CONCEPT OF OPERATIONS (CONOPS)

Florida Department of Transportation

District 5

LPGA Boulevard PD&E Study

Limits of Project: From US 92 to Williamson Boulevard

Volusia, Florida

Financial Management Number: 448456-1

ETDM Number: 14332

Date: March 2023

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022 and executed by the Federal Highway Administration and FDOT.

Transportation Systems Management & Operations

Concept of Operations (ConOps) for 448456-1-22-01 – LPGA Boulevard from US 92 (SR 600) to Williamson Boulevard PD&E Study

Version: V1.2

Approval Date: [*Insert Approval Date*]

DOCUMENT CONTROL PANEL		
File Name:	2023.01.06 – I-95 at LPGA ConOps – v1.2.docx	
File Location:	\\lkmw00\pmwork3\Jobs\79410 - FDOT D5 I-95 at LPGA\TechProd\TSM&O\ConOps	
Version Number:	V1.2	
	Name	**Date**
Created By:	Christopher Karmeris, PE, HNTB	2022/09/26
Reviewed By:	Sarah Parinella, PE, HNTB	2023/01/06
	Katie King, P.E. MEI for FDOT	2023/03/06
Modified By:	Christopher Karmeris, PE, HNTB	2023/XX/XX
	Sarah Parinella, PE, HNTB	2023/03/03
	R. Carlo Adair, PE, HNTB	2023/03/05
	Sarah Parinella, PE, HNTB	2023/03/28
Approved By:	[*insert approver name, organization*]	[*insert approval date*]

Table of Contents

List of Tables

List of Figures

List of Acronyms and Abbreviations

ARC-IT ..... Architecture Reference for Cooperative and Intelligent Transportation
AST ..... Agency for State Technology
ATSPM ..... Automated Traffic Signal Performance Measures
CARs ..... Crash Analysis Reporting
CAV ..... Connected and Automated Vehicle
CCTV ..... Closed Circuit Television
ConOps ..... Concept of Operations
CV ..... Commercial Vehicle Operations
DM ..... Data Management
DMS ..... Dynamic Messaging Sign
FAC ..... Florida Administrative Code
FDOT ..... Florida Department of Transportation
FHP ..... Florida Highway Patrol
FHWA ..... Federal Highway Administration
FOC ..... Fiber Optic Cable
FON ..... Fiber Optic Network
FTE ..... Florida's Turnpike Enterprise
ITS ..... Intelligent Transportation Systems
LED ..... Light-Emitting Diode
LOS ..... Level of Service
LRTP ..... Long-Range Transportation Plan
MOT ..... Maintenance of Traffic
MOU ..... Memorandum of Understanding
MPA ..... Metropolitan Planning Area
NITSA ..... National ITS Reference Architecture
O-D ..... Origin-Destination
OpsCon ..... Operational Concept
PD&E ..... Project Development and Environment
PM ..... Parking Management
PS ..... Public Safety
PSEMP ..... Project Systems Engineering Management Plan
R2CTPO ..... River to Sea Traffic Planning Organization
RCTO ..... Regional Concept for Transportation Operations
RITSA ..... Regional ITS Architecture

RTMC ..... Regional Transportation Management Center
RTVM ..... Requirements Traceability Verification Matrix
R/W ..... Right-of-Way
SEA ..... Systems Engineering Analysis
SELS ..... Statewide Express Lanes Software
SITSA ..... State ITS Architecture
SMART Signals ..... Systematic Monitoring of Arterial Road Traffic Signals
SIS ..... Strategic Intermodal System
SOP ..... Standardized Operations Procedures
TM ..... Traffic Management
TMC ..... Transportation Management Center
TMS ..... Traffic Monitoring Sites
TPAS ..... Truck Parking Availability System
TS ..... Traveler Safety
TSM&O ..... Transportation Systems Management and Operations
TTC ..... Temporary Traffic Control
TTS ..... Travel Time System
USDOT ..... United States Department of Transportation
WAN ..... Wide Area Network

1. Overview

The first section of the Concept of Operations (ConOps) document provides six elements: system identification, purpose and audience, an overview of the document, a high-level overview of the proposed system, stakeholders, and references. These elements are described in the following sections.

1.1 Identification

Project Name: LPGA Boulevard from US 92 (SR 600) to Williamson Boulevard PD&E Study
Financial Project Identification: 448456-1-22-01
Federal Aid Project Number: N/A

1.2 Purpose and Intended Audience

The purpose of this ConOps document is to:

- Document existing Transportation Systems Management and Operations (TSM&O) solution sets and background.
- Identify stakeholders and elaborate on system needs.
- Define expected TSM&O system enhancements within the project limits to assist in final design.
- Garner support from identified stakeholders regarding the proposed TSM&O solution sets.

The intended audience for this ConOps document is for:

- Non-technical program management inclusive of the Florida Department of Transportation (FDOT) and Local Stakeholder decision-makers.
- Technical management of participating local stakeholders.
- Technical and non-technical parties engaged in the final design phase of the project.
- Individuals engaged in project oversight.

1.3 Document Overview

This ConOps document describes the existing system or operation, the shortcomings or unmet needs, proposed changes that would address the needs, and the final system after the changes are made to the system or operation, based on the assumption that all systems modifications proposed in this document are adopted during the final design phase.

1.4 High-Level System Overview

TSM&Os are vital to the success of the I-95/LPGA Project Development and Environment (PD&E) process by providing a system of processes to identify existing systems and services and proposed opportunities to enhance services and capacity conducive to stakeholder goals accommodating all transportation system user groups. This holistic approach to the planning process aims to preserve and enhance capacity, safety, and reliability for stakeholders. The

overarching goals addressed in the LPGA Boulevard and I-95 interchange redesign are focused on accommodating future transportation demands and enhancing safety for all users.

The TSM&O program for the subject project serves the core purpose of providing insight into existing key transportation technologies that contribute to overarching goals focused on safety and efficiency and casts light on the performance of these activities by analyzing collision history. It addresses engineering and planning needs by identifying improvement opportunities and coordinating stakeholder buy-in prior to the design phase, the TSM&O process positions the project in a holistic manner to address safety concerns for a variety of users.

1.5 Stakeholders

Table 1: Stakeholders

Stakeholder	Project Role
City of Daytona Jim Nelson: Public Works Department – City Engineer (386) 671-8613 nelsonjames@codb.us	Stakeholder – Provide insight into the needs of the City
Federal Highway Patrol (386) 736-5350 FHP@flhsmv.gov	Stakeholder – Provide insight into the needs of the Florida Highway Patrol
FDOT District 5 Jeremy Dilmore (386) 943-5360 Jeremy.dilmore@dot.state.fl.us	Stakeholder – Provide insight into the needs of the District
FDOT Central Office Kenneth Shiver (850) 410-5608 Kenneth.shiver@dot.state.fl.us	Stakeholder – Provide insight into the needs of the District
HDR Victor Muchuruza (407) 420-4200 Victor.muchuruza@hdrinc.com	Prime Consultant for PD&E overall development
HNTB Scott Zornek (407) 805-0355 szornek@hntb.com	Subcontractor – Work with the Contractor and Stakeholders
River 2 Sea TPO Stephan Harris: Transportation Planner – Project Manager (386) 226-0422 ext. 20248 Sharris@r2ctpo.org	Stakeholder – Provide insight into the needs of the TPO
Votran Elizabeth Suchsland: Assistant General Manager (386) 761-7700 esuchsland@volusia.org	Stakeholder – Provide insight into transit needs

Stakeholder	Project Role
Volusia County Tadd Kasbeer (386) 257-3874 tkasbeer@volusia.org	Stakeholder – Provide insight into the needs of the County
Volusia County Emergency Services Aubrie Austin: Emergency Management Planner (386) 254-1500 ext. 11625 alaustin@volusia.org	Stakeholder – Provide insight into the needs of the Volusia County Emergency Services
Volusia County Sheriff (386) 323-3502	Stakeholder – Provide insight into the needs of the Volusia County Sheriff

1.6 Referenced Documentation

List of References used in developing this ConOps:

Table 2: Referenced Documentation

Document Name	ID, Revision, Date, etc.	Link, or Contact Info to Obtain
Florida Department of Transportation Intelligent Transportation Systems Master Plan – District 5	Published October 31, 2016 Accessed September 26, 2022	https://cflsmartroads.com/docs/District%205%20ITS%20Master%20Plan_FINAL.pdf
Florida Department of Transportation TSM&O, 2017 Strategic Plan	Published August 17, 2017 Accessed September 26, 2022	https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/content/traffic/doc_library/pdf/2017-tsm-and-o-strat-plan-aug-24-2017-final.pdf?sfvrsn=d38c3054_0
Florida Department of Transportation TSM&O, Concept of Operations for Florida Department of Transportation District 5 Event Management Phase II – ITS Surveillance System	Accessed February 10, 2023	Jeremy Dilmore (386) 943-5360 Jeremy.Dilmore@dot.state.fl.us
River to Sea 2040 Long Range Transportation Plan	Published June 2019 Accessed January 17, 2023	https://www.r2ctpo.org/planning-studies/long-range-transportation-plan/
River to Sea Connected and Automated Vehicle Readiness Study – Technology Transition Plan	Published June 2020 Accessed September 26, 2022	https://cflsmartroads.com/docs/R2CTPO_CAV-Technology-Transition-Plan_FINAL_June2020.pdf
River to Sea Intelligent Transportation Systems Master Plan – Phase 1	Published August 2016 Accessed September 26, 2022	https://cflsmartroads.com/docs/R2CTPO%20ITS%20Master%20Plan%20Phase%201.pdf
River to Sea Intelligent Transportation Systems Master Plan – Phase 2	Published June 2018 Accessed February 26, 2023	R2CTPO-TSMO-Master-Plan-Ph-2-Final-ADOPTED-06.27.18.pdf
Systems Engineering and ITS Architecture Procedure 750-040-003	2019	FDOT Forms Management/Procedures https://pdl.fdot.gov/

2. Current System Situation

2.1 Background, Objectives, and Scope

FDOT is conducting a Project Development and Environment (PD&E) Study of LPGA Boulevard from US 92 (International Speedway Boulevard) to Williamson Boulevard within the City of Daytona Beach in Volusia County (approximately 6.6 miles). The proposed improvements involve the widening of LPGA Boulevard, which will include the addition of bicycle and pedestrian facilities and modifications to the LPGA Boulevard/I-95 interchange.

A project location map is provided in Figure 1. The existing LPGA Boulevard is a two-lane roadway from US 92 to Tomoka Farms Road (east of the Tomoka River), a four-lane roadway from Tomoka Farms Road to the I-95 Southbound Ramps, and a six-lane roadway from the I-95 Southbound Ramps over I-95 to Williamson Boulevard. There are 14 intersections along the corridor including ramp terminals at the I-95 interchange, nine (9) of which are signalized.

