FLORIDA DEPARTMENT OF TRANSPORTATION

TSM&O

TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

2017 STRATEGIC PLAN

AUGUST 17, 2017

FDOT

EXECUTIVE SUMMARY

The Florida Department of Transportation's (*FDOT) 2017 Transportation Systems Management and Operations (TSM&O) Strategic Plan, hereafter called the "Strategic Plan,"* was developed by the State Traffic Engineering and Operations Office (STEOO), TSM&O Division, with considerable collaboration from districts and other central office functional area managers, and the industry.

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.

Each section of the *Strategic Plan* is summarized below:

A. Section I - TSM&O Vision, Mission, and Goals

Section I delineates FDOT's TSM&O program vision, mission, and goals.

VISION: To increase the delivery rate of fatality-free and congestion-free transportation systems supporting the FDOT vision and Florida Transportation Plan goals.

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

Related to the vision and mission are the program goals. Outcome-based goals cover all phases of TSM&O strategy development from planning, preliminary engineering (PE), and implementation through operations and maintenance (O&M). Performance areas are mobility, safety, and system up-time. Performance metrics for mobility include planning time index (PTI), throughput, delay reduction, and all lanes cleared times. In relation to safety, this *Strategic Plan* focuses on a reduction in secondary crash rates. System up-time availability focuses on the accessibility of field technologies, Regional Transportation Management Center (RTMC) technologies, communication infrastructure and statewide systems such as Florida's Advanced Traveler Information System (FLATIS) called FL511.

Three types of goals are included in this Section, as follows:

- Performance Goals (Goals) ⇨ Goals apply to on-going O&M of existing TSM&O systems and strategies.
- Performance Enhancement Goals (PEG) ⇨ PEG apply to the O&M of existing systems to the extent the current performance has not yet attained goals and/or to the extent a district desires to improve goals above current levels.
- Project-Performance Enhancement Goals (P-PEG) ⇨ P-PEG apply to outcomes for TSM&O strategies and projects planned and funded for implementation.

A plan for establishing Goals is presented for each performance metric. District by district Goals will be established for routes, route segments and ITS/communication networks in rural areas, urban areas, urban cores, and for statewide TSM&O programs and ITS/communication networks.

B. Section II – Strategic Plan Development and Background

Section II summarizes the development, purpose, objectives, delivery and context of the *Strategic Plan*. To fulfill the TSM&O program vision, mission and goals and ensure departmental alignment, the *Strategic Plan* has the following objectives:

- **Mainstream** – enhance TSM&O mainstreaming across applicable functional elements of FDOT.
- **Identify** – innovation, emerging technologies, strategies, tools and resources.
- **Prioritize** – statewide and regional TSM&O program focus areas.
- **Develop** – partnership frameworks, resource realization plans, organizational frameworks, processes, standards, specifications, policies, guidelines, and training.
- **Implement** – PFAs by means of pilot projects, research projects, test beds, strategic partnerships, stakeholder inclusion, and regional and statewide deployment.
- **Operate and Maintain** – quantification and allocation of resources, policies, procedures, and scope templates, funding for O&M, and leverage district support and TSM&O teams.
- **Measure Effectiveness** – define, monitor, and measure performance objectives.

These objectives are addressed in more detail throughout the *Strategic Plan*.

C. Section III – TSM&O Snapshot - Where We Are Today

Section III summarizes FDOT's recent TSM&O program's Capability Maturity Model (CMM) assessment. As expected, the CMM ranked FDOT's capabilities for freeway management, incident management, and O&M as the most mature. Arterial, freight, and transit management capabilities are emerging, and need better definition for optimization. FDOT has made a significant investment in real-time data resources, data archiving, and data analysis resources. An important real-time data analysis tool discussed in this *Strategic Plan* is the Regional Integrated Traffic Information System (RITIS). Data archived in RITIS includes FDOT traffic detector data, privately collected vehicle probe data and SunGuide® event data. Section III also describes FDOT's nascent efforts regarding connected vehicle (CV) planning and pilot projects. Finally, Section III summarizes TSM&O national best practices. FDOT is currently evaluating and implementing many of the concepts/tools highlighted by the Federal Highway Administration (FHWA), the National Operations Center of Excellence (NOCoE), Maryland's Coordinated Highways Action Response Team (CHART) program and the Washington State Department of Transportation's (WSDOT) performance assessment report, called the "Gray Notebook."

D. Section IV – Challenges and Opportunities

Section IV describes safety and mobility challenges facing the State of Florida. Both safety and mobility trends need careful monitoring, especially in light of the goals expressed in the *Florida Strategic Highway Safety Plan* and the *Florida Transportation Plan* (FTP). Monitoring the trends is also important to achieve FDOT's vision of fatality-free and congestion-free transportation systems. FDOT also has opportunities to address these trends with existing systems, such as the statewide Freeway Management Systems (FMS) network, the newly developed Statewide Arterial Management Program (STAMP), growing implementation of Advanced Signal Control Technologies (ASCT), expanding use of the FLATIS, new adaptations of the TSM&O program's SunGuide® software, emerging technologies such as CV systems, and a statewide commitment to express lane implementations in the largest urban areas.

