; lack of redundant pathways
- Areas without device coverage (e.g., rural areas, hurricane evacuation routes)
- Aging and/or legacy equipment (e.g., traffic signal controllers)
- New technology subsets for application-based improvements to safety and operations (e.g., high-injury network locations, detour routes)
- Center-to-center (C2C) connections for interlocal communications exchange

Description of the Current System or Situation

Table 7-2, and Table 7-3, below, illustrate the existing signal systems network, as well as the end devices (e.g., traffic signals, cameras, etc.) maintained by each agency within the SCTPO boundary.

Table 7-2: Existing Signal System Networks

Jurisdiction	Number of Signals	Number of Interconnected Signals	Type of Communication for Interconnection	Type of Network Used	Central Software System	Type of Controllers
Brevard County1	351	219	Fiber and wireless	Routed/distributed network containing physical/virtual lands; Layer 2 edge devices segmented logically to maintain spanning tree limitations	Cubic ATMS. now (version 5.12)	Naztec, mix of 980 and ATC
City of Melbourne	67	67	Fiber and Wireless	Layer 2 (ITS Express 80404); Layer 3 Juniper EX4300; Firewall Juniper SRX320	Cubic ATMS. now	Commander Scout/980 and ATC
City of Palm Bay	43	0	n/a	n/a	Centracs	Naztec/ Econolite
City of Titusville	42	4	Fiber	Four signals connect to Brevard County TMC	n/a	Naztec, mix of 980 and ATC

[1] *Includes five signals maintained by the City of Titusville where Brevard County maintains the interconnect.*

[2] *As of April 5, 2021, City of Melbourne wrapping up project to migrate 45 signals from wireless to fiber*

Table 7-3: Existing Intelligent Transportation System End Devices

Stakeholder	Fiber Optic Cable (miles)	Total ITS Devices	CCTV*	DMS*	MVDS/ AVI*	Bluetooth
Brevard County	71	170	100	0	0	50
City of Melbourne	4.5	12	12	0	0	7
City of Palm Bay	0	1	1	0	0	0
City of Titusville	0	0	0	0	0	0

** CCTV = Closed Circuit Television, DMS = Dynamic Message Sign, MVDS = Microwave Vehicle Detection System, AVI = Automated Vehicle Identification*

Table 7-4: Signals Owned and Operated within the SCTPO Boundary

Stakeholder	Number of Signals	Number of Interconnected Signals	Number of Adaptive Signals	Number of Coordinated Signals
Brevard County	351	219	112	unavailable
City of Melbourne	67	67	0	56
City of Palm Bay	43	0	0	11
City of Titusville	42	4	4	0

Brevard County

Maintenance staff for Brevard County is responsible for approximately 351 traffic signals and school flasher systems located on state-, county-, and city-maintained roadways. This maintenance is included within agreements between Brevard County and the cities of Cocoa, Cocoa Beach, Cape Canaveral, Indian Harbour Beach, Indialantic, Malabar, Melbourne, Melbourne Beach, Palm Bay, Rockledge, Satellite Beach, and West Melbourne. The County has standardized to Cubic (formerly Trafficware/Naztec)-based controller models and all intersections are controlled and monitored through the County's Trafficware ATMS.now central management software. In addition, the County maintains and operates various ITS field devices, including CCTV cameras and Bluetooth travel time readers.

Brevard County currently operates all its facilities from an office space converted into a TMC equipped with a video wall within the Viera Government Center located at 2725 Judge Fran Jamieson Way, Viera, Florida. The video wall equipment consists of high-definition televisions and computers arranged to provide the ability to monitor and control the existing ITS system through third-party video management software. The available operations staff is extremely limited since most individuals perform both operations and maintenance roles, with maintenance efforts consuming the majority of available time. At present, a state-of-the-art TMC is in the design phase, providing a stand-alone building for more enhanced coordination and operations efforts. This new facility will provide space for not only Brevard County staff but also other local maintaining agencies.

City of Melbourne

The City of Melbourne operates and maintains approximately 67 traffic signals equipped with Cubic (formerly Trafficware/ Naztec) controllers from the localized TMC. All signalized intersections are managed, operated, and maintained independently of Brevard County and communicate through an existing network leveraging both fiber optic and wireless technologies. At the time of this document's development, the City is closing a project to bring 45 signals online via fiber optic communications, providing the ability to monitor and manage the signal system through ATMS.now. The City also will be able to operate the arterial roadway system using CCTV cameras and Bluetooth travel time readers.

City of Palm Bay

The City of Palm Bay is actively deploying its first ITS implementation on Malabar Road. This system consists of fiber optic communications, CCTV cameras, and video vehicle detection systems to supplement the approximately 43 traffic signals maintained and operated by the City. Palm Bay is currently undergoing a transition from Trafficware/ Naztec controllers to Econolite models communicating with the Centracs central management software. Currently, signalized intersections within the City are coordinated based on global positioning system (GPS) clocks.

City of Titusville

The City of Titusville does not maintain or currently have plans for a stand-alone TMC, but rather turns to Brevard County for the operations of arterial roadways and the integration of interconnected signals into the County's ATMS.now. The City maintains approximately 42 traffic signals, primarily of the Naztec/Trafficware model, with five intersections equipped with Cubic models and connected to the Brevard County network.

Port Canaveral

Port Canaveral is a cruise, cargo, and naval port servicing over 4.5 million cruise passengers and 6 million tons of cargo annually. The Port maintains an agreement with FDOT District Five for the operation of multiple Dynamic Message Signs (DMSs) installed along State Road (SR) 528 to monitor and manage the information displayed.

Space Coast Area Transit

Space Coast Area Transit (SCAT) is the municipal bus system serving the Brevard County region through 19 fixed bus routes. SCAT recently completed the deployment of in-vehicle systems for fleet buses, including GPS units providing Automatic Vehicle Location (AVL) information and Automatic Passenger Counting Systems (APCS). These field data are received centrally and provided to transit users through a mobile application displaying bus locations, schedules, and routes in real time. A future enhancement for electronic fare payment is currently under consideration and may be implemented within the mobile application. In addition to the in-vehicle systems, each fleet vehicle will provide in the future Wi-Fi for public use during trips.

User Class Profiles

Seven basic user types (see Figure 7-4) with immediate interaction with the system were identified and each user profile is provided below.

Operator—This user will access and control the ITS devices to monitor and manage traffic flow on the arterial and limited-access corridors throughout the County for the appropriate local maintaining agency or FDOT District Five, respectively. The Operator will be able to perform various functions, including pan, tilt, and zoom the cameras for traffic surveillance; post messages to the DMSs for traveler information; ensure the traffic signal control system is functioning properly and timings are appropriate; gather real-time data collected by the vehicle detection system; broadcast messaging through Connected Vehicle (CV) technologies; and more. Operators also will be responsible for the verification of the overall status of the system and dispatching maintenance crews to fix all issues and noted systems not functioning properly. Operators also will assist first responders in identification, notification, and mobilization to decrease response and arrival times and manage the traffic while an incident is ongoing.

Maintenance Personnel—This user will be responsible for maintaining the traffic signalization equipment, ITS field devices, and communication systems to minimize device downtime. This user will access the ITS devices routinely and verify each device systemwide is operational and fully functional. Maintenance Personnel will include city, county, and state traffic signal technician(s).

Network Support Personnel—This user will access the network and ensure the network is operational and fully functional. This user also will be responsible for implementing any necessary network updates, security enhancements, or device integration and is responsible for the overall architecture of the system. This user also will verify the communications network is stable and free from any outages or damage (e.g., fiber cuts).

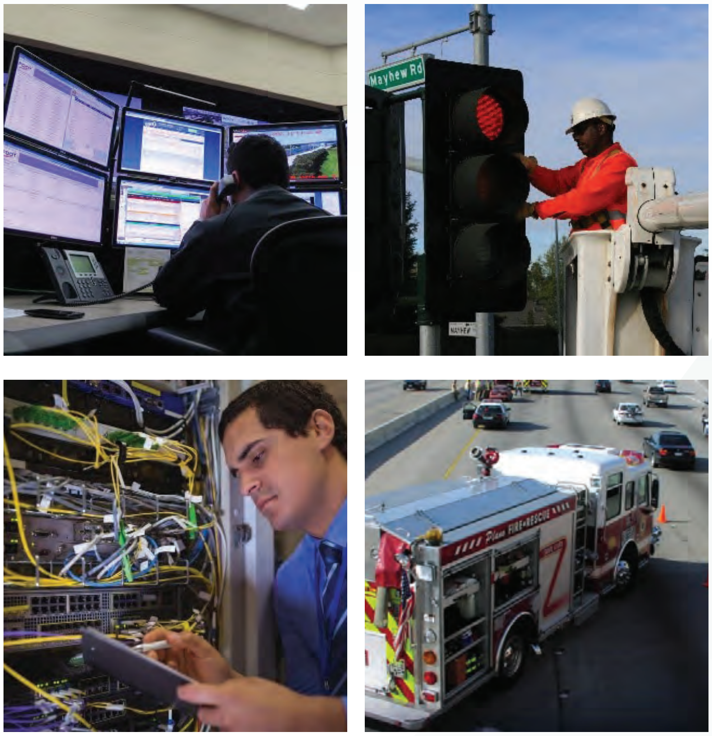
Operations Engineers— Operations Engineers will be able to analyze real-time system data to make decisions for the improvement of mobility and safety of the region's corridors. This user will provide analytical-based recommendations for traffic signal timing changes, detour routes, traffic incident management strategies, and more to improve mobility for either recurring congestion or non-recurring incidents. Additionally, this user will provide engineering-based input on future roadway and safety projects.

Emergency Response Personnel— This subset of users includes dispatch personnel and first responders. Dispatchers will be responsible for the receipt and dissemination of information concerning incidents to first responders, including location, type, severity, number of vehicles involved, and more about an event, as well as the optimal travel route. This user may have access to view traffic surveillance video feeds and receive traveler information directly or coordinate closely with Operators. Conversely, first responders will provide all emergency services at the scene of the incident, including first aid, traffic control, wreckage removal, and more.

Data Management Personnel— This user will be directly responsible for the management, analysis, and dissemination of all system-provided data, including inputs from field devices and third-party providers. Data Management Personnel roles will include the upkeep of real-time and historical databases, application of quality control standards to verify accuracy and normalize received data, identification of data policies (e.g., data dictionary definition, sharing agreements), and more.

General Public—The general public will directly interface with the regional ITS deployment by using traveler information disseminated from the system to drive mobility decisions (e.g., avoiding congested routes, selecting between multiple modes of transportation). The public will be informed of real-time traffic and roadway conditions through traveler information systems (e.g., Arterial Dynamic Message Sign [ADMS], CV technology) and centralized systems such as mobile applications (e.g., FL511, WAZE). Information provided to motorists includes, but is not limited to, incident locations, construction zones, road closures, weather hazards, alternative routing, multimodal options, and other useful information to improve commute and travel times.

Figure 7-4: Images of User Types



Support Environment

Each agency (see Figure 7-5) provides a unique approach to the support of existing ITS deployments based on staffing, funding, and technical capabilities.

Figure 7-5: Agencies Supporting Existing ITS

- *FDOT, District Five*—The District employs a robust support staff, including dedicated maintenance contractors, network technicians, and software support specialists. District Five provides a redundant Layer 2/3 network with fiber optic backbone communications regenerating in a number of communication hubs across the region. All network communications are routed to the RTMC, where the Layer 3 switches and servers housing software suites (e.g., SunGuide, Activu) are located. Note that the District does not maintain signalization equipment or systems, but it defers this work to the appropriate local maintaining agency who is compensated through the current Traffic Signal Maintenance and Compensation Agreement (TSCMA).
- *Brevard County*—The County employs a full-time staff of eight employees to handle the maintenance responsibilities for the traffic signalization and ITS components. The staff includes one ITS Systems Manager who also serves in a supervisory role and handles the networking responsibilities for the County, as well as seven technicians with varying degrees of experience and responsibilities from utility locates to bench testing. In addition, Brevard County maintains all signalization equipment for cities that cannot perform self-maintenance (e.g., Cities of Cocoa, Cocoa Beach, Indialantic, Indian Harbour Beach, Rockledge, Palm Shores, Satellite Beach, West Melbourne). All operations and fiber optic network communications is centered within the TMC located in Viera, Florida, which also is responsible for housing the servers for all necessary software packages (e.g., ATMS.now, BlueARGUS).
- *City of Melbourne*—The City employs a full-time staff of four, including an Operations Manager, one ATMS Coordinator, and two traffic signal technicians. The responsibilities of this crew include all maintenance efforts for the signalization equipment, network, and backend software suites (e.g., ATMS.now). Networking equipment and servers are located within the TMC operated and managed by the City.
- *City of Palm Bay*—The City employs a full-time staff, including a Supervisor and one to two dedicated traffic signal technicians providing maintenance efforts for all signalization equipment within the city limits.
- *City of Titusville*—The City employs a Supervisor and two to three maintenance technicians to handle all public work facility needs, including traffic signalization equipment. These individuals also are responsible for all maintenance and repair efforts for roadways, sidewalks, signing, and other infrastructure components. The City does not maintain a unique instance of centralized control software (e.g., ATMS.now) for management and operation of the signal system. Most intersections within the City are not interconnected, with the exception of the few being maintained by Brevard County.

Change Justification

Justification for Changes

More than 600,000 residents call Brevard County home and that number continues to rise steadily due to an influx of economic and residential development spurred by the recent surge in the region's space program. Many of these individuals commute to and from work, shopping centers, restaurants, and other businesses on a daily basis. As is the case throughout the state of Florida, the majority of these commutes are made in automobiles, which leads to an increasing number of vehicles on the local roadways. This heavy traffic volume leads to recurring congestion, traffic incidents, stalled vehicles, and other disruptions in traffic flow, which further decreases the capacity of the roadway. According to the United State Census (2019), Brevard County residents spent a mean travel time of 25.2 minutes commuting from home to their place of employment per trip.

Coupled with the growing population of the region, numerous corridors of significance (e.g., hurricane evacuation routes) are without existing system deployments and/or using legacy hardware that is nearing the end of its service life. These factors contribute to the rising need to implement new field devices, subsystems, and systems throughout the region to better enhance the mobility and safety of all road users through the application of technology.

ITS performs an integral part by providing innovative services to alleviate traffic congestion on local roadways and provide real-time traveler information to motorists within Brevard County. The regional agencies (FDOT District Five, Brevard County, and the Cities of Melbourne, Palm Bay, and Titusville) have agreed that traffic operations will be monitored and controlled in a collaborative manner and environment. This environment will leverage the regional deployment of various systems and technologies to improve transportation efficiency, promote safety, increase traffic flow and travel time reliability, reduce emissions, and improve the dissemination of traveler information across jurisdictional boundaries.

User Needs

As part of the overall Intelligent Transportation Systems Master Plan Update, a comprehensive User Needs memorandum was developed (November 2020). This effort identified the following long-term vision and goals for the ITS program:

- Safety
- Innovation/Technology
- Operations
- Corridor Function
- Resiliency, including Redundancy and Security
- Leadership/Policy

For additional information, refer to the Space Coast Transportation Planning Organization 2021 Intelligent Transportation Systems Master Plan Update—Needs Memo.

Concepts for the Proposed System

Background, Objectives, Scope

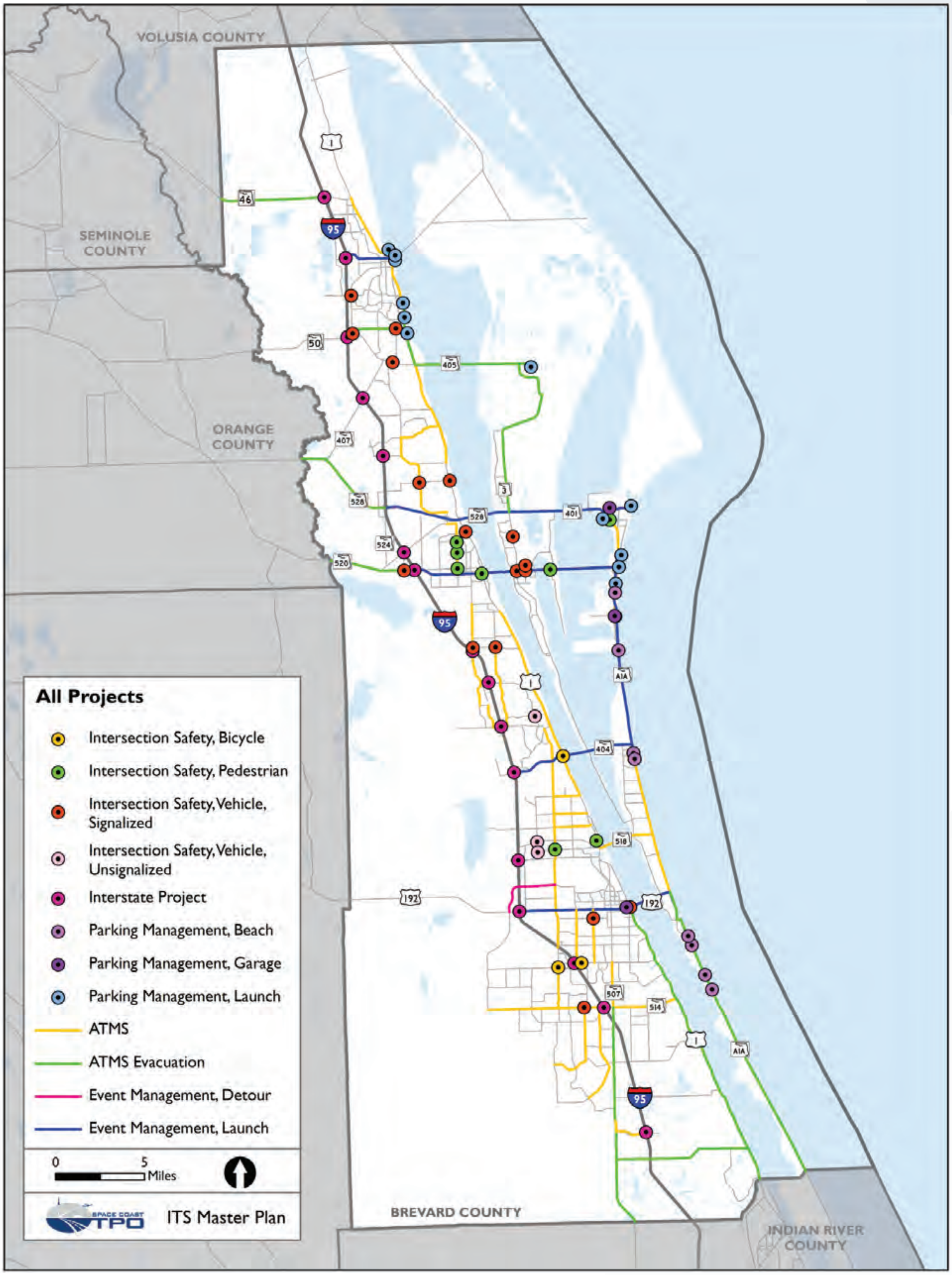
Through the expansion and upgrade of the existing regional ITS systems, agencies will realize benefits to traffic management, congestion management, traffic incident management, and traveler information provided to all road users and the general public. When complete, the proposed system will include a robust and redundant communications network providing connection between a variety of field devices (e.g., signal controllers, CCTV cameras, DMS, vehicle detection systems) and control centers. Proposed locations for technology deployments include limited-access corridors and signalized intersections, as well as mid-block locations within arterial roadways.

The primary objectives of the proposed improvements include:

- Establish a regional Wide Area Network (WAN) with redundant communications and connections between local maintaining agencies and FDOT District Five
- Upgrade legacy hardware to newer standards to provide a state-of-the-art system
- Develop an environment for data-rich applications
- Provide new technologies to mitigate the growing operational changes in the region
- Provide a scalable system for future deployments and new technologies (e.g., Connected Vehicle)

Refer to Figure 7-6, below, for additional information related to the proposed systems.