LPGA Boulevard is a county road maintained by Volusia County, except between Tomoka Farms Road and Technology Boulevard/Outlet Boulevard where FDOT maintains the limited access right-of-way to the I-95 interchange. Most of LPGA Boulevard does not have paved shoulders and sidewalks, and there are only limited areas of sidewalks between Tymber Creek Road and Williamson Boulevard.

I-95 is a six-lane, Strategic Intermodal System (SIS) facility and is a hurricane evacuation route. The I-95 interchange at LPGA Boulevard (Exit 265) is a partial cloverleaf interchange, or parclo interchange, with six on and off ramps. This interchange is located approximately 3.5 miles north of the I-95 and US 92 interchange and approximately 2.7 miles south of the I-95 and SR 40 interchange.

The purpose of this project is to accommodate existing and projected future travel demand, enhance safety, and improve operations for the LPGA Boulevard corridor and the I-95 interchange.

The need for the project is based on existing and future transportation demand and safety along the LPGA Boulevard corridor and at the interchange area. Improvements are necessary to address unacceptable levels of service (LOS) (below target LOS D and LOS E) and enhance the safety of travel conditions along LPGA Boulevard and at the I-95 interchange area.

Attributes are overarching processes and procedures typical of a specific Intelligent Transportation Systems (ITS) project and include evaluation of operational and safety needs, stakeholder coordination for regional technical specifications and preferences of service packages, educational augmentation for overall operational improvements, and development of resources to expedite economic considerations.

Figure 1. Project Location Map

2.2 Operational Constraints

The River to Sea Transportation Planning Organization (R2CTPO) ITS Master Plan – Phase 1 noted opportunities for improved network architecture configurations with FDOT and R2CTPO subsidiaries. Challenges exist for the stakeholders to effectively transmit data between agencies. Volusia County and FDOT, are able to share limited Closed-Circuit Television (CCTV) camera footage, however there is still more improvement between agencies that can be made. Data that can be mined to facilitate effective management of congestion and leveraged for initiatives to enhance driver safety has also been observed.

The enhancement of data processing techniques has provided stakeholders to effectively collect, store, manage, mine, and interpret large datasets not previously possible. These enhancements have translated to stakeholders requesting more precise data collection standards and the supporting infrastructure necessary to process larger sample sizes. Implementing efforts coalesce in Automated Traffic Signal Performance Measures (ATSPM) and Smart Signals systems deployed at signalized intersections will aid in the collection of collect a myriad of standard and new data sets otherwise historically gathered through resource-intensive legacy practices.

2.3 Description of the Current System or Situation

The LPGA Boulevard interchange is located within the limits of Daytona Beach, immediately north of the International Speedway Boulevard and I-4 interchanges on I-95. These interchanges are vital to the regional flow of traffic in Daytona Beach. Congestion from events and incidents has significant downstream impacts on local and regional traffic flow.

I-95 has four (4) dynamic messaging signs (DMS) within the vicinity of the LPGA Boulevard interchange. Three (3) signs are located on the southbound side 1.8 miles and 4.1 miles north and 2.6 miles south of the interchange while the last one is located 0.9 miles north of the interchange on the northbound side. These signs are used to convey information to drivers regarding emergency services, changes in traffic patterns, hazardous conditions, and travel time in addition to event-specific messaging. Effective communication with drivers supports desired traffic behavior to real-time changes in conditions. Decisions that appropriately address dynamic needs require a complex integration of a number of subsystems that ultimately coordinate the dissemination of information. During congestion, the mainline provides an excellent source of information to navigate the environment; however, arterial roadways, such as LPGA Boulevard, do not provide further guidance on appropriate decision-making to navigate congestion. As such, these conditions constrain the arterials and negatively impact the regional traffic flow. The inclusion of additional DMS signs upstream of the LPGA Boulevard interchange on the arterials will guide drivers, further enhancing traffic congestion alleviation efforts. However, adding a DMS sign on the west side of the interchange may not be beneficial as feasible alternative routes are not available.

Volusia County monitors 35 CCTV cameras throughout the county with several positioned throughout the interchange and are monitored by two Traffic Monitoring Centers (TMC) located in DeLand and Holly Hill and the Regional Transportation Monitoring Center (RTMC) located in

Seminole County. The cameras are used to identify incidents and to determine the proper procedure needed. The County's fiber optic network (FON) includes 72-strand single-mode and 24/12-strand hybrid backbone for a total length of approximately 52 miles. Currently, data sharing between the FDOT District 5 Operations Office and RTMC with Volusia County Traffic Operations and Management includes CCTV video feeds and varying datasets supporting County needs. Enhancements to the data set will be further vetted based on feedback from stakeholder coordination and public involvement efforts.

The City of Daytona Beach has a strong FON with approximately 90 miles of fiber optic cable throughout the city, but there are gaps that prohibit the monitoring of intersections that are not connected to the network. Approximately 93 of the 125 traffic signals within the City limits are connected to the City's communication network. The City monitors 60 CCTV cameras at its TMC facility located in the City's Public Works building. During the early deployment of the R2CTPO ITS Master Plan – Phase 2, connection was provided between the City of Daytona Beach TMC and the Volusia County TMC.

FDOT District 5 uses probe vehicle detectors to detect speed data and travel times for certain roadways and has a robust deployment of standardized VDS providing speed, volume, and occupancy datasets. This information can be matched to the same vehicle at other detection locations and can be used along with traffic data vehicle detectors to identify incident detection, maintenance of traffic performance measuring, origin-destination research, and travel time predictions. Refer to Section 2.5 for supplementary information.