E. Section V – Roadmap to Achieving TSM&O Program Goals

Section V describes TSM&O PFAs, which include TSM&O program mainstreaming (see Section VI), freeway management, arterial management, express lanes, CV and information systems. Section V provides high-level guidance in the form of a roadmap for implementation of each of the PFAs. Various performance assessments are defined for reporting to the TSM&O Division which will maintain a record of projects and impacts.

F. Section VI – TSM&O Program Mainstreaming

The TSM&O program mainstreaming discussion in Section VI is an important product of the *Strategic Plan*. The *Strategic Plan* summarizes how the TSM&O systems engineering process dovetails with FDOT's project development process. The *Strategic Plan* identifies specific steps for integrating TSM&O program input into FDOT's Statewide Acceleration Transformation (SWAT) process as defined in the 2016 update to the Project Development and Environment (PD&E) Manual. Section VI also describes FDOT manuals, guides, standards and specifications that will be created for or updated with TSM&O program content. Finally, Section VI provides an overview of TSM&O program outreach.

VISION

TSM&O will increase the delivery rate of fatality-free and congestion-free transportation systems supporting the FDOT vision and Florida Transportation Plan goals.

MISSION

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

G. Section VII – TSM&O Program Resources

This section discusses TSM&O program resource needs and recommendations. Resource topics covered include: district TSM&O staffing structure and positions, funding for TSM&O implementation, O&M, TSM&O program capacity, and workforce development.

A matrix of optional district TSM&O program staffing structures represents process and system models of TSM&O project management. A second matrix identifies the range of consultant positions and roles in TSM&O.

Funding for TSM&O program implementation and O&M explores funding mechanisms such as the Ten-Year TSM&O Cost Feasible Plan (formerly known as the ITS Cost Feasible Plan) and maintenance funding.

The Statewide TSM&O Excellence Program (STEP) was conceived to meet the needs of TSM&O capacity and workforce development. The section examines STEP needs and target audiences.

TSM&O program outreach began with eight Regional ITS Architectures (RITSA), strategic planning, and feasibility studies involving FDOT districts and external stakeholders, such as metropolitan planning organizations and transportation planning organizations (MPO/TPO), local agencies, transit organizations, and others. The *Strategic Plan* identifies districts as the agents to work with internal and external stakeholders to support local and regional transportation goals and objectives.

H. Section VIII – Next Steps and Action Plans

To achieve the TSM&O program vision, mission, and goals, next steps include SMART Action Plans. The TSM&O Division will assess progress accomplishing SMART Action Plans and outcomes, and report progress at quarterly TSM&O Leadership Team meetings and at District Traffic Operation Engineers (DTOE) meetings. Next steps include a plan for monitoring and updating the *Strategic Plan* and a commitment to delivering and monitoring progress on the SMART Action Plans.

I. Appendix A – TSM&O Strategy Toolbox

Appendix A provides basic definitions for over 50 facility-centric, modal-centric and mobility-centric TSM&O strategies or tools, each of which apply to one or more PFAs. While Appendix A is comprehensive, it purposefully only covers major or commonly implemented tools. Additionally, some strategies such as FMS and STAMP often encompass several other strategies. TSM&O strategies that reach implementation are developed through a collaborative planning and project development process involving multiple offices within FDOT and often regional and local stakeholders as well.

J. Appendix B – RITIS Performance Measurement Tools

This appendix provides additional guidance on availability and use of RITIS performance measurement tools.

K. Appendix C – Acronyms

This appendix defines the various acronyms used throughout the *Strategic Plan*.

L. Appendix D – Strategic Plan Development Process

This appendix provides an overview of the TSM&O Strategic Plan Development Process.

TSM&O VISION, MISSION, AND GOALS

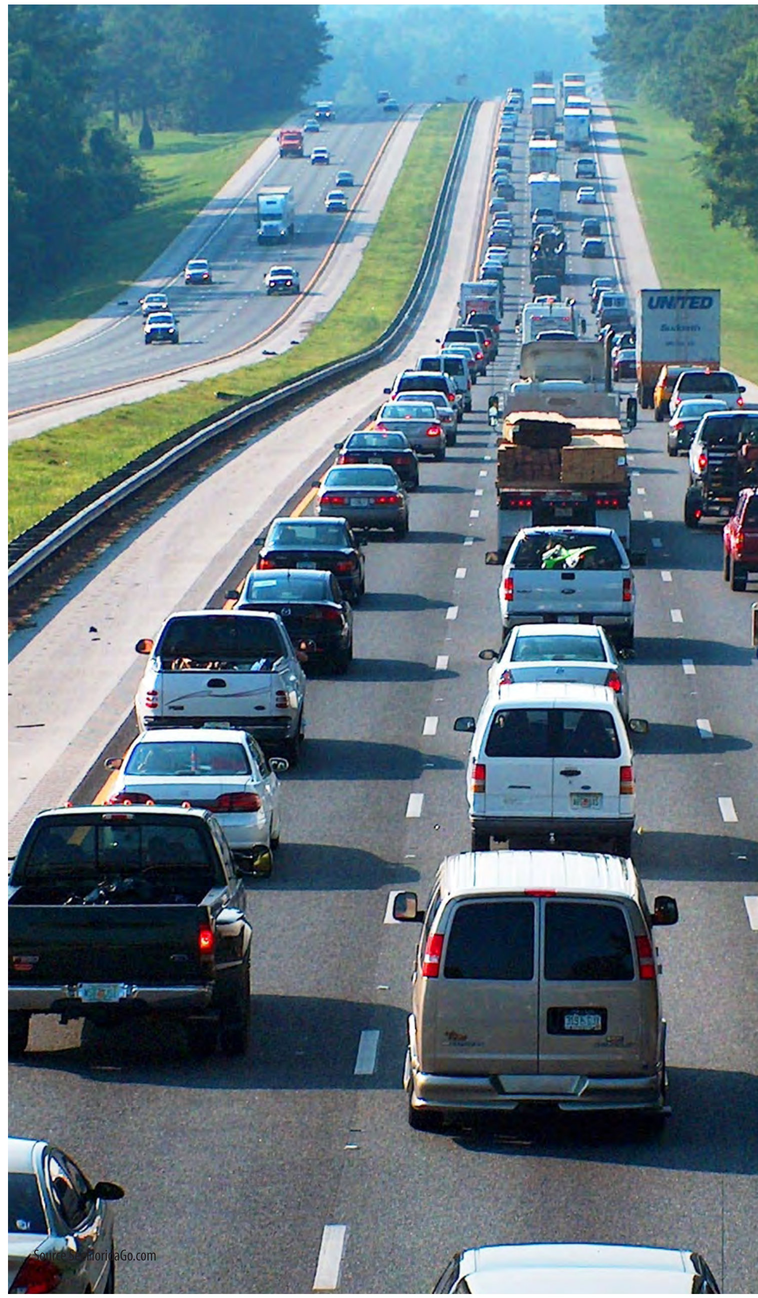
Section I provides the TSM&O vision, mission, and goals. It describes outcome-based performances for mobility, safety, and maintenance that apply to freeway and arterial management and ITS/communication network maintenance. This section defines paths for setting outcome-based Goals and application of PEG for achieving Goals and P-PEG for new and expanded TSM&O planning and implementation.

A. TSM&O Vision and Mission

The vision and mission for the Florida statewide TSM&O *Strategic Plan* are:

VISION: to increase the delivery rate of fatality-free and congestion-free transportation systems supporting the FDOT vision and Florida Transportation Plan goals.

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



B. TSM&O Program Goals

In addition to addressing user, stakeholder, and system needs described in various documents and efforts, FDOT and local partners will identify, implement, operate, and maintain TSM&O strategies that will positively and significantly impact mobility, safety, and ITS/communication network availability (up-time). These goals apply to all systems and modes impacted by the TSM&O strategy or implemented strategies.

Three types of goals are discussed in this *Strategic Plan*.

- Goals ⇨ Goals apply to on-going O&M performance of TSM&O systems and strategies once they are implemented.
- PEG ⇨ PEG apply to the O&M of implemented systems to the extent current performance has not yet attained Goals and/or to the extent a district desires to improve Goals above current levels.
- P-PEG ⇨ P-PEG apply to outcomes for TSM&O strategies and projects planned and funded for implementation.

C. Goals

Districts and the Central Office TSM&O Division will use a process to establish Goals within two years for the following outcome-based performance measures:

- Mobility ⇨ Improve travel time reliability
- Mobility ⇨ Reduce all lanes cleared time
- Mobility ⇨ Throughput increase
- Mobility ⇨ Delay reduction
- Safety ⇨ Secondary crash rates
- ITS/communication networks maintenance ⇨ district uptime availability
- ITS/communication networks maintenance ⇨ Statewide uptime availability

Travel-time reliability, throughput, and delay reduction mobility performance measures apply to all modes of travel from pedestrians to transit. Districts are encouraged to consider and set goals for other outcome-based performance measures.

Mobility ⇨ Travel Time Reliability Goals	
Application	Limited access roadway segments managed from the district RTMC. Non-controlled access arterials for which the districts are using Active Arterial Management (AAM) and/or ASCT TSM&O strategies. Other routes as determined by the districts.
Performance Metrics	Peak Period PTI (95th Percentile), throughput, and delay reduction. Districts may select other performance metrics to supplement PTI.
Path to Goal Setting	Fiscal Year (FY) 17/18 through 18/19 • Districts will select all or crucial segments of their RTMC managed roadways to monitor. • Districts will identify AAM and adaptive corridors which they intend to monitor. • Districts will decide on the real-time data sources which they will use for their analysis. • Districts will begin data collection and analysis. • Districts will collect and assess PTI, as a minimum, and optionally collect and assess throughput and/or delay reduction to support district Goals. • Districts will access results monthly and report results quarterly and annually to the TSM&O Division. • