Transportation Systems Management and Operations (TSM&O)

Strategic Plan

FDOT TSM&O
Transportation Systems Management & Operations

FLORIDA'S TURNPIKE

Final Submittal
May 2019

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List of Abbreviations

AADT	Annual Average Daily Traffic
AAM	Active Arterial Management
ADM	Active Demand Management
AFC	Automated Fare Collection
ASCT	Advanced Signal Control Technologies
ASE	Automated Speed Enforcement
ATM	Active Traffic Management
ATSC	Advanced Traffic Signal Control
AV	Autonomous Vehicle
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
C2C	Center to Center
C2I	Center to Infrastructure
CAR	Crash Analysis and Reporting
CCTV	Closed Circuit Television Cameras
CFAVP	Central Florida Automated Vehicle Partnership
CMM	Capability Maturity Model
CV	Connected Vehicle
CVO	Commercial Vehicle Operations
DDS	Dynamic Detour System
DIVAS	Data Integration Video Aggregation System
DLG	Dynamic Lane Allocation/Grouping
DMC	Dynamic Merge Control
DMS	Dynamic Message Sign
DSRC	Dedicated Short-Range Communication
EFC	Electronic Fare Collection
EL	Express Lanes
EOC	Emergency Operations Center
ERCAR	Existing Roadway Condition Assessment Report
ESS	Environmental Sensing Stations

FDOT	Florida Department of Transportation
FHP	Florida Highway Patrol
FHWA	Federal Highway Administration
SHSP	Florida Strategic Highway Safety Plan
FMS	Freeway Management Systems
FRATIS	Freight Advanced Traveler Information Systems
FTE	Florida’s Turnpike Enterprise
GIS	Geographic Information System
HAR	Highway Advisory Radio
HSR	Hard Shoulder Running
ICM	Integrated Corridor Management
ITS	Intelligent Transportation System
LCS	Lane Control Sign/Signals
LOS	Level of Service
MP	Master Plan
MUTCD	Manual on Uniform Traffic Control Devices
MVDS	Microwave Vehicle Detection System
OBU	On-Board Units
ORT	Open Road Tolling
PD&E	Project Development and Environment
PDO	Property Damage Only
PER	Preliminary Engineering Report
PFA	Priority Focus Areas
REL	Reversible Express Lanes
RISC	Rapid Incident Scene Clearance
RITIS	Regional Integrated Transportation Information System
RoS	Routes of Significance
RRSP	Road Ranger Service Patrol
RSE	Roadside Equipment
RTMC	Regional Traffic Management Center
RWIS	Road Weather Information Systems

SIRV	Severe Incident Response Vehicle
SMART	Specific, Measurable, Achievable, Relevant and Time-bound
SP	Service Patrols
SPaT	Signal Phase and Timing
STARR	Specialty Towing and Roadside Repair
STEOO	State Traffic Engineering and Operations Office
TIM	Traffic Incident Management
TMC	Transportation Management Center
TPAS	Truck Parking Availability Systems
TSM&O	Transportation Systems Management and Operations
TSR	Traffic Services Request
UPS	Unified Payment System
V2I	Vehicle to Infrastructure
VMIS	Virtual Weigh-In Motion
VSL	Variable Speed Limit
WAN	Wide Area Network
WWD	Wrong Way Driving

Preface

The Florida Department of Transportation (FDOT) and the Federal Highway Administration (FHWA) have a substantial investment in limited-access facilities. The Florida's Turnpike Enterprise (FTE) Transportation Systems Management and Operations (TSM&O) Strategic Plan is integral into promoting and improving safety on the Turnpike roadways.

Purpose

The purpose of this document is to provide a strategic plan on the TSM&O program elements, methods, strategies and analysis tools. The FHWA defines TSM&O as "an integrated program to optimize the performance of existing multimodal infrastructure through implementation of systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system." TSM&O technology is changing rapidly and will continue to evolve in the coming decades. This document supplies a snapshot of current conditions and trends that will need to be updated frequently.

Acknowledgements

This TSM&O Strategic Plan could not have been developed without the collaborative input FTE internal partners.

Document Organization

This Strategic Plan is organized into seven (7) sections and two (2) appendices:

- Section 1: TSM&O Consideration
- Section 2: Actions and Initiatives
- Section 3: Strategies
- Section 4: Implementation
- Section 5: Assessment
- Section 6: Evaluation
- Section 7: Next Steps
- Appendices

Section 1: TSM&O Consideration

1.1 Background

Florida's Turnpike Enterprise (FTE) strives to manage travel conditions more efficiently on its roadways and to meet the goals and objectives of Florida Department of Transportation's (FDOT's) Strategic plan created a TSM&O Program. TSM&O is a strategic approach to proactively improve mobility for all modes of transportation by integrating planning and design with operations and maintenance to holistically manage the transportation network and optimize existing or proposed infrastructure. Additionally, TSM&O is a program of elements, methods, strategies and analysis tools for traffic management addressing safety, congestion (recurring and non-recurring) and incident management. Over the years, FTE has incorporated TSM&O strategies or initiatives such as all electronic tolling (AET), signal optimization, freeway safety patrol, roadway monitoring (using vehicle detectors, CCTV cameras, etc.), traveler information using electronic signs and a 511-traveler information website, ramp metering, express lanes and other strategies. The purpose of these strategies is to optimize existing or maximize performance of existing infrastructure, quick detection and clearance of incidents, provide information to travelers, prepare alternate routes during incidents, prepare for inclement weather, etc.

FTE's TSM&O program involves multi-disciplinary stakeholders within and external to FTE and FDOT that work cohesively to develop, implement, monitor and evaluate these congestion management and safety strategies in an attempt to reduce travel times to one's destination, improve trip reliability through consistent travel times, and reduce the risk of crashes.

1.2 Florida's Turnpike Facilities

The FTE is a business unit of the FDOT that manages and operates limited-access tolled highways throughout Florida. Several of these highways are commonly referred to as Expressways. These tolled highways span several counties in the State of Florida including south, west, central and northeast Florida regions; covering approximately 600 miles of roadway and 80 percent of all tolled facilities in Florida. The FTE roadway network shown in **Figure 1** and **2** includes the Turnpike Mainline System, 10 expansion projects (including one under construction), 6 Department-owned and 2 Department-operated facilities.

Figure 1: Florida's Turnpike System

Figure 2: Department Owned & Operated Toll Facilities

1.3 Purpose and Need

A well-defined purpose and need is critical in a project development process and it provides a basis for evaluating the reasonableness of options for improvements. The purpose defines the transportation problem to be solved. The need provides information and/or data to support the problem identified in the purpose. The following factors may be helpful in establishing the "Need" for a proposed action:

- Capacity and transportation demand
- Safety
- Legislative directive
- Economic development and planned growth
- Modal interrelationships
- System linkage
- Transportation facility deficiencies

Each need should be demonstrated through specific quantitative investigation and supported by discussion of appropriate data. Data serves as the critical link in identifying roadway operational and safety problems, selecting appropriate countermeasures, and evaluating performance. Without data, traffic safety and roadway engineering-related statistical analysis becomes more difficult. It is also more difficult to compete for funding and justify improvement needs.

1.4 Where We Are Now

The FTE produces an Annual Traffic Trends Report that is the initial component of the long-range planning process that evaluates current and future capacity deficiencies on FTE System facilities. An integral part of the 2018 Traffic Trends Report is an evaluation of mobility or mobility report card (**Table 1).** The mobility report card provides an annual assessment of the existing travel conditions on FTE's facilities, while also providing a future mobility outlook. The future outlook highlights deteriorating travel conditions or improved mobility as capacity improvements are completed. At the core of the existing conditions evaluation are three mobility measures:

- Percent Travel Meeting Level of Service (LOS) Criteria
- Percent Miles Severely Congested
- Travel Time Reliability

An overall mobility score, indicative of the three mobility measures, has been developed for each facility. Mobility scores range from 0 to 100, where a higher score indicates a better level of mobility and a lower score indicates a reduced level of mobility. A traffic light symbol has been included to provide a quick reference on the range of mobility scores:

- Green represents a score of 100
- Yellow represents a score of 99 to 75
- Red represents a score of 74 or lower[1]

[1] 2018 Traffic Trends Report

Table 1: Mobility Report Card, 2018 Annual Traffic Trends Report

Facility	CY 2017 Mobility Measures and Score						CY 2016	Future Outlook			Comments
	Transaction Growth Rate (2016-2017)	Daily VMT / System Length	% Travel Meeting LOS Criteria	% Miles Severely Congested	Travel Time Reliability	Mobility Score (0 - 100)	Mobility Score (0 -100)	Programmed Widening	Earliest Year of Unfunded Need	Future Trend	
Turnpike Mainline – Homestead Extension / S.R. 821	-0.5%	107,700	22%	45%	5%	3	9	✓	2025	↑	The overall mobility score decreased. VMT and % of miles severely congested increased, and % of travel meeting LOS criteria and travel time reliability decreased. Negative transaction growth rate was experienced, mostly due to impacts associated with the largest hurricane evacuation in U.S. history (Hurricane Irma in September 2017), and ongoing construction activities related to widening projects. These factors have resulted in a mobility score of 3. The mobility score is anticipated to remain low, and even decrease further until various programmed construction improvements are complete, at which point, a future upward trend is expected.
Turnpike Mainline - Southern Coin System / S.R. 91	3.0%	116,100	58%	14%	12%	33	40		2020	↓	The overall mobility score decreased. VMT increased, % of miles severely congested was unchanged, and % of travel meeting LOS criteria and travel time reliability decreased. These factors have resulted in a mobility score of 33. The overall mobility score is anticipated to remain low, and even decrease further until previously identified 2020 needs between MP 66-69, and MP 75-81, as well as the 2020 needs between MP 71-75 and MP 0X-53, are programmed and construction is complete.
Turnpike Mainline – Ticket System / S.R. 91	3.0%	42,700	88%	5%	80%	81	85	✓	2020	↓	The overall mobility score decreased. VMT increased, % of miles severely congested and % of travel meeting LOS criteria was unchanged, and travel time reliability decreased. These factors have resulted in a mobility score of 81. The only programmed improvement, between MP 86-93, is mostly anticipated to mainly address needs on the Southern Coin System, but there are additional 2020 unfunded needs that have been identified between MP 93-107. The mobility score is anticipated to decrease further until additional improvements are programmed and construction is complete.
Turnpike Mainline - Northern Coin System / S.R. 91	8.1%	68,300	76%	15%	79%	71	80	✓	2030	↑	The overall mobility score decreased. VMT and % of miles severely congested increased, and % of travel meeting LOS criteria and travel time reliability decreased. These factors have resulted in a mobility score of 71. The mobility score is anticipated to remain low, and even decrease further until programmed construction improvements between MP 242-254 are complete, at which point, a future upward trend is expected.
Beachline West Expressway / S.R. 528	5.8%	89,000	50%	50%	0%	12	11	✓	2035	↑	The overall mobility score increased. VMT increased, and % of miles severely congested, % of travel meeting LOS criteria, and travel time reliability were unchanged. These factors have resulted in a mobility score of 12. The mobility score is anticipated to remain low, and even decrease until programmed construction improvements between MP 0-4 are complete, at which point, a future upward trend is expected.
Beachline East Expressway / S.R. 528	2.9%	39,400	100%	0%	100%	100	100		2030	Stable	This facility has a perfect mobility score and a stable outlook.
Sawgrass Expressway / S.R. 869	4.1%	79,000	48%	30%	65%	42	61	✓	2025	↑	The overall mobility score decreased. VMT and % of miles severely congested increased, and % of travel meeting LOS criteria and travel time reliability decreased. These factors have resulted in a mobility score of 42. The mobility score is anticipated to remain low, and even decrease further until programmed construction improvements between MP 0-18 are complete, at which point, a future upward trend is expected. Additional unfunded needs have been identified between MP 18-21, so traffic in the vicinity of this location should be monitored.
Veterans Expressway / S.R. 589	9.8%	49,800	57%	0%	0%	40	29	✓	2035	↑	The overall mobility score increased. VMT increased, % of travel meeting LOS criteria and % of miles severely congested decreased, and travel time reliability was unchanged. These factors have resulted in a mobility score of 40. The mobility score is anticipated to continue to increase as the ongoing programmed construction improvements are nearing completion, and as a result, a future upward trend is expected.
Seminole Expressway / S.R. 417	6.2%	52,300	76%	3%	58%	65	84	✓	2020	↓	The overall mobility score decreased. VMT and % of travel meeting LOS criteria increased, travel time reliability decreased, and % of miles severely congested was unchanged. These factors have resulted in a mobility score of 65. The immediate need south of MP 38 is being addressed in partnership with CFX, but there are additional 2020/pre-existing unfunded needs that have been identified between MP 38-49. The mobility score is anticipated to decrease further until improvements are programmed and construction is complete.
Southern Connector Extension / S.R. 417	15.8%	20,900	100%	0%	68%	83	100		2040	↓	The overall mobility score decreased. VMT increased, travel time reliability decreased, and % of travel meeting LOS criteria and % of miles severely congested were unchanged. These factors have resulted in a mobility score of 83. The mobility score is anticipated to decrease further. Observed congestion due to northbound weaving issues north of Osceola Parkway at World Center Drive / S.R. 536 should be monitored.
Polk Parkway / S.R. 570	6.2%	21,900	100%	0%	100%	100	93	✓	2040	Stable	This facility has a perfect mobility score and a stable outlook. A widening project is programmed to provide system continuity between MP 18-23.
Suncoast Parkway / S.R. 589	5.7%	21,200	100%	0%	72%	85	85		2025	↓	The overall mobility score did not change. VMT and travel time reliability increased, and % of travel meeting LOS criteria and % of miles severely congested were unchanged. These factors have resulted in a mobility score of 85. The mobility score is anticipated to decrease. Forecasts suggest increased congestion due to development along the corridor, particularly in the vicinity of S.R. 54. Traffic in the vicinity of this location should be monitored.
Western Beltway / S.R. 429	18.0%	25,700	100%	0%	92%	96	100		2035	↓	The overall mobility score decreased. VMT increased, travel time reliability decreased, and % of travel meeting LOS criteria and % of miles severely congested were unchanged. These factors have resulted in a mobility score of 96. The mobility score is anticipated to decrease further. Observed congestion due to southbound merging issues onto westbound I-4 could potentially impact the score in the future. There has also been extensive development along the corridor and the traffic growth rate continues to remain high. Traffic on this facility should be monitored.
All Facilities	***4.2%***	***58,800***	***66%***	***12%***	***50%***	***52***	***58***		2020		Continued traffic growth and ongoing/upcoming construction activities on the lowest scored systems have resulted in a decrease in the overall mobility score. While there are improvements either under construction or programmed to address some urgent needs on various facilities, some facilities are still expected to experience a future downward trend. This is partly due to delayed construction funding to address some needs, and coordination with other agencies.

Ranges of Mobility Scores:	**100**	**99-75**	**74-0**

The Transportation Management Center (TMC) is the hub or nerve center of most freeway management systems. It is the central point where data about the freeway system is collected and processed then fused with other operational and control data, further synthesized to produce "information" and finally distributed to stakeholders such as the media, other agencies, and the traveling public. TMC staff uses the information to monitor the operation of the freeway and to initiate control strategies that affect changes in the operation of the freeway network. It is also where agencies can coordinate their responses to traffic situations and incidents.[2]

There are three (3) FTE TMCs located at Pompano (south Florida), Turkey Lake (north Florida) and the Florida Highway Patrol (FHP) Lake Worth Dispatch Center. The Turkey Lake TMC was expanded to include workstations to monitor Express Lanes and the Pompano TMC is scheduled for renovation to include express lanes monitoring stations. The Pompano and Turkey Lake TMCs are managed and operated by FTE staff. TMC staff are provided to work at the FHP Dispatch Center.

Intelligent transportation system (ITS) is an advanced application of systems in which information and communication technologies are applied in the field of road transportation, including infrastructure, vehicles and users, traffic management, mobility management, as well as interfaces with other modes of transportation. ITS technology and deployment needs varies. Existing devices on the FTE system include the following:

- Closed Circuit Televisions (CCTV)
- Express lanes CCTV
- Dynamic Message Sign (DMS)
- Arterial DMS
- Express DMS
- Embedded DMS/Lane Control Signs (LCS)
- Microwave Vehicle Detection System (MVDS)
- Express lanes MVDS
- Bluetooth/ Automatic Vehicle Identification (AVI) Readers
- Highway Advisory Radio (HAR)
- Road Weather Information System (RWIS)
- Wireless Radio Devices
- Communication/Master Hub
- Fiber Optic Cable
- Generators
- Cabinets
- Unified Payment System (UPS)
- Network Switches

Crash Analysis Reporting System (CAR) data provided by the FDOT State Safety Office was used to estimate various measures of roadway safety, including crashes. The Florida Strategic Highway Safety Plan (FL-SHSP) identifies thirteen (13) emphasis areas to address safety issues. The SHSP relies on the four E's of traffic safety – engineering, education, enforcement, and emergency services, working together. Crashes may be categorized in multiple areas. For instance, a lane departure crash may also involve an impaired driver and/or aging road user. **Table 2** provides a breakdown of crashes for FTE as a whole in relation to the emphasis areas for 2012 – 2016. Similar inferences can be made by looking at each FTE roadway facility as shown in **Table 3**.

[2] TMC Pooled-Fund Study, Federal Highway Administration

Table 2: FTE SHSP Emphasis Area Crash Summary

	Emphasis Area	Fatalities			Injuries		Property Damage Only	Total		
		Crashes	*Fatalities*	*Injuries*	*Crashes*	*Injuries*	*Crashes*	*Crashes*	*Fatalities*	*Injuries*
(FL-SHSP)	Teen Driving	32	39	108	1851	3688	2782	4665	39	3796
	Aging Road Users	35	41	103	1514	2980	1987	3536	41	3083
	Impaired Driving	54	63	64	358	579	394	806	63	643
	Distracted Driving	17	19	6	1616	2652	2192	3825	19	2658
	Speeding and Aggressive Driving	26	31	19	1728	2737	2867	4621	31	2756
	Occupant Protection	79	93	173	593	1304	310	982	93	1477
	Bicyclists and Pedestrians	26	28	13	99	139	14	139	28	152
	Motorcyclists	33	34	7	412	477	57	502	34	484
	Commercial Motor Vehicles	44	52	36	840	1367	2501	3385	52	1403
	Lane Departures	159	183	221	6418	9727	12000	18577	183	9948
	Intersections*									
	Work Zones	15	16	4	575	937	957	1547	16	941
Additional	Horizontal Curves	47	52	27	1937	2758	3285	5269	52	2785
	Nighttime (no lighting)	45	52	54	1040	1766	1767	2852	52	1820
	Ramps	45	45	35	1901	2739	3609	5555	45	2774
	Wet Weather	39	46	64	3616	5488	7415	11070	46	5552
	Wrong Way Driving	12	16	19	17	31	17	46	16	50

Source: Crash Analysis Reporting System (CAR) 2012 - 2016 crash data
**Excluded from Turnpike consideration due to referencing and identification errors for locations*

Table 3: FTE Facilities Crash Summary

Facility	Fatalities			Injuries		Property Damage Only	Total		
	Crashes	*Fatalities*	*Injuries*	*Crashes*	*Injuries*	*Crashes*	*Crashes*	*Fatalities*	*Injuries*
SR 91 - Turnpike Mainline	119	134	177	6743	11117	12399	19261	134	11294
SR 407 - Beachline Expressway									
SR 408 - EW Western Expressway									
SR 417 - Southern Connector Extension									
SR 417 - Seminole Expressway									
SR 429 - Western Beltway									
SR 528 - Beachline Expressway									
SR 570 - Polk Parkway									
SR 589 - Veterans Expressway									
SR 589 - Veterans Expressway Spur									
SR 589 - Suncoast Parkway									
SR 821 - HEFT									
SR 869 - Sawgrass Expressway									

Source: Crash Analysis Reporting System (CAR) 2012 - 2016 crash data

1.5 Relationship to Other Plans and Programs

Understanding the importance of TSM&O on improving operations and safety, TSM&O is recognized in a number of FDOT programs as a method to promote their strategies.

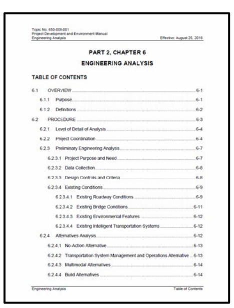
FDOT TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSM&O) STRATEGIC PLAN

The FDOT **2017 Transportation Systems Management and Operations (TSM&O) Strategic Plan** by the State Traffic Engineering and Operations Office (STEOO), TSM&O Division involved considerable collaboration from Districts and other Central Office functional area managers. The Strategic Plan presents the FDOT TSM&O vision, mission, goals, objectives, and Priority Focus Areas (PFA). It also poses Specific, Measurable, Accountable/Achievable, Relevant and Time-bound (SMART) action plans to be accomplished over the next three to five years.

FTE VISION PLAN AND TRAFFIC TRENDS REPORT

The identification of new projects to be included in the annual update of the **FTE Vision Plan** is made through internal and external means. The **Turnpike Annual Traffic Trends Report** is the initial component of the FTE's long-range planning process that evaluates current and future capacity deficiencies on the Turnpike system. The report serves as a screening tool to identify improvement projects that are needed in addition to those that are already programmed in the Tentative FTE Work Program. The report addresses TSM&O strategies, initiatives and projects.

PROJECT DEVELOPMENT AND ENVIRONMENT (PD&E) MANUAL


Topic No. 650-000-001
Project Development and Environment Manual
Engineering Analysis — Effective: August 25, 2016

PART 2, CHAPTER 6

ENGINEERING ANALYSIS

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Engineering Analysis — Table of Contents

The FDOT ***PD&E Manual*** provides project analysts and Project Managers with a framework for the consistent development of transportation projects to achieve compliance with federal and state laws, regulations, and requirements. The Part 2, Chapter 3 covers Engineering Analysis which includes a sub-section on the TSM&O Alternative that shall be discussed in the alternatives section of the Preliminary Engineering Report (PER) and Environmental Document. Documentation of the TSM&O alternative evaluation must include a description of the strategies considered. If the TSM&O Alternative does not meet the purpose and need for the project, the PER and Environmental Document must briefly explain why.

Other documents that identify concerns are the FTE Existing Roadway Condition Assessment Report (ERCAR) and Operations Tour Book.

1.6 Vision, Mission and Goals

The vision and mission of the FTE's TSM&O program are adopted from FDOT's Statewide TSM&O Strategic Plan.

VISION

To operate Turnpike transportation systems at the highest level of customer satisfaction, safety and cost-effective performance.

MISSION

To deploy a regionally integrated and optimized TSM&O program focused on superior customer-service, improving safety, reducing congestion, providing reliable travel times and increasing mobility through use of effective TSM&O strategies to maximize performance of existing and proposed infrastructure.

FDOT TSM&O 2017 Strategic Plan

VISION

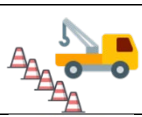
To increase the delivery rate of fatality-free and congestion-free transportation systems supporting the FDOT vision.

MISSION

To identify, prioritize, develop, implement, operate, maintain, and update TSM&O program strategies and measure their effectiveness for improved safety and mobility.

GOALS

FTE has identified five (5) key goals with subsequent objectives in addressing traffic operations and safety concerns. Objectives for the goals will be developed and maintained in the TSM&O Implementation Plan.

	Mitigate recurring congestion and improve safety.
	Improve ITS device network, efficiency, reliability and maintenance capabilities.
	Facilitate the management of non-recurring events.
	Deploying new technology to improve safety and efficiency.
	Deploy a TSM&O Program Management and Implementation Plan.

1.7 Capability Maturity Model

The Capability Maturity Model (CMM) is a guidance framework developed to help transportation agencies improve the effectiveness of their TSM&O activities. The CMM self-assessment framework is structured in terms of six (6) dimensions of capability.

Three (3) dimensions are process oriented:

1. Business Processes: including planning, programming, and budgeting (resources)
2. Systems and Technology: including use of systems engineering, systems architecture standards, interoperability, and standardization
3. Performance Measurement: including measures definition, data acquisition, and utilization.

Three (3) dimensions are institutional:

4. Culture: including technical understanding, leadership, outreach, and program legal authority;
5. Organization and Staffing: including programmatic status, organizational structure, staff development, and recruitment and retention
6. Collaboration: including relationships with public safety agencies, local governments, MPOs, and the private sector.[3]

Four (4) incremental levels of capability (**Figure 3**) are used to assess current state of play and improvement targets for each dimension.

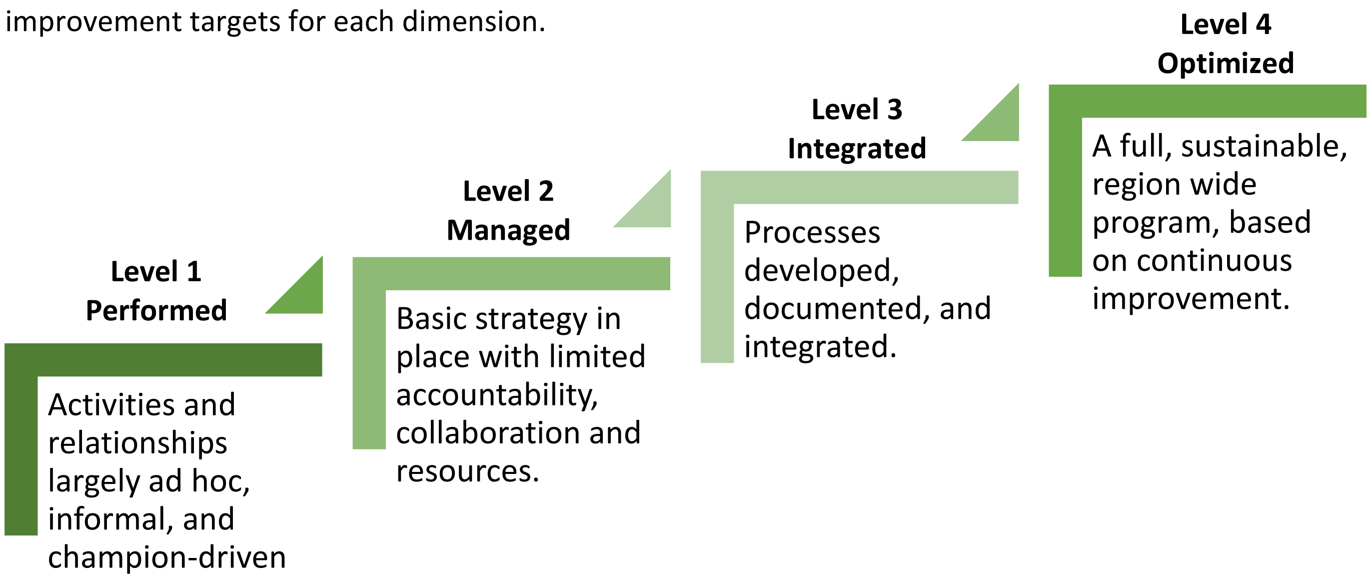


Figure 3: Capability Maturity Model Levels

Two (2) self-assessment workshops were held in April 2014; one at the Turkey Lake Headquarters on April 23 and one at the Pompano Operations Center on April 30. Five (5) dimensions were covered in total, collaboration was not evaluated. The results of the assessment were based on the consensus of the participants of the workshop and are summarized in **Table 4**. The action items identified during the

[3] Organizing for Reliability – Capability Maturity Model Assessment and Implementation Plans, FHWA 2015

assessment are included in the under-development FTE TSM&O Implementation Plan referenced in Section 7.

Table 4: 2014 Capability Maturity Model Summary

Dimension	Performed	Managed	Integrated	Optimized	Current	Next Target
Business Processes					3.0	3.5
Systems and Technology					2.0	3.0
Performance Measurement					2.75	3.0
Culture					1.50	2.0
Organization and Staffing					2.50	3.0
Collaboration		N O T E V A L U A T E D			N/A	2.0

Section 2: Actions and Initiatives

The TSM&O Strategic Plan is presented in terms of existing conditions and future initiatives, keeping in mind the steps necessary to achieve desired capabilities of each key component over 5-years. The following sub-sections provides lists of known or planned actions or initiatives.

2.1 Mitigate recurring congestion and improve safety

- Development and implementation of proactive safety program
- Implementation of Road Safety Audit Program
- Development and implementation TSM&O Evaluation Program Development and implementation of TSM&O dashboard
- Reliable and current data source

2.2 Improve network and device efficiency, reliability and maintenance capabilities.

- Improved implementation planning
- Leverage devices for multiple uses
- Additional device coverage BlueTOAD™/BlueTooth, CCTV, RWIS, etc.
- Improved Tracking of Device Uptime
- Improved Device and Communications Inventory/Asset Management
- Expansion of Wrong Way Driving (WWD) Countermeasures
- Considerations for Connected Vehicle/Autonomous Vehicles (CV/AV)

2.3 Facilitate the management of non-recurring events.

- TMC Operations staffing
- TMC Operator training
- Turkey Lake TMC expansion
- Coordination of Freeway and Arterial Operations
- Efficient Information Gathering & Dissemination

2.4 Deploying new technology to improve safety and efficiency.

- Conduct Pilot projects (Truck Platooning, CV and AV Deployment)
- CV Readiness Study
- Construct SunTrax Test Track
- Participate in CV/AV Groups such as Central Florida Automated Vehicle Testbed, Central Florida Automated Vehicle Partnership (CFAVP)

2.5 Deploy a TSM&O Program Management and Implementation Plan.

- Incorporation of TSM&O strategies into the planning and project development process
- Procure support for TSM&O (Continuing Services Contract, Management, etc.)
- Procure TSM&O delivery method (design-build/bid-build push button contract)
- Participation in TSM&O Groups

Section 3: Strategies

TSM&O strategies are an important aspect of delivering transportation services to customers. TSM&O strategies should be considered during capacity projects and large-scale improvements. The implementation of a TSM&O strategy does not change the project into a TSM&O project, but incorporates an appropriate strategy based on need. Additionally, for long term projects (>15 years), a TSM&O strategy may be identified that could be implemented in the interim, prior to completion of the long-term project.

TSM&O implementation of improvements as a standalone project are relatively low-cost, within the right of way (or limited acquisition) and done within a short to mid-term (under 5 years) timeframe. These are typically operational strategies to enhance safety and increase system reliability. The focus of operational strategies is to be aggressive in recovering capacity lost due to congestion and disruptions. The most appropriate implementation time frame defined as show in **Table 5**.

Table 5: Implementation Time Frame

Time Frame	Years	Status
Short-term (ST)	0 - 2	Implemented
Mid-term (MT)	2 – 5	Implemented or Programmed
Long-term (LT)	5 or more	Programmed

In determining a TSM&O strategy plan it is important to note that there are times to select more than one (1) strategy for deployment to address the operational and/or safety concerns. Strategies selected should take into consideration the needs of the stakeholder, local conditions, safety and operational concerns, and limitations/constraints.

TSM&O strategies are organized into focus areas, however there are instances where they overlap. Strategies may fit in more than one focus area and/or work in parallel. Strategies are identified in **Table 6** and provide the following information:

- Focus area for similarity of application is identified as:
  - Active Demand Management (ADM)
  - Active Traffic Management (ATM)
  - Congestion and Safety
  - Freight Management
  - Incident Management
  - Infrastructure Management and Operations
  - Policy Consideration

Appendix A expands upon **Table 6** and provides the following information:

- Description of the strategy for consistency of identification and application.
- Applicable goal(s) that the strategy corresponds with or satisfies.
- Identification of the Performance Measures per strategy.

Table 6: TSM&O Strategies

Focus Area	Strategy	Implementation ST	Implementation MT	Implementation LT
Active Demand Management (ADM)	Acceleration Lane Extension	✓	✓	
	Managed Lanes (ML)			✓
	Freeway Management Systems (FMS)		✓	
	Integrated Corridor Management (ICM)		✓	✓
	Third Party Data	✓		
Active Traffic Management (ATM)	Access Management		✓	
	Adaptive Traffic Signal Control (ATSC)	✓		
	Dynamic Detour System (DDS)		✓	
	Dynamic Lane Allocation/Grouping (DLA/G)			✓
	Dynamic Merge Control (DMC)			✓
	Hard Shoulder Running (HSR)		✓	
	Lane Control Signs/Signals (LCS)		✓	
	Turn Lanes (ramp-terminal intersections)		✓	✓
	Queue Warning	✓	✓	
	Ramp Metering		✓	
	Signal Phase and Timing (SPaT)	✓		
	Traveler Information Services	✓		
	Variable Speed Limits (VSL)		✓	✓
Congestion and Safety	Intersection Collision Avoidance		✓	
	Wrong Way Driving (WWD) Countermeasures	✓		
Freight Management	Freight Advanced Traveler Information System (FRATIS)		✓	
	Truck Parking Availability System (TPAS)		✓	
	Truck Parking	✓	✓	
Incident Management	Automatic Vehicle Location (AVL)	✓		
	Traffic Incident Management (TIM) Program	✓		
	Transportation Management Center (TMC)	✓		
Infrastructure Management and Operations	All Electronic Tolling (AET) Conversion		✓	✓
	Center to Center (C2C) Communication	✓		
	Data Integration Video Aggregation System (DIVAS)	✓		
	Road Weather Information System (RWIS)		✓	
	SunGuide® Software	✓		
	Vehicle to Infrastructure (V2I) Communication		✓	✓
Policy Consideration	Automated Speed Enforcement (ASE)			✓

Section 4: Implementation

Vital to the success of the FTE TSM&O Program is mainstreaming TSM&O into the FTE process. Mainstreaming is the systematic approach to consider strategies which allows for more efficient and cost-effective deployments. Key to the FTE TSM&O program mainstreaming is the composition of multi-disciplinary stakeholders within and external to FTE and FDOT that work cohesively to develop, implement, monitor and evaluate congestion management and safety strategies to reduce travel times to one's destination, improve trip reliability through consistent travel times, and reduce the risk of crashes. The essence of this concept is provided in Section 5 through the development of a TSM&O Assessment for projects and/or initiatives.

Three (3) working groups have been set up to address TSM&O: Core, Technical and Advisory. These working groups work together to achieve the goals and objectives of TSM&O. The groups are domain-specific and focus on discussion or activity around a specific subject area. Team members may be involved in multiple groups.

4.1 Core Working Group

The core working group (**Figure 4**) consists of key internal partners that meet monthly to discuss concerns and the appropriate way for implementing improvements.

The group's objectives include:

- Lead the creation & maintenance of FTE's TSM&O Program Plan Actions
- Give strategic direction to functional areas of FTE to increase TSM&O efforts
- Evaluate TSM&O strategies for use by FTE
- Set priorities and initiatives and present recommendations to top management
- Coordinates closely with the other working groups to ensure that all needed research topics are identified
- Coordinates efforts for using existing transportation management assets to improve operating efficiency, safety, security and consistency

Traffic Operations	Roadway Maintenance	Planning	Environmental Management	Design/Concept Engineering	Program Management	Toll Studies and Express Lanes Development
Assistant Traffic Operations Engineer	Deputy District Maintenance Administrator	Planning Traffic Program Manager	Project Development Engineer	District Roadway Design Engineer	Project Management Program Manager (North and South)	Tolls Studies Program Manager
Senior Traffic Engineering Manager		Traffic Engineering Group Manager		Traffic Design Engineer (North and South)	SunTrax Business Development Manager	Program Coordinator
TSM&O and Safety Engineer		Transportation Engineer		Design Program Manager (North and South)		
Safety Specialist		Transportation Planning Manager		Design Concept Project Manager (North and South)		
TMC Team Manager		Government Liaison				
Incident Management Program Manager						

Chair: TSM&O Engineer
Support: TSM&O Continuing Services Consultant

Figure 4: TSM&O Core Working Group

4.2 Technical Working Group

The technical working group consists of specialty experts and meets on an as-needed basis. Specialty areas may include (non-inclusive):

- Traffic Operations
- Traffic Management Center
- Incident Management
- CV/AV
- Tolling
- Marketing/Communications
- ITS Technology
- Project Development
- Geographic Information System (GIS)
- Express Lanes
- Traffic Modeling/Forecasting

4.3 Advisory Working Group

The advisory working group (**Figure 5**) consists of FTE department heads and/or administrators. These members are typically copied into the Core or Technical Working group meetings for informational purposes. Their council and direction is sought on issues that involve policy decisions and when making process changes/updates.

Operations	Transportation Development
District Traffic Operations Engineer	District Program Management Administrator
District Construction Engineer	District Design Engineer
District Maintenance Engineer	Planning & Environmental Management Administrator
	Turnpike Environmental Management Engineer
	Express Lanes Development Administrator

Chair: TSM&O Engineer
Support: TSM&O Continuing Services Consultant

Figure 5: TSM&O Advisory Working Group

FTE Department Directors and the Executive Director/Chief Executive Officer are presented recommendations from the working groups for approval and agency wide implementation; thereby mainstreaming TSM&O.

Section 5: TSM&O Assessment

As mentioned in section 4, mainstreaming TSM&O into FTE is vital to the success of the program. This section provides a framework on the level of expectation in assessing TSM&O strategies. To support a transparent, consistent and defendable program, it must be developed through a process. The purpose of a TSM&O Assessment is to evaluate TSM&O alternative(s) identified during the planning process, design, operations and/or other project development phases to make recommendations to the project team that improves reliability, safety, quality of life, and traveler information. The finalized TSM&O Assessment should be developed through the TSM&O Working Group and Advisory Working Group with approval from FTE Executive Management. **Figure 6** supplies a conceptual outlook of what the process may involve.

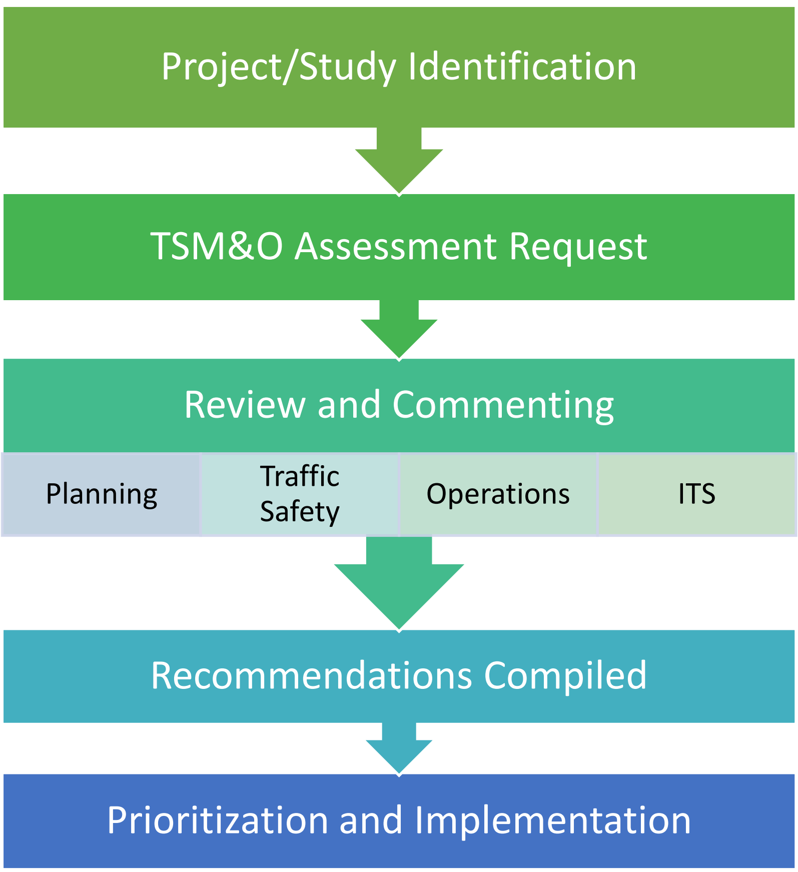


Figure 6: TSM&O Assessment

The assessment should occur pre-scoping, however it can be started at any stage of a project including concepts, PD&E and operations analysis. The TSM&O Assessment will evaluate the project area and make recommendations to the project team for improvements related to Safety, Operations, and ITS.

The initiator will conduct a Level 1 review that addresses:

- Planning
- Traffic Safety
- Traffic Operations
- ITS

If any item reveals further analysis required, the assessment will be moved to Level 2 and forwarded to the identified Department Representative for review and commenting. Each area will conduct a review based on the complexity of the project and give recommendations.

The TSM&O Assessment results in summarized recommendations for improvements given to the Project Manager (PM) who will actively seek to implement them in a current or future project.
A resolution must be showed for each recommendation. Recommendations that are not funded or implemented should be cataloged for future consideration.

Section 6: Evaluation

Performance measures are indicators of progress toward attaining a goal, objective, or target (a desired level of future performance). Performance measures are integrated into FDOT's business practices on three levels:

- Strategic: Performance measures help to establish and inform goals, objectives, and strategies as well as to monitor FDOT Mission attainment.
- Decision-making: Performance measures are used to inform and assess the financial policies for allocating funds among programs such as highway preservation, system expansion, and public transportation.
- Project delivery: After projects are selected, performance measures help to monitor the efficiency and effectiveness of projects and services in the Five-Year Work Program and in relation to FDOT's Transportation Asset Management Plan.[4]

Performance measures allow data to be formatted in a way to communicate trends and system usage in a concise manner that indicates if progress is being made in advancing goals. TSM&O offers a performance-based approach to managing a multimodal transportation system in support of the FDOT Performance Management Policy. The performance measures identified under TSM&O address one or more of FDOT's Safety, Preservation, Mobility, Economy or Environment performance measures. The objectives of the FTE TSM&O performance measures are to:

- Provide information to the public from the Florida's Turnpike Enterprise and Florida Department of Transportation
- Showcase projects and their benefits to facility users
- Highlight information about the users and the system that support continued investments and future enhancements
- Emphasize performance improvements

Performance measures are either outcome-based or activity–based. Outcome-based show us how the system is operating and describe the state of the roadway system. Activity based performance measures are measures of activities performed by transportation professionals that indirectly improve the reliability of the transportation system. These measures are described in **Appendix B**.

[4] 2016 Performance Report, Florida Department of Transportation

Section 7: Next Steps

To lead the creation and maintenance of FTE's TSM&O Program the Core Working Group will focus on the following activities:

Mitigate recurring congestion and improve safety.

- TSM&O Continuing Services Contract
- Development of TSM&O Dashboard

Improve ITS device network, efficiency, reliability and maintenance capabilities.

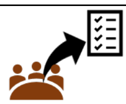
- Expansion of ITS network
- Improve data management

Facilitate the management of non-recurring events.

- Development and deployment of Smart Work Zones
- Expansion of Incident Management Program
- Expansion of Traffic Management Center

Deploying new technology to improve safety and efficiency.

- Conduct CV Readiness study for Turnpike mainline
- Conduct CV Deployment pilot project



Deploy a TSM&O Program Management and Implementation Plan.

- Set priorities and initiatives and present recommendations to management
- Development of companion documents including
  - TSM&O Implementation Plan
  - TSM&O Assessment Guide and Tool
- Integrate TSM&O Assessment into Project Development Process
- Development of training to provide strategic direction to functional areas on TSM&O

APPENDIX A

TSM&O Strategies Matrix

Focus Area: Active Demand Management

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Acceleration Lane Extension	Providing additional length to permit adjustments in speeds of both through and entering vehicles so that the driver of the entering vehicle can position himself opposite a gap in the through-traffic stream and maneuver into it before reaching the end of the acceleration lane. The intent is to have acceleration lanes meet criteria or extend to address an operational or safety need.	◈					Safety (O) Throughput (O) Travel Time (O)	◈	◈	
Managed Lanes (ML)	Managed Lanes are defined by FDOT as "highway facilities or sets of lanes within an existing highway facility where operational strategies are proactively implemented and managed in response to changing conditions with a combination of tools." These tools include access control, vehicle eligibility, variable pricing, or a combination thereof. Managed lanes can include express lanes, high occupancy vehicle (HOV) lanes, reversible lanes, truck-only toll lanes, and vehicle- restricted lanes. Express Lanes are the most common type of managed lanes that will be utilized throughout the state of Florida. Express lanes use dynamic pricing to manage demand through electronic tolling in which toll amounts are set based on traffic conditions. Express lanes can provide a high degree of operational flexibility, which enables them to be actively managed to respond to changing traffic demands.	◈	◈	◈	◈	◈	Safety (O) Throughput (O) Travel Time (O)			◈
Freeway Management Systems (FMS)	Freeway Management System (FMS) is an application of Intelligent Transportation System (ITS) Technology to improve overall network operations by detecting, reacting and clearing incidents faster and at the same time provide information to the motorists to allow optimum route choices and to reduce delays. Faster detection and reaction to accidents significantly improves road safety by getting medical assistance to an accident scene as quickly as possible. FMS allows for the collection of data on incidents and overall network performance which can be translated into useful management information to guide decisions on operations and network improvements. Network coverage includes fiber-optic communication, Closed-Circuit Television (CCTV), vehicle counting/detector stations (VDS), variable and dynamic message signs (V/DMS) to actively monitor traffic conditions, detect traffic congestion and incidents, and warn travelers of hazardous conditions. FMS collects a variety of data such as volume, speed, occupancy (vehicle density), and travel times. Data collected by the detection system(s) is used to produce performance measurement reports in conjunction with RTMC, RRSP, RISC and SIRV.	◈	◈	◈	◈		System Reliability (A) Management Efficiency (A)		◈	
Integrated Corridor Management (ICM)	Optimizing the use of existing infrastructure by managing a transportation corridor as a system rather than using the more traditional approach of managing facilities or modes individually. ICM development analyzes transportation information from a multi-model perspective, allowing where feasible technologies for traffic, transit, freight, incident management and other limited access modes to work together in easing overall congestion. ICM requires institutional, operational and technical integration. Coordination to collaboration between various agencies and jurisdictions that transcends institutional boundaries. Multi-agency and cross-network operational strategies to manage the total capacity and demand of the corridor. Sharing and distribution of information, and system operations and control functions to support the immediate analysis and response.	◈	◈	◈	◈	◈	System Reliability (A) Management Efficiency (A)		◈	◈

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Third Party Data	Third-party data is acquired from data sales houses or other large site and system operators. The benefit of acquiring this data is often its depth and breadth which would be hard to derive from a single data source. Third party data providers such as HERE, INRIX and Waze are good sources of information for monitoring corridors. This type of data is often captured by tracking mobile phones or from crowd-sourced information.			◈	◈		Incident Response (O/A) Management Efficiency (A)	◈		

Focus Area: Active Traffic Management

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Access Management	Access management is the coordinated planning, regulation, and design of access between roadways and land development. It promotes the efficient and safe movement of people and goods by reducing conflicts on the roadway system and at its interface with other modes of travel. On interstate highways and limited access facilities, key elements include interchanges, ramps, medians and median openings or crossovers. On arterial roadways, key elements include driveways, medians, median openings and intersections. It is important to ensure that the design of each road properly balances access and mobility. Examples of ways to balance access and mobility may include time of day restrictions, median crossover closures or median turn restrictions.	◈	◈	◈		◈	Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Management Efficiency (A)		◈	
Adaptive Traffic Signal Control (ATSC)	This strategy continuously monitors arterial traffic conditions and the queuing at exit ramps and dynamically adjusts the signal timing and phasing to accommodate changing traffic patterns and ease traffic congestion. Adaptive Traffic Signal Control approaches typically monitor traffic flows upstream/downstream of signalized locations or segments with traffic signals, anticipating volumes and flow rates in advance of reaching the first signal, then continuously adjusting timing parameters (e.g., phase length, offset, cycle length) during each cycle to optimize operational objectives.	◈	◈	◈	◈	◈	Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) System Reliability (A) Management Efficiency (A)	◈		
Dynamic Detour System (DDS)	The collection of real-time freeway and alternate route traffic conditions. Dissemination of real-time information to travelers allows them to make informed decisions on remaining on current route or selecting an alternate route. DDS relies heavily on an ITS network that collects real-time traffic information from the road network and/or receives information from alternate routes that is enhanced through a Decision-Support System (DSS) and ICM.		◈	◈	◈		Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) System Reliability (A) Management Efficiency (A)		◈	

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Dynamic Lane Allocation/Grouping (DLA/G)	DLA/G enables the number of lanes in one direction at a given point of the network to vary. DLGs dynamically changes lane allocation in response to real-time movement demands. It allows for exclusive and shared lanes. Applications may include: ▪ Roadway Section The dynamic management of lanes for one direction on road sections temporarily (daytime, event-based) due to capacity requirements in different directions. These sections are identified by means of transition areas at the beginning and at the end of the section. Suitable control measures must ensure that the lanes properly allocated. Examples includes Contra-flow lane. ▪ Intersection Intersections can be involved in lane signalization if the cross-section and the directional allocation of the respective lanes are kept in the intersection area. An additional lane allocation on the ramp (approach) to signal controlled intersections increases the exiting traffic and reduces congestion at unchanged green periods. For example, the right turn lane is closed for through traffic while at the same time the lane is provided as an additional access lane of the ramp. Thus, temporally increasing demands of entering/exiting traffic. Lane Control Signals (LCS) are a component of this strategy.	◈	◈	◈	◈	◈	Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Traffic Management (A) System Reliability (A) Management Efficiency (A)			◈
Dynamic Merge Control (DMC)	Dynamic merge control, or junction control, regulates or closes specific lanes upstream of an interchange. DMCs consists of dynamically managing the entry of vehicles into merge areas with a series of advisory messages (e.g., displayed on a dynamic message sign [DMS] or lane control sign) approaching the merge point that prepare motorists for an upcoming merge and encouraging or directing a consistent merging behavior. Applied conditionally during congested (or near congested) conditions, dynamic merge control can help create or maintain safe merging gaps and reduce shockwaves upstream of merge points.	◈	◈	◈	◈		Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Traffic Management (A) System Reliability (A)			◈
Hard Shoulder Running (HSR)	HSR, also known as temporary shoulder use, is the use of the breakdown shoulder lane on freeways or expressways to provide additional capacity during peak periods, during incidents and/or during emergencies. HSR may be considered as an extra lane on either the left or right-side shoulder and is typically fixed time or can be triggered when there is recurrent or a non-recurrent surge of traffic demands. HSR operation can be dynamically controlled or a fixed-time-of-day operation, and usually relies on ITS technologies such as CCTV, DMS and Lane Control Signals (LCS) for operational status and incident management. HSR applications require monitoring of the lane by the RTMC, RRSP and Florida Highway Patrol (FHP) and emergency stopping areas are recommended.	◈	◈	◈		◈	Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Traffic Management (A) System Reliability (A)		◈	
Lane Control Signs/Signals (LCS)	LCS are used in conjunction with other freeway or expressway management systems such as HSR, speed harmonization, and congestion management. A lane control signal is placed over the HSR lane or over all lanes and operated as required by the ConOps. A signal is placed over each controlled lane and any controlled shoulders. The signal can display several indications, such as downward green arrow and red X, to convey to motorists the status of the lanes. Diagonal arrows and flashing indications are often used in transitions between open and closed lanes. The Manual on Uniform Traffic Control Devices (MUTCD) provides directions for proper installation for the type of signal.	◈	◈	◈	◈		Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) System Reliability (A)		◈	