2.4 User Class Profiles

The R2CTPO oversees urban transportation planning and programming efforts for the metropolitan planning area (MPA) that includes Volusia County and portions of Flagler County. They document existing conditions and are responsible for the planning of growth for the region. TSM&O projections and goals are found in the latest ITS Master Plan (2016) and the Long-Range Transportation Plan (LRTP) (2019).

As the largest stakeholder in the region, FDOT maintains a myriad of infrastructure elements supporting the core goals and needs of the adopted TSM&O program. Existing conditions of infrastructure providing the data, user interfaces, and decision-making tools along with regional transportation-related projections of future demands all fall within the umbrella of their vast responsibilities.

Volusia County, a key subsidiary in the R2CTPO, operates and maintains an ITS with FDOT, but provides County-specific elements of the TSM&O program. County system functionality leverages DOT data expanding their system with supplemental functionality such as transportation monitoring via access to Department CCTV, various data metrics, and a host of other backend and user-interface uses.

The City of Daytona Beach is another key subsidiary of the R2CTPO. The City's continual investment in ITS infrastructure is currently limited to providing spur connections between various major trunklines. Event management operations contain all aspects of the TSM&O program involving all stakeholders of the region.

2.5 Support Environment

R2CTPO performs community outreach, analysis, and planning with their regional partners and is the primary vehicle with which larger-order TSM&O activities are directed in the area.

Much of the FDOT's TSM&O program goals, priorities, and funding allocations are documented in the FDOT ITS Strategic Plan (2017). Specifically for this study, included are fiber optic cable (FOC) trunklines for data communications, four (4) DMS signs to convey information to traveling motorists, and numerous CCTV cameras to monitor traffic flows and congestion as planned deployments to enhance operations, expand coverage, and provide infrastructure for Wide Area Network (WAN) integration of the local partners. Seven (7) existing network-connected intersections and microwave vehicle detection systems provide an array of data characteristics to Regional and Local TMCs to aid in the overall management of the transportation system operations.

Volusia County possesses an independently owned FOC, providing the primary medium through which regional communications are transferred, and leverages FDOT FOC in various locations to establish redundancy for system efficiency and security. Volusia County has both system connections to subsystem elements (e.g. traffic signals) and FOC WAN with FDOT. Volusia County maintains a separate system of other ITS-related subsystems throughout the County such as CCTV cameras, DMS, and Travel Time (TT) that are also shared with FDOT in support of TSM&O regional partnering practices. While the networks provide the opportunity to communicate between FDOT and Volusia County ITS networks, limitations in selected network architectures greatly reduce the level of communication. As such, there is currently only one CCTV camera at the I-95 and US 1 interchange monitored by Volusia County, but there are two more proposed as part of the R2CTPO Master Plan Phase 2, which will have a direct impact on the operations of the County roadway network.

Similarly, The City of Daytona Beach also owns and operates a FOC communications network that routes a number of critical data communications for various systems. TSM&O-related systems include traffic system monitoring and real-time data analytics. The city has expanded fiber interconnection, supplementing County and State infrastructure to accommodate the increasing traffic growth forecasted for the region investing in ITS infrastructure along city-maintained roadways and establishing spur connections to both County and State systems for the same aforementioned reasons. The data collected through the interconnected networks assists the City directly in handling traffic constraints on local roadways and is a vital function of their system as hosts to large recurring events throughout the year.

3. Change Justification

3.1 Justification for Changes

The Daytona Beach region is host to many events that attract large volumes of attendees significantly impacting traffic volumes. These events include Daytona Speedway events, Bike Week, Spring Break, Summer Break, conventions, and Embry Riddle Sporting events which spike traffic volumes exceeding system capacity thus requiring implementation of TSM&O and technology opportunities. Effectively managing events seek to reduce congestion periods and involves the participation of all local stakeholders.

The increase in freight along the corridor anticipated with the projected growth of the region's population will require approaches to system solutions integrating with the industry trends of major market providers. Models of operations for supply delivery of these market providers have planned for last-mile solutions ranging from automated vehicle and drone transport. Infrastructure and roadway network planning considers the requirements of such systems supporting local stakeholders' projected modes by which their systems will adapt to and integrate with the developing technology. Due to economic factors including limited Right-of-Way (R/W), expansion of truck parking facilities is not a feasible solution to address increased parking demands. As such, effective TSM&O solutions to the issue must effectively allocate the available resources throughout the region lending to the planning of solutions leveraging the trends of the freight industry.

The R2CTPO Connected and Automated Vehicle (CAV) Readiness Study discusses opportunities to incorporate initiatives that would improve government services using different technology applications. Technology is constantly changing and R2CTPO is continuously updating and adopting new programs such as adding parking management and automated shuttle deployment as pilot programs. They have proposed to install or upgrade the FOC along LPGA Boulevard to 96 single-mode to improve communication and data sharing between the TMCs. Another potential upgrade would be the addition of parking management systems that would monitor parking availability and share with drivers the location of available parking via mobile apps or wayfinding signs, which would reduce the travel time for drivers. During special events, automated shuttles could be used to transport attendees safely between the event and their vehicles, reducing the number of vehicles on the road in the area directly surrounding the event. There are currently some advanced parking management systems, including dynamic parking guidance and reservation and dynamically priced parking, located within Volusia County, R2CTPO, and FDOT District 5.

3.2 User Needs

Application of the TSM&O planning approach provides a way to effectively focus on potential operational and technical advancements that assist in supporting stakeholder goals. Evaluation of opportunities to preserve and enhance safety, traffic congestion, event management, and data collection efforts are compared to the project's overall benefit/cost ratio for determination of appropriate applicability within economic constraints. The TSM&O approach to incorporating

improvements baselines innovation selection through coordination with stakeholders to identify and/or verify concerns previously recorded in the various supporting documents.

The following solution sets will be shared for consideration and refined to enhance the TSM&O goals of this project. All proposed improvements have established network workflows as defined in the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) Version 9.0 of the federal architecture. Each is to be identified for feasibility and applicability while further guiding discovery in the latest direction of each stakeholder's initiatives to align TSM&O processes at the State, Regional, and Project levels. Service packages fall under the main areas of Data Management (DM), Parking Management (PM), Public Safety (PS), Commercial Vehicle Operations (CV), Traffic Management (TM), and Traveler Safety (TS) and may be further explored at the following website (https://www.arc-it.net/html/servicepackages/servicepackages-areaspsort.html).

Table 3: User Needs

User Need ID	User	Need
UN001	FDOT, Volusia County, and City of Daytona	Increase data sharing between agencies
UN002	FDOT, Volusia County, and City of Daytona	Increase information to drivers about parking availability, especially during events
UN003	FDOT, Volusia County, and City of Daytona	To reduce secondary crashes and response time for emergency vehicles
UN004	FDOT, Volusia County, and City of Daytona	Truck parking availability
UN005	FDOT, Volusia County, and City of Daytona	Additional CCTV cameras along both LPGA Blvd and I-95 corridors
UN006	FDOT, Volusia County, and City of Daytona	Additional information to drivers about crashes and delays along LPGA Blvd and I-95
UN007	FDOT, Volusia County, and City of Daytona	Detect vehicles traveling in the wrong direction along off-ramps

4. Concepts for the Proposed System

4.1 Background, Objectives, and Scope

Base data such as speed, volume, and occupancy are now processed at the "edge" of newer systems for reporting of next-level data metrics such as turning movements, travel time, and Origin-Destination (O-D) paths, amid a host of other valuable traffic management performance measurement categories. ATSPM and Smart Signals include standardized practices such as monitoring of intersections via CCTVs and automating data evaluation which contributes to the safety, mobility, efficiency, and longevity of signalized intersections, level of service, and regional assessment tools such as modeling and projection to name a few.

Implementing additional dynamic messaging signs upstream of LPGA Boulevard, wrong-way driving detection on the off-ramps and ramp metering would improve the overall safety and efficiency of the interchange. The installation of subsystems such as wrong-way driving and ramp

metering will also generate a broader range of new datasets to enhance various performance metrics evaluation techniques. Similarly, the enhancement of the overall system provides for an opportunity to fulfill the requisitioning by local partners for enhanced network integration systems between the stakeholders. Doing so will enhance the performance in culminating, interpreting, and comparing data and facilitate improved collaboration between the agencies.

4.2 Operational Policies and Constraints

Operational policies in place are the adopted practices of FDOT D5 and the regional partners Volusia County. Each agency provides access to their adopted policies via their agency websites. Various contributing documents contribute to the overall operating policies of each agency. General management for collaborative cross-jurisdictional operations is practiced through FDOT D5's TSM&O department. Links to each agency's department is provided below:

Table 4: Agency Departments

Department	Link
FDOT D5 TSM&O	https://www.fdot.gov/traffic/its/tsmo.shtm
Volusia County - Development Engineering	https://www.volusia.org/services/public-works/engineering-and-construction/development-engineering/

4.3 Description of the Proposed System

The overall proposed system is the enhancement and augmentation of the existing system currently deployed within the project limits and as described in early sections. The improvements to the existing system fall under two categories: enhancements to existing or addition of new subsystems. Enhancements would be applied to all existing subsystems where replacement and or upgrades would support the regular practice of maintaining best practices of operation and maintenance standards. Additional subsystems for consideration support the TSM&O program goals of D5, which include ramp metering and wrong way driving subsystems.

Effective communication of applicable system operations elements such as messaging to drivers, email notification to managers, alerts to law enforcement and other established stakeholders, and actuation of alerting subsystems, such as specific DMS messages, remains a complex modality undergoing an ever-improving process. Maximizing the effectiveness of interoperations, logistics, and decision-making is one of the primary functions of the TSM&O program. Ensuring system augmentation and enhancements integrate into the reliable FON is critical to success. Likewise, the complexities of communications reliability require the proper coordination and design of the fiber optic cable infrastructure and associated network hardware.

Effective communication to drivers of congestion and highlighting alternative routes significantly improves the management of regional traffic operations. TSM&O considers a myriad of subsystems that contribute to the function of diversion route management needed during high traffic events. It involves the use of vehicle detection systems upstream and downstream of the system which monitors traffic conditions. Triggers of predetermined system settings automate

associated system reactive processes and workflows for various pre-programmed conditions such as diversion routes developed by management and operations.

Similarly, the installation of vehicle detection systems at off-ramps is proposed to monitor traffic flow for the presence of vehicles traveling in the wrong direction. Identification of wrong-way vehicles is actuated with Light-Emitting Diode (LED) reflective "Wrong-Way" signs to alert drivers while simultaneously issuing alert notices to various TSM&O responsible personnel. These include emergency responders, law enforcement, and traffic management operations. Additional personnel defined in the Standardized Operations Procedures (SOP) are also programmed into the system, which is configurable and adjustable as a standard practice. Construction of Wrong-Way Driving systems is now required at all off-ramps within the State in support of the Target Zero Program. A relatively newer subsystem of ITS, D5 has design guidance that has been developed through regional-partner coordination with enhancements that are under consideration to further increase its proven beneficial functionality.