Figure 7-6: Countywide Map with Proposed ITS Deployments



Operations Policies and Constraints

FDOT District Five does not maintain traffic signalization systems and relies on the involvement of local maintaining agencies to perform this work. This work is reimbursed through the TSMCA executed between each agency and the District, with the dollar values derived from pre-determined algorithms developed by the FDOT Central Office.

The City of Melbourne, City of Palm Bay, and City of Titusville each operate and maintain systems within the respective jurisdictional boundaries, with the exception of a small number of signals within Titusville connected to the larger Brevard County central management system (ATMS. now). Brevard County owns a number of traffic signals and school zone flashers located on County roadways; however, the County also is responsible for the operation and maintenance of traffic signals on state and local roads in jurisdictions that are unable to perform this work internally. Currently, there is no cross-agency communications or data exchange between a majority of the local entities, limiting the ability to establish a regional traffic management approach.

Within the region, inadequate funding that limits the ability to expand infrastructure and staff appropriately affects almost all stakeholders, especially local municipalities responsible for operations and maintenance. Additionally, there is a lack of available technician staff with the requisite expertise related to either traffic signalization and/or ITS components within the region.

Description of the Proposed System

The proposed changes within the SCTPO region have been organized into eight functional types of projects. Each project type is described in greater detail in the following subsections.

Advanced Traffic Management System

Advanced Traffic Management System (ATMS) projects include the upgrade and enhancement of the existing traffic signal system along arterial corridors. Through the implementation of these projects, agencies will benefit from an enhanced ability to monitor and operate arterial corridors and motorists will benefit from improved traffic flow and additional data that can be gathered and passed on to them. Examples of technologies (see Figure 7-7) included within ATMS projects include, but are not limited to:

- Communications
- Traffic Signal Controllers
- CCTV Cameras
- Connected Vehicle Roadside Units
- Arterial Dynamic Message Signs
- Vehicle Detection Systems
- Adaptive Signal Control Technology

ATMS projects will provide reliable Ethernet-based network communications between the field devices (e.g., traffic signal controller, CCTV cameras) and the appropriate central command center (e.g., TMC). Communications may be established through fiber optic communications or through wireless means, such as point-to-point wireless access points or cellular modems. Network connectivity will be provided to each signalized intersection within a corridor, as well as specific mid-block locations, and equipped with a Layer 2 Ethernet switch for configuration, management, and scalability of communication with end devices. The development of backhaul communications along arterial roadways within the ATMS projects will allow for future implementation of systems without the need to install communications.

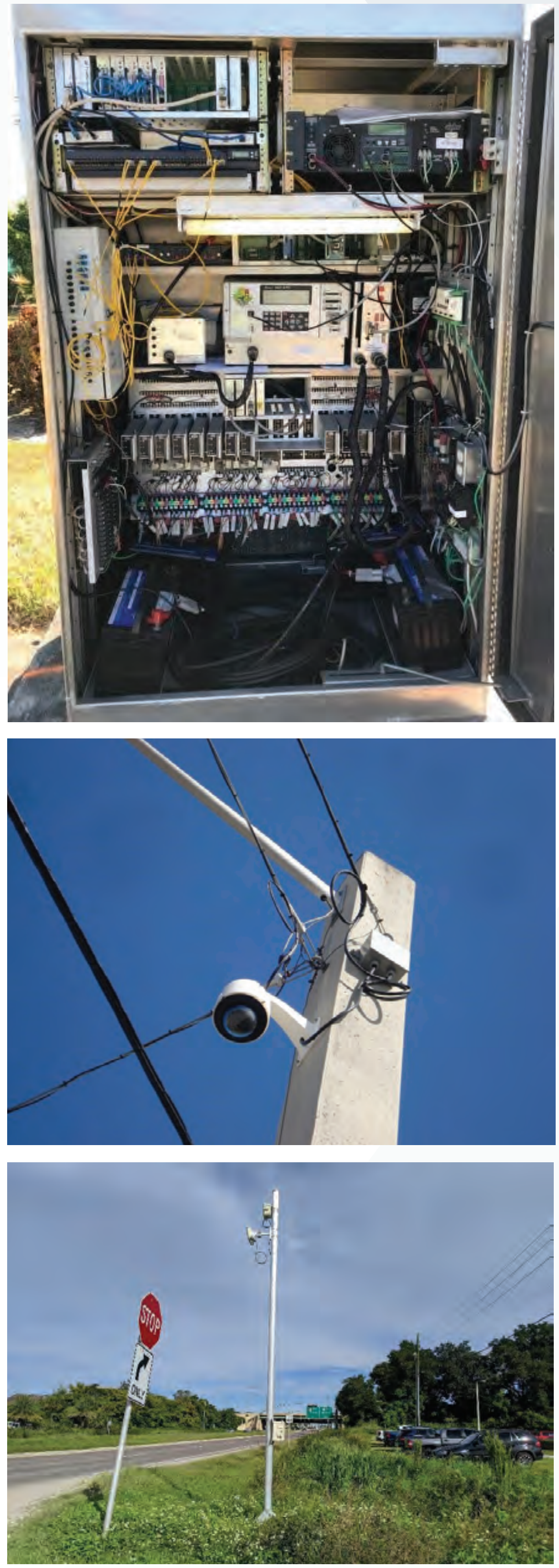
Each signalized intersection will include upgrades to the existing signal controller to use models consistent with the Advanced Transportation Controller (ATC) standards. Installation of an ATC unit provides a powerful, on-street computing platform capable of basic signalization features, high-resolution data streams, and advanced ITS applications (e.g., Connected Vehicle). Additionally, ATMS projects will provide improvements to the existing traffic signal controller cabinet assemblies (e.g., NEMA Type 7 cabinets with maximum 64 detection channels) and vehicle detection systems to state-of-the-art hardware. Enhancements to signalized intersections also may include the implementation of adaptive signal control technology (ASCT) to reduce travel delay; installation of CCTV cameras for real-time surveillance of traffic and roadway conditions; and cellular vehicle-to-everything (C-V2X) roadside units (RSU) capable of enabling various safety and mobility CV-based applications (e.g., Signal Phase and Timing, Traveler Information Message).

All upgrades to signalized intersection hardware will be in accordance with the current FDOT District Five "smart" signal efforts and standards. Refer to the *www.cflsmartroads.com* website for additional information.

In addition to technology deployed at signalized intersections, ATMS projects also will include field devices installed at mid-block locations along arterial corridors. Examples of mid-block technologies include arterial dynamic message signs (ADMS) capable of providing real-time information to motorists in a text or graphic format; vehicle detection systems (e.g., side-fire radar, Bluetooth travel time readers) responsible for collecting traffic information, such as volume, lane occupancy, travel time, travel speed, and origin-destination data; and more. Similar to signalized intersections, mid-block locations will transmit and receive information across the backhaul communications network.

Configuration, management, and operation of all field devices and systems included as part of ATMS projects will occur within the appropriate TMC for each local maintaining agency. Operational staff will be able to monitor either individual or coordinated intersections from the centralized signal system software (e.g., ATMS.now, Centracs) to adjust signal phase and timing, revise time-of-day plans, and run diagnostic reports on the status of the system. Similarly, operators will have access to live video feeds and real-time sensor data to help monitor and manage the system, including identification and mobilization of responses to detected incidents.

Figure 7-7: ATMS Field Devices and Systems



Interstate

Interstate-type projects include the implementation of new systems at the interchange of limited-access highways and arterial roadways and can be located on either the exit (off-ramp) or entrance (on-ramp) terminals. These systems will be deployed to reduce vehicle-to-vehicle incidents at interchanges, as well as reduce congestion on both the mainline and side street roadways resulting from queue spillback.

Examples of systems (see Figure 7-8) included in Interstate projects include:

- Wrong Way Detection Systems
- Ramp Signal Systems
- Queue Warning Systems
- Automated Truck Warning Systems
- Communications
- CCTV Cameras
- Connected Vehicle Roadside Unit
- Traffic Signal Controllers

In accordance with FDOT Roadway Design Bulletin 19-3, Wrong Way Detection System (WWDS) installations are required at all interchange exit ramps for a limited-access facility . When deployed, WWDS will identify vehicles traveling up the exit ramp in the improper direction, notify the motorist of the error through visual cues, and alert the appropriate response personnel of the wrong way driving event. Each WWDS is comprised of three primary subsystems: vehicle detection, motorist awareness, and logic controller. Following the determination of a wrong way driving event, the WWDS will alert operational staff within the RTMC to mobilize the appropriate response (e.g., notify first responders and law enforcement, change DMS displays to warning messages).

Deployed at on-ramps affected by recurring congestion from traffic merging into the mainline traffic flow, Ramp Signal Systems (RSSs) use detection subsystems to identify gaps in traffic patterns for incoming vehicles to enter seamlessly. By eliminating unexpected congestion centered about the on-ramp entry point, RSSs help to reduce collisions on the limited-access facility. RSSs consist of vehicle detection subsystems and signalization equipment, including vehicular signal heads, cabinet assembly, and controller unit.

Queue Warning Systems (QWSs) use vehicle detection subsystems to identify spillback volumes building on interstate off-ramps and impeding mainline traffic flow. When vehicle presence is determined within the queue detection area, the QWS enacts the pre-determined mitigation strategy, such as pre-empting the traffic signal controller at the ramp terminus to run a "flush" plan, actuating a series of motorist warning systems (e.g., flashing beacons, in-vehicle messaging) upstream of the queue spillback, and more. The connection between the local signalized intersection and QWS may be established over the regional network (e.g., Ethernet-based) or through an analog signal direct to the traffic signal controller input panel.

Automated Truck Warning Systems (ATWSs) use vehicle detection subsystems to identify vehicle size, classification, and speed to determine if a large vehicle (e.g., truck) is traveling at a dangerous speed when entering into an off-ramp. Typically, ATWSs are deployed at off-ramps with tight geometric curves prone to overturned vehicle events. The system sensors will measure real-time vehicle parameters against predetermined thresholds to actuate a series of motorist warning systems (e.g., flashing beacons, in-vehicle messaging) to alert the driver to reduce speed.

Figure 7-8: Interstate Field Devices and Systems

Intersection Safety

Focused on deploying technology to improve safety at specific locations, Intersection Safety projects include new technologies to reduce vehicle-to-vehicle, vehicle-to-bicycle, and vehicle-to-pedestrian crashes. These projects may be deployed at either signalized or unsignalized intersections within an arterial corridor, and at at-grade railroad crossings. Examples of field devices (see Figure 7-9) included in Intersection Safety projects include:

- Blank-Out Signs
- Electronic Feedback Signs
- Connected Vehicle Roadside Units
- Bicycle/Pedestrian Detection Systems (e.g., passive)
- Advanced Motorist Warning Systems (e.g., Rapid Rectangular Flashing Beacon [RRFB])
- Intelligent Lighting
- Communications
- Traffic Signal Controllers
- Adaptive Signal Control Technology
- CCTV Cameras

Most of these solutions will function as either independent systems or as subsystems to the existing signalized intersection, providing additional operational capabilities. These systems will leverage existing network communications to the respective TMC for operations and management capabilities.

Figure 7-9: Intersection Field Devices and Systems

Event Management

Event Management projects will provide field devices capable of responding to real-time roadway and traffic conditions and enable the dissemination of traveler information to motorists for alternative routing and wayfinding. Located on arterial roadways, these technologies will aid in the movement of vehicles in response to both planned (e.g., space launches, sporting events) and unplanned (e.g., road closures) events. Examples of technologies included in Event Management projects include:

- Blank-Out Signs
- Connected Vehicle Roadside Units
- Dynamic Message Signs
- Vehicle Detection Systems
- CCTV Cameras
- Communications

Responsible for directing traffic to and from major traffic-generating event locations, as well as potential detour routes to and from Interstate 95, the deployment of blank-out signs at major intersections within the region will provide operational staff the ability to provide end-to-end wayfinding information to motorists remotely. Each blank-out sign will be prepared to accommodate multiple scenarios (e.g., "PARKING LEFT," "PARKING RIGHT," "DETOUR LEFT," DETOUR THRU") for the development of configurable traffic management plans that can be implemented, monitored, and revised in real-time from the appropriate TMC. Each blank-out sign will require connection to a localized control unit capable of communications to the network for management and operation. From the central command software, operators will maintain the ability to actuate a pre-determined plan or individually cycle specific displays on and off based on need and traffic conditions.

Supplemental devices—including CCTV cameras and vehicle detection systems to monitor traffic patterns on detour routes in real-time, DMS displays to provide advanced notification of the upcoming detour route, and RSU to provide in-vehicle messaging to motorists—will provide operational staff further capabilities to enact response plans and observe their effectiveness.