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Queue Warning	This strategy involves real-time displays of warning messages (typically on dynamic message signs and possibly coupled with flashing lights) along a roadway to alert motorists that queues or significant slowdowns are ahead, thus reducing rear-end crashes and improving safety. In an ATDM approach, as the traffic conditions are monitored continuously, the warning messages are dynamic based on the location and severity of the queues and slowdowns.	◈	◈	◈	◈		Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) System Reliability (A)	◈	◈	
Ramp Metering	Ramp meters are freeway on-ramp traffic signals to smooth or reduce traffic entry onto the mainline. The goal of ramp metering is to efficiently utilize traffic gaps on the mainline to reduce on-ramp impacts to the mainline traffic flow without significant negative impacts on feeder and parallel arterials. Ramp meters can be standalone or part of a corridor wide implementation, pre-timed or dynamically controlled, and automated or semi-automated over a range of vehicle discharge rates. Ramp meters may be used in conjunction with other TSM&O tools such as Express Lanes and ICM. Ramp meters may also be managed as a group to reduce congestion caused by downstream bottlenecks.	◈	◈	◈	◈	◈	Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Traffic Management (A) System Reliability (A) Management Efficiency (A)		◈	
Signal Phase and Timing (SPaT)	SPaT is a support application in the Connected Vehicle Reference Implementation Architecture (CVRIA) that provides the current intersection signal phases. The current state of all lanes at a single intersection are provided as well as any preemption or priority. This application is used to support a variety of V2I Applications, including Connected Traffic Signals. Under this strategy the Florida's Turnpike would coordinate with the geographic districts and local agencies to obtain any data produced.		◈		◈		Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Traffic Management (A) System Reliability (A)	◈		
Traveler Information Services	Florida's statewide website, telephone system (FL511) for disseminating real-time traveler information, social media and other communication methods. Predictive traveler information, generated from historical data and real-time modeling, can be displayed on DMS signs in advance of major decision points.			◈	◈		Traffic Management (A)	◈		
Variable Speed Limits (VSL)	VSL signs are used for speed harmonization or to reduce speed when traffic conditions or environmental conditions such as heavy fog create hazardous driving. In urban areas, VSL have been used in conjunction with overhead LCS to support speed harmonization for lanes that are open to traffic. In rural areas, side-mounted VSLs are used. For roadside VSLs, the MUTCD requires a VSL signed on each side of each direction of travel. There have been a number of studies on the effectiveness of VSLs, but most conclude that at least some reduction of speed occurs when the VSL are perceived to be based on real traffic conditions rather than just activated by time of day. Enforcement of VSLs will need to be considered and evaluated based on the availability of enforcement resources. The speed harmonization is used to reduce the occurrence of repetitive speed waves of slowing and accelerating traffic in congested areas. VSL are applicable to areas of recurring congestion to reduce crashes in the congested zone and thus improve travel time reliability.	◈		◈	◈		Safety (O) Throughput (O) Travel Time (O)		◈	◈

Focus Area: Congestion and Safety

Strategy	Description			Goal			Performance Measures	Implementation ST	MT	LT
Intersection Collision Avoidance	Several types of collisions are of concern at intersections. The goal of intersection collision avoidance is to reduce angle crashes for all types of intersections as well as crashes that involve pedestrians and bicyclists. Signalization can often reduce angle crashes but can also increase rear-end crashes which can cause injuries. Gap detection technologies such as dilemma zone detectors and advance red signal ahead warning flashers help drivers recognize an acceptable gap to enter or cross the major highway. With the advent of CVs, it is anticipated that V2V and V2I communication will allow development of applications to greatly reduce intersection collisions.		◆	◆	◆	◆	Safety (O) Incident Response (O/A) System Reliability (A)		◆	
Wrong Way Driving (WWD) Countermeasures	WWD countermeasures include detection of WWD entries onto freeways and expressways, active warnings to the WWD driver, warnings to approaching motorists, and real-time notification to law enforcement. WWD detection systems also provide alerts to the RTMC to allow activation of DMS and verification of the WWD location and direction of travel by means of CCTV.		◆	◆	◆	◆	Safety (O) Incident Response (O/A) System Reliability (A)	◆		

Focus Area: Freight Management

Strategy	Description			Goal			Performance Measures	Implementation ST	MT	LT
Freight Advanced Traveler Information System (FRATIS)	The Freight-Specific Dynamic Travel Planning application (real time and/or static) provides both pre-trip and in route travel planning, routing, and commercial vehicle related traveler information, which includes information such as truck parking locations and status.				◆	◆	System Reliability (A) Management Efficiency (A)		◆	
Truck Parking Availability System (TPAS)	TPAS is a type of advanced parking management system specifically for commercial trucking. The goal of TPAS is to help truck drivers find parking quickly and efficiently when they need it. Truckers are allowed limited hours per day behind the wheel. TPAS parking availability information is conveyed to drivers by means of roadside signs and on-board displays.				◆	◆	System Reliability (A) Management Efficiency (A)		◆	
Truck Parking	Assessment of available and needed truck parking spaces at the Service Plazas resulting in providing necessary spaces. Additionally, truck parking provided off-system such as tandem truck lots.	◆				◆	Safety (O) Management Efficiency (A)	◆	◆	

Focus Area: Incident Management

Strategy	Description			Goal			Performance Measures	Implementation ST	MT	LT
Automatic Vehicle Location (AVL)	AVL is primarily used for the tracking of emergency responders using on-board Global Positioning System (GPS) for dispatching to traffic incidents. AVL in combination with V2V and other on-board vehicle sensors such as radar are envisioned to have potential to dramatically reduce the number of multi-vehicle and run of the road crashes as these systems become more prevalent within the vehicle fleet.			◆	◆		Incident Response (O/A) System Reliability (A)	◆		

		Goal						Implementation		
Strategy	**Description**						**Performance Measures**	**ST**	**MT**	**LT**
Traffic Incident Management (TIM) Program	TIM is a multi-agency effort to improve the management of highway incidents such as crashes, disabled and abandoned vehicles, debris in the roadway, construction (work zones), adverse weather and special events that impact travelers and the transportation system. Incident Response activities include: ▪ Road Ranger Service Patrol (RRSP) ▪ Rapid Incident Scene Clearance (RISC) ▪ Specialty Towing and Roadside Repair (STARR)			◈		◈	Safety (O) Incident Response (O/A) Management Efficiency (A)	◈		
Transportation Management Center (TMC)	TMCs are equipped with operator work stations, usually a video display wall, and hardware and software to view and control roadside elements such as CCTV cameras, DMS, and vehicle detection systems. Turnpike TMC is equipped with SunGuide® central system software for both control and logging of actions taken to manage traffic and inform travelers.	◈	◈	◈	◈	◈	Safety (O) Throughput (O) Travel Time (O) Incident Response (O/A) Traffic Management (A) System Reliability (A) Management Efficiency (A)	◈		

Focus Area: Infrastructure Management and Operations

		Goal						Implementation		
Strategy	**Description**						**Performance Measures**	**ST**	**MT**	**LT**
All Electronic Tolling (AET) Conversion	The implementation or conversion to high speed all electronic tolling (AET). In Florida, all toll road agencies use the SunPass® transponder or E-Pass to collect fares at highway speed. Florida's Turnpike Enterprise and others also use license-plate reading technology to identify toll road users and collect payment through invoices to motorists.	◈	◈			◈	Throughput (O) Travel Time (O) System Reliability (A) Management Efficiency (A)		◈	◈
Center to Center (C2C) Communication	C2C connects the various TMCs and RTMCs to each other to share information and assist with event response when multiple agencies are involved. The Turnpike goal is to create and sustain C2C communication with the FHP, local TMC, emergency operations centers and public safety response (911) centers.		◈	◈		◈	Incident Response (O/A) System Reliability (A) Management Efficiency (A)	◈		
Data Integration Video Aggregation System (DIVAS)	Florida's statewide tool for collecting and sharing data with public and private partners engaged in some aspect of traffic management or traveler information.				◈	◈	System Reliability (A) Management Efficiency (A)	◈		
Road Weather Information System (RWIS)	The goal of RWIS is to use real-time weather information to improve travel safety. RWIS uses Environmental Sensing Stations (ESS) which consist of one or more environmental sensors to detect fog or smoke, wind speed and direction and rainfall intensity. When ESS are placed in a grid and combined with a forecasting service, they can be used to predict when whether events will occur and allow warnings to be posted before the problem is severe.		◈	◈	◈		Traffic Management (A) System Reliability (A) Management Efficiency (A)		◈	
SunGuide® Software	SunGuide® software is an advanced traffic management system (ATMS) software that is used at all regional traffic management centers (RTMCs) within Florida. SunGuide software offers a comprehensive set of tools to the traffic management centers (TMCs) including managing Intelligent Transportation Systems (ITS) devices, automated incident detection and assisting with event management. It also allows each TMC to customize the software and set user level security permissions.		◈	◈		◈	System Reliability (A)	◈		

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Vehicle to Infrastructure (V2I) Communication	V2I refers to communication to/from Road Side Units (RSU) to/from vehicle On-Board Units (OBU). With CV technologies, V2I is envisioned to collect vehicle parameters through basic safety messages (BSMs) and to send safety warnings to drivers. Ultimately, V2I will support vehicle control systems as automated vehicle (AV) technologies become more prevalent.		◈		◈		Safety (O) Traffic Management (A) System Reliability (A) Management Efficiency (A)		◈	◈

Focus Area: Policy Consideration

Strategy	Description	Goal					Performance Measures	Implementation		
								ST	MT	LT
Automated Speed Enforcement (ASE)	ASE requires statutory authority and utilizes cameras that can be stationed at different places along the roadway. The cameras are often installed at locations where there has been a history of speeding violations, speed harmonization, and/or crashes associated with speeding. It has been found particularly effective to support variable speed control and in work zones.	◈			◈	◈	System Reliability (A) Management Efficiency (A)			◈

APPENDIX B

Performance Measures

Monitoring and Reporting

👓	Monitoring
✍	Reporting (Static and/or Real-Time)
D	Daily
W	Weekly
M	Monthly
Q	Quarterly
Y	Yearly

Responsible Area

TS	Traffic Operations Traffic Services
TMC	Traffic Management Center
ISD	Intermodal Systems Development
ITS	Traffic Operations ITS
IT	Traffic Management Center IT
MNT	Roadway Maintenance
TSM&O	Traffic Operations TSM&O
TIM	Traffic Incident Management

PM 1: Safety - Crashes and Secondary Crashes — Outcome-based

Performance Measure	*Monitoring and Reporting*					*Responsible Area*							
	D	*W*	*M*	*Q*	*Y*	*TS*	*ITS*	*TSM&O*	*TMC*	*IT*	*ISD*	*MNT*	*TIM*
Crash Rate and Severity Rate			✍	✍	✍			✓					
Secondary Crashes Rates			✍	✍	✍			✓					
Work Zones Crashes	✍		✍	✍	✍			✓	✓			✓	✓
Crashes/Secondary Crashes	✍		✍	✍	✍			✓	✓				

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Crash Rate (Secondary Crash Rate)

- Goal: Decrease crash rate
- Source: FDOT Crash Analysis Reporting System (CAR) and/or using the following formulas:

$$\text{Crash Rate (CR)}_{\text{section}} = \frac{1{,}000{,}000 \ x \ CRASH}{AADT \ x \ Length \ x \ 365 \ x \ Years}$$

$$CR_{\text{intersection}} = \frac{1{,}000{,}000 \ x \ CRASH}{AADT \ x \ 365 \ x \ Years}$$

CRASH = Number of crashes for the section
Years = Number of years for the study
AADT = Average Annual Daily Traffic
Length = Length of Section (in miles)

Severity Rate

- Goal: Decrease severity rate
- Source: The severity rate (SR) applies a weight value to the severity of the crash using the following formula:

$$SR_{\text{section}} = \frac{1{,}000{,}000 \ x \ [5(K)+4(A)+3(B)+2(C)+1(PDO)]}{AADT \ x \ Length \ x \ 365 \ x \ Years}$$

$$SR_{\text{intersection}} = \frac{1{,}000{,}000 \ x \ [5(K)+4(A)+3(B)+2(C)+1(PDO)]}{AADT \ x \ 365 \ x \ Years}$$

K = Number of fatal crashes
A = Number of incapacitating injury crashes
B = Number of non-incapacitating injury crashes
C = Number of possible injury crashes
PDO = Number of property damage only crashes
Years = Number of years for the study
AADT = Average Annual Daily Traffic
Length = Length of Section (in miles)

Work Zone Crashes

- Goal: Reduction in the number of crashes in work zones
- Source: CAR, SunGuide®, Orion

PM 2: Throughput — Outcome-based

Performance Measure	*Monitoring and Reporting*					*Responsible Area*							
	D	*W*	*M*	*Q*	*Y*	*TS*	*ITS*	*TSM&O*	*TMC*	*IT*	*ISD*	*MNT*	*TIM*
Average System Speed (mph)	👓		✍	✍	✍				✓				
Bottlenecks	👓		✍	✍	✍			✓			✓		
Volume/Capacity Ratio	👓	👓	✍	✍	✍			✓			✓		

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Average System Speed (mph)
- Goal: Maintain or increase system speed (pre-determined) based on facility and time of day
- Source: SunGuide®, BlueTOAD™

Bottlenecks
- Goal: Reduction in the number of bottleneck locations on all facilities
- Source: SunGuide®, RITIS, Traffic Trends

Volume-to-Capacity (V/C) Ratio
- Goal: Maintain or increase system capacity by reducing congestion
- Source: ISD

PM 3: Travel Time — Outcome-based

Performance Measure	*Monitoring and Reporting*					*Responsible Area*							
	D	*W*	*M*	*Q*	*Y*	*TS*	*ITS*	*TSM&O*	*TMC*	*IT*	*ISD*	*MNT*	*TIM*
Travel Time Delays	👓		✍	✍	✍	✓			✓		✓		
Average Travel Time	👓		✍	✍	✍	✓			✓		✓		
Travel Time Reliability	👓		✍	✍	✍	✓			✓		✓		

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Travel Time Delays (for project specific needs)
- Goal: Decrease in travel time
- Source: SunGuide, Orion, Travel time runs, BlueTOAD™

Average Travel Times (peak periods)
- Goal: 5% decrease in the average travel times on all facilities on a year to year basis
- Source: SunGuide®, BlueTOAD™

Travel Time Reliability (Peak Periods)
- Goal: Decrease in the 95% reliable travel times on all facilities on a year to year basis

- Source: SunGuide®, BlueTOAD™

PM 4: Incident Response — Activity/Outcome-Based

Performance Measure	Monitoring and Reporting					Responsible Area							
	D	W	M	Q	Y	TS	ITS	TSM&O	TMC	IT	ISD	MNT	TIM
Average Incident Clearance Times	👓		✍	✍	✍				✓				✓
Average Roadway Clearance Time	👓		✍	✍	✍				✓				✓
Average Response Time	👓		✍	✍	✍				✓				✓
Responder Responses	👓		✍	✍	✍								✓
Responder Hours of Service	👓		✍	✍	✍								✓

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Average Incident Clearance Times (min)
- Goal: Reduce clearance times by facility. FDOT has an Open Roads Policy of 90 minutes.
- Source: SunGuide®

Average Roadway Clearance Times (min)
- Goal: Reduce clearance times by facility. FDOT has an Open Roads Policy of 90 minutes.
- Source: SunGuide®

Average Response Times (min)
- Goal: Reduce response times
- Source: SunGuide®, Automated Vehicle Location (AVL) System

Responder Responses
- Goal: Number of responses of incidents by responders
- Source: SunGuide®, Automated Vehicle Location (AVL) System

Responder Hours of Service
- Goal: Number of hours work
- Source: SunGuide®, Automated Vehicle Location (AVL) System

PM 5: Traffic Management — Activity-based

Performance Measure	Monitoring and Reporting					Responsible Area							
	D	W	M	Q	Y	TS	ITS	TSM&O	TMC	IT	ISD	MNT	TIM
Traveler Alert Notifications	👓		✍	✍	✍				✓				
Dynamic Message Sign (DMS) PSAs	👓		✍	✍	✍				✓				

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Traveler Alert Notifications

- Goal: Number of Traveler Alert Notifications sent via social media, text or email
- Source: Florida 511, Twitter, Public Information Office (PIO)

Dynamic Message Sign (DMS) Public Service Announcements (PSA)

- Goal: Increase usage of dynamic message signs for PSAs on all facilities per year
- Source: SunGuide®

PM 6: System Reliability — Activity-based

Performance Measure	Monitoring and Reporting					Responsible Area							
	D	W	M	Q	Y	TS	ITS	TSM&O	TMC	IT	ISD	MNT	TIM
ITS Device Deployment			👓	👓	✍		✓	✓					
Device Availability	👓	✍	✍	✍	✍		✓	✓		✓		✓	

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ITS Device Deployment

- Goal: Increase in number of new/upgraded ITS devices on all facilities per year
- Source: SunGuide®, Orion

Device Availability

- Goal: Increase in percentage of uptime on devices by type
- Source: SunGuide®, Orion

PM 7: Management Efficiency — Activity-based

Performance Measure	*Monitoring and Reporting*					*Responsible Area*							
	D	*W*	*M*	*Q*	*Y*	*TS*	*ITS*	*TSM&O*	*TMC*	*IT*	*ISD*	*MNT*	*TIM*
TSM&O Assessments	*To be determined after development*												
Projects/Studies/Implementation			👓	👓	✍		✓	✓			✓		
Trainings/Out-Reach			✍	✍	✍		✓	✓			✓		

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TSM&O Assessments

- Goal: Number of assessments completed per year
- Source: Traffic Trends Report, TSM&O Report

Projects/Studies/Implementation

- Goal: Increase the number of reviews, studies and projects completed per year
- Source: Traffic Trends Report, Traffic Ops Tour Book, TSM&O Report

Trainings/Out-Reach

- Goal: Increase the number of educational opportunities
- Source: Traffic Trends Report, Traffic Ops Tour Book, TSM&O Report