Installation of ramp metering at all on-ramps is a consideration to enhance the management of traffic behavior in unsafe queuing and weaving conditions. LOS determines the applicability of subsystem deployment. Ramp metering systems regulate the number of vehicles entering the freeway from the on-ramps. They are throttled when the mainline is experiencing volume-to-capacity ratios known to create unsafe queuing and weaving conditions. Vehicles are released from the on-ramp queue at a rate determined by the mainline volume and speed conditions. Throttling on-ramp volume eliminates ramp platooning which removes the merge condition such that disruption to mainline flow is reduced. However, constructing an isolated ramp metering can backfire as more vehicles will travel to nearby on-ramps to avoid the metering and cause deteriorating ramp and freeway performance. By 2050, the projected I-95 Level of Service (LOS) will be a LOS C to D. This LOS does not currently demand full ramp metering deployment. However, construction of conduits and pull boxes infrastructure would be beneficial due to the negligible cost to include it within the project. Ramp metering deployments as additional system enhancements to prepare for future needs are expected.

Enhancement of existing subsystems includes CCTV cameras throughout the project limits, which aids in the monitoring of the traffic, environment, and situational conditions. CCTV systems assist the TSM&O management and operations departments in monitoring real-time conditions and are critical to the successful implementation of emergency management directives. Similarly, messages to drivers via DMS, as well as informing truck drivers of available parking nearby via the Truck Parking Availability System (TPAS) are information dissemination subsystems standard to TSM&O. There are currently no TPAS located within the vicinity of the I-95/LPGA Boulevard interchange however, adjoining roadway network facilities do have sites. Similarly, expansion of the TPAS program is under consideration under both the additional site development of the current version as well as the consideration of various technology solutions becoming available in the market. Such solutions include software integrating public and private parking data expanding the principle of the current version of TPAS. Alternatively, the last-mile solution consists of concepts that transition the use of freight to a version of drone-delivery systems both large and small. Enhancement of these subsystems through design for maximum effectiveness using the newest

available hardware and software ensures the functionality meets the latest standards of the industry. Finally, the development of a Network Integration Plan and design would address the noted preferences of local stakeholders to improve system communications supporting data exchange between the agencies.

Lastly, the interchange enhancements will include the treatment of supplemental signing, see Figure 1 below, and ITS subsystem integration of various support functionality to enhance the local partners' event management system. Daytona Speedway seasonal events coupled with the expansive development of additional visitor venues has continually impacted the event demands in the region. Deployments of various ITS subsystems such as CCTV, DMS, VDS, and TTS have been integrated into an expansive traffic management network with a primary focus to facilitate the efficient management of event traffic. Subsystems are in place to detect and monitor traffic conditions and distribute information to traffic management staff for decision-making. Similarly, the use of information dissemination subsystems assists both field-deployed resources (such as law enforcement personnel) and the traveling public by directing traffic to programmed routes. All components work together to augment event traffic behavior to follow system-designed routes focused on efficiency and safety.

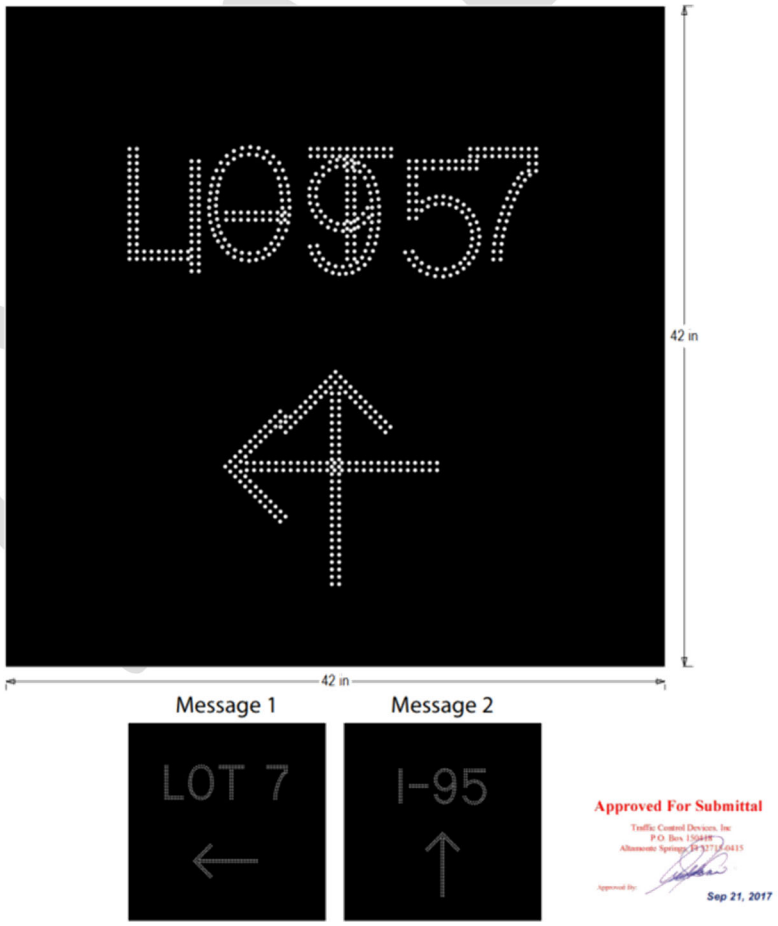

Figure 2: Proposed I-95 Blank Out Signs

Table 5: Desired Changes

Change Type	Change	Priority
Capability	*Reduce head-on collisions due to wrong-way drivers on off-ramps with the implementation of vehicle detection systems.*	10
System Processing	*Provide a broader spectrum of traffic data with the implementation of more CCTV cameras throughout the interchange.*	5
Interface	*Allow for intercommunication among the different stakeholders by implementing network integration.*	8
Personnel	*More TSM&O responsible personnel will be needed to aid in the increased amount of footage coming from the addition of extra CCTV cameras.*	4
Environment	*With the implementation of route notification via the DMS, alternate routes can be suggested to drivers when traffic volumes become too high.*	6
Operations	*Less traffic should be expected after the implementation of diversion routes.*	6
Support	*An increased amount of maintenance will be required due to the addition of more signs.*	3
Other	*Less time spent from trucks on the interchange due to TPAS.*	2
Considered	*More law enforcement support could be necessary due to the higher level of surveillance in the area.*	1

4.4 Modes of Operation

TSM&O solutions to address event management include notification of upcoming events to drivers, development of specific timing patterns, deployment of Temporary Traffic Control (TTC) designs, coordination of law enforcement personnel, real-time monitoring from traffic management centers, and response efforts inevitably encountered during events. Enhancements consider emergency services response time, diversion routes, a collaboration of business, public, and private agencies, and stakeholders' efficiencies amongst an evolving solution set of developing technologies produced to address a range of factors from specific detection devices for special conditions to regional management software ingesting, displaying, and facilitating real-time decision making.

4.5 User Involvement and Interaction

TMC and other responsible personnel will interact with the system by monitoring live feed coming from the various CCTV cameras throughout the interchange. In addition to this, they will be responsible for displaying corresponding messages via the DMS for the correct course of action to be taken by the drivers, as well as any important information to aid them about oncoming traffic conditions.

In a wrong-way driving scenario, responsible personnel are to oversee the vehicle detection systems and confirm it is in fact a wrong-way driver. Preceding this, they should contact emergency responders, law enforcement, and traffic management, as well as display to oncoming traffic via the DMS (if possible) to not take the ramp involving the incident.

4.6 Assumptions and Constraints

Potential DMS locations could be constrained by the Right-of-Way, which in turn introduces an unfavorable scenario. For example, the driver's sight distance could be obstructed by an obstacle, or the placement of the sign is not far enough from the incident for the driver to make an optimal decision.

Expansion of the ITS backbone could result in redundancy concerns. A way to mitigate this potential constraint is to review The City of Daytona's network to determine that extended trunkline and new connected signals will have sufficient routes of redundancy.

4.7 Risks

Potential project risks are listed below in Table 6.

Table 6: Risk Register

Risk #	Risk Owner	Description of Risk and Impact	Likelihood (1-4)	Impact (1-4)	Rating (L + I) (2-8)	Mitigation Strategy	Status
1	FDOT	DMS sign location's R/W not optimal for driver sight lines and decision-making processes	1	4	5	Review preliminary placement of the DMS signs during the PD&E study to determine idealized locations and review R/W adequacy	Not Started

4.8 Support Environment

The TMC would be responsible in monitoring video coming in from the CCTV cameras throughout the project area. In scenarios, like wrong-way drivers, they would assess the situation and, if necessary, contact emergency responders, law enforcement, and traffic management operations as well as notify oncoming traffic via the DMS.

In other situations, like congested traffic, TMC responsible personnel would notify drivers via the DMS well before they have reached the congestion with any corresponding route notifications and possible diversion routes, they could take to avoid the congestion.

5. Operational Scenarios

Installation of vehicle detection systems at off-ramps that monitor for the presence of vehicles traveling in the wrong direction brings more involvement and interaction from various TSM&O responsible personnel. When such presence is detected, the mentioned personnel must react expeditiously in assessing the situation and alert emergency responders, law enforcement, and traffic management operations, as well as oncoming traffic with the use of DMS.

The installation of ramp metering at on-ramps will break up the platoons of vehicles that typically make it difficult to merge into traffic and will be used only when the mainline is near or at capacity. Vehicles will queue on the on-ramp, stopping at a signal, and will be released individually depending on mainline vehicle speed and volume.

With the use of CCTV cameras, TSM&O responsible personnel are also involved in monitoring the traffic near the interchange and communicating any possible congestion, alternate routing, accidents, etc., that may be a concern to drivers. This communication is conveyed via the DMS from a TMC by letting the drivers know of the location and any immediate alternate routes that can be taken.

TPAS provides notification of available spaces at nearby parking locations. Monitoring truck volumes in and out of parking areas provides information to help direct drivers on the appropriate course of action.

5.1 Normal Operations Scenario

Network-integrated CCTV cameras throughout the interchange display a live feed of the current scenario in the area, indicating to various TSM&O responsible personnel the severity of the situation. Whether the condition results in congestion, an accident, etc., this in turn allows them to digest the information and enact appropriately; alerting emergency responders, stating there is traffic congestion on the dynamic messaging signs, etc.

5.2 Maintenance Scenario

Maintenance is imperative in keeping all implemented systems up and running properly. All DMS, CCTV cameras, and on-ramp metering signals should always be operational for proper system operations. All subsystem components have maintenance schedules managed and performed by the maintenance contractors. Similarly, the FON communication subsystem is constantly monitored, and any sub-standard conditions are addressed by the maintenance contractor at pre-determined response and correction times depending on the scenario. Regular system maintenance occurs during nonpeak hours to maximize safety and minimize impacts to drivers.

Implementing additional CCTV cameras along the interchange and surrounding area would increase the amount of video that will be surveilled. This results in a need for an increase in TMC staff, hardware, software, and hours of operation. However more surveillance is vital in the detection of accidents and provides the ability to notice potential fatalities as early as possible. This, in turn, would produce a need for more law enforcement and emergency responders to respond to the scene in an emergency scenario.

5.3 Failure Scenario

A malfunction in any of the subsystem equipment, whether it be a CCTV camera watching for congestion or a microwave vehicle detection system monitoring for wrong-way drivers, could result in a failure in performance of the overall system. It is critical for TSM&O responsible

personnel to have a reliable functioning system. The severity of a failure in the system ranges from a low impact such as a lapse in traffic data records collection to high such as affecting real-time emergency response capabilities. For example, the failure of a CCTV would impact management personnel from quickly recognizing an accident's location and conditions which may make the difference in emergency response arrival time to save a life. In all failure scenarios, trained professionals are equipped with SOPs to guide sufficient and efficient resolution.

6. Summary of Impacts

The following is a list of user impacts created by implementing the proposed system:

- Additional DMS signs will inform drivers earlier of wrong-way drivers and construction that requires extra caution
- Implementing wrong-way driving signs will provide extra information to drivers to prevent confusion at the interchange
- Installing ramp metering will reduce congestion during peak hours and the number of crashes
- Additional CCTV cameras will alert TMC staff to crashes located throughout their corridor where they can then alert emergency personnel needed
- Additional CCTV cameras will require an increased number of TMC staff to monitor and emergency personnel to respond to emergencies

7. Analysis of the Proposed System

7.1 Alternatives

Some alternatives include using Bluetooth Travel Time Sensors to monitor travel time through the corridor. They have been installed in DeLand and in other counties and are currently being installed in Volusia County, replacing the BlueMac with Iteris Bluetoth/RSU units. There are also wireless magnetometers that could be used for vehicle detection in place of microwave detection. However, the magnetometers would need to be installed into the roadway and calibrated while microwave detection is located on the side of the road. The magnetometers tend to move out of alignment over time and would need to be replaced, unlike microwave detection.

Another alternative is to directly connect the LED wrong-way sign to the TMC rather than using the existing fiber network. This would guarantee connectivity between the signs and the TMC, however, it would be very costly compared to using wireless communications. Additionally, the wrong-way signs could be solar-powered instead of using line power from the closest service point, but with the unpredictable Florida weather, there is a small chance of the signs not working when they are needed.

7.2 Cost, Schedule, and Procurement Options

Cost, schedule, and procurement options will be better described later in the process.

7.3 Systems Engineering Plan

The guidance provided in this document will illustrate an in-depth description of the workings behind the new technology opportunities implementation. It characterizes the details of the technologies, describes the capabilities of their functionality, and states the benefits, repercussions, and potential data that can be gathered with its addition. This document captures the concepts of preferred system solutions and contemplates the enhancement and augmentation of the overall system through assessment of ramp metering, wrong-way driving, network integration between stakeholders, ATSPM, SMART Signals, route notification and diversion, TPAS, Arterial DMS, and travel time.

Highlighting the methods to support the importance of safety for the public, drivers, and all involved personnel remains the highest priority of the Department. Safety is the overarching primary goal of all the technology opportunities mentioned in this document. Guidance and direction for the concepts herein are fully supportive of the Statewide Target Zero initiative.

7.4 Performance Measurement for System Validation

The Statewide Target Zero Program is the paramount motivation for implementing the wrong-way driving safety feature. The distinguished success of the vehicle detection systems currently installed throughout various off-ramps across the state exhibit the importance of such a system, and the need for it everywhere. An improvement in Traveler Safety (TS) can be recognized through FDOT's Crash Analysis Reporting (CARs) data by utilizing existing crash reports at the LPGA Boulevard interchange and comparing them to future data.

Seeing an improvement in Traffic Management (TM) and Commercial Vehicle Operations (CV) will also be witnessed following the implementation of the additional DMS, CCTV cameras throughout the interchange, and ramp metering. By utilizing previously gathered queuing data from FDOT's Traffic Monitoring Sites (TMS) the change in traffic volumes can be accurately deduced.

8. Notes

This section will be annotated, as needed, with changes to the approved ConOps document made over the course of the project. There are no notes at this time.

9. Appendices

This section will be annotated, as needed, with changes to the approved ConOps document made over the course of the project. There are no appendices at this time.

10. Glossary

National ITS Reference Architecture (NITSA): The National ITS Reference Architecture, also known as the "*Architecture Reference for Cooperative and Intelligent Transportation*" or simply "ARC-IT", provides a common framework for planning, defining, and integrating intelligent transportation systems. ARC-IT is a reference architecture providing a common basis for planners and engineers with differing concerns to conceive, design and implement systems using a common language as a basis for delivering ITS, but does not mandate any particular implementation. The National ITS Reference Architecture is maintained by the United States Department of Transportation (USDOT).

Operational Concept: A component of a regional architecture that identifies the roles and responsibilities of participating agencies and stakeholders in the existing and planned systems. The operational concept (or OpsCon) designs the institutional and technical vision for the region and describes how ITS will work at a very high level, frequently using operational scenarios as a basis.

Regional ITS Architecture (RITSA): A regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects.

SMART Signals: A system that is able to collect and archive event-based traffic signal data simultaneously at multiple intersections.

DOCUMENT REVISION HISTORY			
Version Number	**Approved Date**	**Description of Change(s)**	**Created/ Modified By**