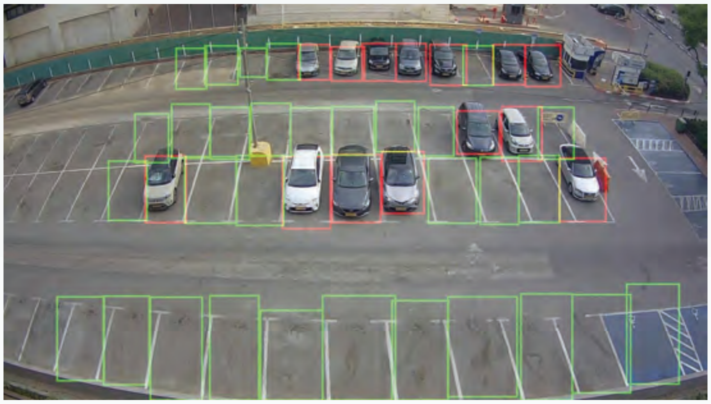
Parking Management

Parking Management projects will provide technology to determine the availability of parking in dedicated facilities (e.g., garages, surface lots, on street) and disseminate that information to the general public to help with informed decision making. The implementation of these systems will alleviate congestion on arterial roadways resulting from vehicle overflow at popular parking facilities and dangerous conditions created by illegal parking (e.g., off-the-shoulder parking). Examples of technology (see Figure 7-10) included in Parking Management projects include:

- Vehicle Detection Systems
- Dynamic Message Signs
- Connected Vehicle Roadside Units
- CCTV Cameras
- Communications

Deployed at various parking facilities (e.g., space launch viewing sites, beach access parking, downtown on-street parking, Port Canaveral garages), vehicle subsystems will determine the available number of stalls through either per-stall or entry-exit counts. This information will be published to the general public through embedded DMS displays and Connected Vehicle messaging, while also being made available to smartphone mobile applications. Operational staff will have the ability to monitor parking facilities in real time from the TMC and notify motorists of the status of popular facilities (e.g., "OPEN," "CLOSED," "FULL"); they also could provide alternative parking locations.

Figure 7-10: Parking Management Field Devices and Systems



Transit

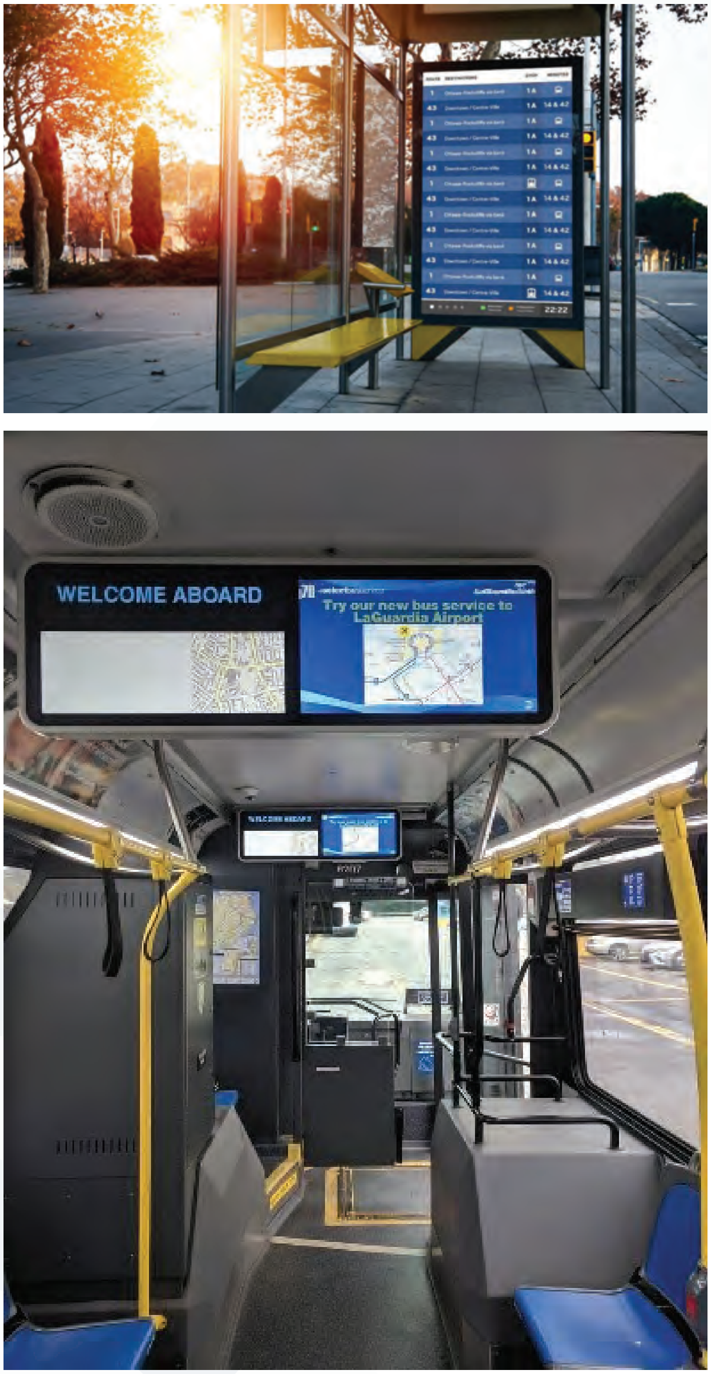
Transit projects include three subsets of technology aimed at improving the overall efficiency, mobility, and user experience of the regional transit system: in-vehicle systems, route-based infrastructure, and transit stop devices. Examples of technology (see Figure 7-11) implemented in Transit projects include:

- Connected Vehicle On-Board Units
- Global Positioning Systems
- Automatic Passenger Counter Systems
- Digital Signage
- Wi-Fi Access Points
- Automated Fare Collection Systems
- Connected Vehicle Roadside Units
- Transit Signal Priority
- Vehicle Detection Systems
- Blank-Out Signs
- Traffic Signal Controllers
- Advanced Mobility Transit Kiosks
- Pedestrian Detection Systems
- CCTV Cameras
- Dynamic Message Signs
- Communications

All field devices and systems related to the transit system are anticipated to be owned, operated, and maintained by SCAT. In-vehicle, route-based, and transit stop systems will provide both operational benefits—including the ability to request transit signal priority (TSP) for reduced dwell at red lights and reduced delay from onboarding passengers through the utilization of the automated fare collection system—and improved customer experience—including publicly available Wi-Fi on buses and interactive kiosks at transit stops providing real-time information on schedules, routes, next stops, and more.

Data collected from the various systems will be processed and applied through the computer-aided dispatch (CAD) system (e.g., AVL information used to identify schedule adherence, passenger count information used to identify "hot spots"). This information may be shared among regional partners and the general public through web-based and mobile applications.

Figure 7-11: Transit Field Devices and Systems



Automated Incident Detection

Automatic Incident Detection (AID) projects will deploy field hardware and back-end software necessary to capture real-time information on traffic conditions and apply business logic to determine incidents without manual involvement from operational staff. This technology will provide for faster and more-reliable incident detection, resulting in reduced response time and incident clearance time, fewer secondary crashes, and reduced disruptions to normal traffic flow.

Examples of technology (see Figure 7-12) implemented in AID projects include:

- CCTV Cameras
- Vehicle Detection Systems
- Bicycle/Pedestrian Detection Systems
- Dynamic Message Signs
- Connected Vehicle Roadside Units
- Communications

Leveraging software-based business logic, AID systems include the deployment of either vehicle detection systems (e.g., doppler and side-fire radar, loops) or CCTV cameras to provide real-time traffic conditions data for analysis. The data are applied against configurable thresholds and parameters (e.g., maximum vehicle dwell time) to determine a variety of incidents, including vehicle-to-vehicle crash, stalled vehicle, debris on the roadway, pedestrian on the roadway, wrong way driving event, and more. When an event is flagged, operators within the TMC will be notified of the type, location, and time-stamp of the incident to actuate the appropriate response. Operational staff will be responsible for the coordination and mobilization of the response plan, including notifying first responders, adding cautionary information messages to DMS displays, generating broadcast in-vehicle messaging (e.g., "INCIDENT AHEAD"), and more. Studies have shown that the implementation of automatic incident detection systems can reduce the time for initial incident identification by up to 10 minutes.

AID projects are applicable for both limited-access and arterial facilities and will require network communication between the field devices and the central management software server located within the appropriate TMC.

Figure 7-12: AID Field Devices and Systems

Bicycle/Pedestrian

Bicycle/Pedestrian projects include advanced field devices for the detection, classification, and tracking of vulnerable road users in high-emphasis areas (e.g., pedestrian signals, mid-block crossings, school zones, trail crossings) to reduce vehicle-to-bicycle and vehicle-to-pedestrian crashes where traditional systems are ineffective. Examples of technologies (see Figure 7-13) used in Bicycle/Pedestrian projects include:

- Connected Vehicle Roadside Units
- Connected Vehicle Onboard Units
- Bicycle/Pedestrian Detection Systems
- Traffic Signal Controllers
- Blank-Out Signs
- Electronic Feedback Signs
- Advanced Motorist Warning Systems (e.g., RRFB)
- Intelligent Lighting
- Communications

This system of devices will employ an advanced detection system for both vehicles and bicycles/ pedestrians—including video analytics, Light Detection and Radar (LiDAR), doppler and microwave radar—to determine with high levels of accuracy the positional information of road users in real time. These data will be exchanged between vehicles and infrastructure multiple times a second to identify and avoid potential collision paths using CV technology (e.g., On-Board Units [OBUs], RSUs). Vehicles equipped with OBUs will provide Basic Safety Messages (BSMs) to other vehicles and infrastructure with real-time information, including position (e.g., latitude, longitude, elevation), speed, heading, steering wheel angle, acceleration set, brake system status, and vehicle size, in accordance with the Society of Automotive Engineers (SAE) J2735 standard. Similarly, bicycle and pedestrian detection systems will identify vulnerable road users and provide comparable information to the BSM (e.g., position, speed, heading), referred to as a Personal Safety Message (PSM), to the RSU for broadcast to vehicles. The exchange of real-time data back and forth between vehicles and infrastructure provides the ability to identify potential collision courses and enact avoidance strategies. For example, RSUs will provide in-vehicle messaging to motorists approaching high-emphasis areas when vulnerable road users (e.g., bicyclists, pedestrians) are determined to be within the roadway as a Roadside Alert (RSA) (e.g., "CAUTION: PEDESTRIAN CROSSWALK AHEAD"). Additionally, various triggers could be programmed to actuate, including changing of signal phase and timing, activating intelligent lighting systems, beginning flashing of RRFBs, and more.

Due to the safety-critical aspect of this system, potential lapses of communications must be avoided. The system will employ edge-computing capabilities with all systems communicating locally and provided with network communications for status reviews and management capabilities. This system functions independently of operational staff involvement from the TMC, but it will provide real-time data to operational staff for analysis and monitoring.

Figure 7-13: Bicycle/Pedestrian Field Devices and Systems

Modes of Operation

The following identifies the current hours of operation for the FDOT District Five RTMC, as well as each local maintaining agency TMC:

- FDOT District Five, RTMC—24 hours/day, 7 days/week, 365 days/year
- Brevard County, TMC—9 hours/day (7:30 a.m. to 4:30 p.m.), 5 days/week (Mon through Fri), excluding holidays
- City of Melbourne, TMC—9 hours/day (8:00 a.m. to 5:00 p.m.), 5 days/week (Mon through Fri), excluding holidays
- City of Palm Bay, TMC—9 hours/day (8:00 a.m. to 5:00 p.m.), 5 days/week (Mon through Fri), excluding holidays

Within the proposed system, two modes of operation will be considered: standard and remote. Standard operations will include the procedures, protocols, and hours currently employed by each agency to operate and maintain the roadways within their jurisdictional boundaries. Operational staff at the TMC will perform all monitoring, management, and operational tasks locally with immediate access to only the field devices, subsystems, and systems within the respective network. Conversely, remote operations will provide the ability for partner agencies to monitor, operate, and manage the systems for another agency during off-hours (e.g., overnight). Leveraging C2C connections, regional partners can provide user rights to personnel from other agencies, granting access to control field devices and software suites necessary to manage the roadways outside of their traditional limits.

Currently, the region is not equipped to successfully perform remote operations; however, with the development of the Brevard County TMC, opportunities for regional traffic management strategies may soon become available.

User Involvement and Interaction

FDOT District Five will be responsible for the operations and maintenance for all existing and proposed systems within the ROW of limited-access facilities. This includes all existing ITS devices and facilities along Interstate 95 and the proposed systems along the various interchange on- and off-ramps. These systems will be connected to the existing FDOT fiber optic network, integrated into the SunGuide central management and control software, and operated from the RTMC in Sanford, Florida. Furthermore, District Five will be responsible for continued and increased compensation for new devices and systems added to the maintenance responsibilities of the local agencies, per the executed TSMCA.

The local maintaining agencies—including Brevard County and the Cities of Melbourne, Palm Bay, and Titusville—will be responsible for the operations and maintenance of all existing and proposed systems located along the arterial roadways within the respective jurisdictional limits. This includes existing signalization and ITS devices, as well as the proposed systems discussed in previous sections. Each agency will provide communications between field devices and the respective networks to manage and operate systems from central software suites within the TMC (e.g., ATMS.now, Centracs). Operational staff with the TMC will be responsible for monitoring roadways (e.g., CCTV cameras, Bluetooth travel time readers), providing traveler information (e.g., DMS, RSU), and adjusting traffic flow patterns in real time (e.g., signal timing adjustments, activation of event management or incident response plans).

Assumptions and Constraints

Many of the proposed systems require a regionalized approach to traffic management spanning jurisdictional boundaries and including portions of multiple local maintaining agency traffic signal systems and networks. At this time, a regional traffic management approach is not available.

Lack of available funding and technical resources necessary to appropriately operate and maintain the proposed systems may result in future issues, including:

- Network outages
- Downtime of field devices
- Higher costs for equipment replacement vs. preventative maintenance
- Reduced system functionality and benefit

Support Environment

The existing local maintaining agency staffing identified in Section 2.5 will need significant augmentation as a result of the proposed systems. Per FHWA, adequate staffing levels for maintenance of traffic signals is recommended at 30 to 40 intersections per technician . However, this number accounts for standardized signalized intersection equipment and not advanced systems (e.g., ITS) and complex networks. As the deployment of field devices and systems increase, so should the staffing levels of each local maintaining agency.

In addition to staffing numbers, maintaining agencies will need to identify mitigation tactics for potential discrepancies in technical expertise. Many of the proposed systems and networking equipment are complex, and many technicians never gaining experience in the installation, maintenance, or troubleshooting of these components.

Strategies for potential development of appropriate staffing include:

- Provide recurring hands-on training from either partner agencies or vendors for each field device, subsystem, and system deployed (e.g., FDOT District Five, Cubic).
- Provide opportunities for technicians to obtain technical certifications (e.g., IMSA Traffic Signals, CompTIA Network+).
- Identify key roles to be performed by specific individuals (e.g., Network Administrator).
- Outsource portions of maintenance responsibilities to third-party contractors.

Operational Scenarios

The following scenarios outline example roles and responsibilities of local maintaining agency staff (e.g., Brevard County and Cities of Melbourne, Palm Bay, Titusville) in the operations and management of the proposed systems. Table 7-5 through Table 7-8 present step-by-step approaches to scenario management, and Figure 7-14 through Figure 7-16 show devices that can be used for the various scenarios.

Table 7-5: Operational Scenario—Normal Conditions

Step	Description	User/System
1	Operator reviews the status of the traffic signal system through the central signal management software (e.g., ATMS.now, Centracs); runs systemwide diagnostics report for outages, failures, alarms	Operator/Signal Management Software
2	Operator monitors CCTV camera feeds on video wall to determine incidents, disruptions in traffic flow, hazardous conditions, etc.	Operator/Video Management Platform
3	Operator reviews traffic sensor data (e.g., Bluetooth travel time readers, microwave radar) to identify anomalies in traffic patterns	Operator/Central Management Software
4	Operator reviews and adjusts signal phase and timing and/or time-of-day plans to optimize real-time traffic conditions, as appropriate	Operator/Signal Management Software
5	Operator reviews traveler information systems (e.g., DMS) for accuracy and relevancy of information	Operator/Central Management Software
6	Repeat Steps 1-5 in accordance with established Standard Operating Procedures	Operator

Table 7-6: Normal Conditions—Systems Failure/Maintenance

Step	Description	User/System
1	Operator reviews the status of the traffic signal system through the central signal management software (e.g., ATMS.now, Centracs); runs systemwide diagnostics report for outages, failures, alarms	Operator/Signal Management Software
2	Operator flags signalized intersection in "FLASH," as reported by diagnostics report	Operator/Signal Management Software
3	Operator coordinates with signal maintenance staff, providing location, time, and type of failure; inputs information into maintenance ticketing system, opens ticket	Operator, Signal Technician/Ticketing System
4	Signal Technician mobilizes to the identified to location; assesses and corrects the issues, returning signal operations to normal	Signal Technician
5	Signal Technician coordinates with Operator to provide "All Clear" status; Operator closes the maintenance ticket in the system	Signal Technician, Operator/Ticketing System

Figure 7-14: Normal Conditions—Systems Failure/Maintenance

Table 7-7: Incident Management (Unplanned Event)

Step	Description	User/System
1	Operator received notification of incident (e.g., vehicle-to-vehicle crash) on arterial roadway through AID software	Operator/Central Management Software
2	Operator uses video management platform to select the nearest CCTV camera video feed and verify incident; records location, type, and severity	Operator/Video Management Platform
3	Operator contacts first responders (e.g., fire-rescue, law enforcement officers) to mobilize the appropriate response	Operator, First Responder
4	Operator uses central management software to update traveler information systems (e.g., DMS displays, Connected Vehicle in-vehicle messaging) providing warning to upstream motorists	Operator/Central Management Software
5	Operator uses signal management software (e.g., ATMS.now, Centracs) to actuate the appropriate special timing plan (response) on impacted and/or adjacent corridors	Operator/Signal Management Software
6	Operator coordinates with regional partner agencies (e.g., state, city, county) to provide notification and information about the incident and potential impacts to jurisdictional roadways	Operator
7	First responders arrive at the scene of the incident; begin maintenance of traffic and first-aid efforts; work to clear scene	First Responder
8	Operator continues to monitor traffic conditions for impacted and adjacent corridors; continues to adjust response plan (e.g., signal timing, traveler information systems), as appropriate	Operator/Video Management Platform, Central Management System, Signal Management System
9	First responders clear the incident, return traffic patterns to normal	First Responder
10	Operator confirms the incident is clear and returns all systems to "Normal Conditions"	Operator/Central Management System, Signal Management System

Figure 7-15: Incident Management (Unplanned Event)

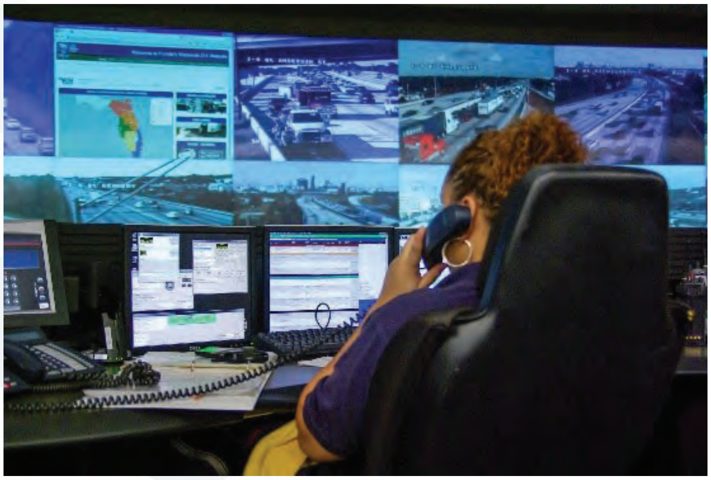


Table 7-8: Event Management (Planned Event)

Step	Description	User/System
1	Operator coordinates with regional partner agencies (e.g., state, city, county) to provide notification and information about event (e.g., downtown parade) and potential impacts to jurisdictional roadways	Operator
2	Operator uses central management system software to update traveler information systems (e.g., DMS, Connected Vehicle in-vehicle messaging) providing advanced notification of the event	Operator/Central Management System
3	Operator uses signal management software (e.g., ATMS.now, Centracs) to actuate the appropriate special timing plan (event) on impacted and/or adjacent corridors	Operator/Signal Management Software
4	Operator uses central management system software to trigger blank-out sign displays for the appropriate "detour" route, providing wayfinding information to motorists	Operator/Central Management System
5	Operator continues to monitor traffic conditions for impacted and adjacent corridors; continues to adjust response plan (e.g., signal timing, traveler information systems, wayfinding information), as appropriate	Operator/Video Management Platform, Central Management System, Signal Management System
6	Following the conclusion of the event, Operator returns all systems to "Normal Conditions"	Operator/Central Management System, Signal Management System

Figure 7-16: Event Management (Planned Event)

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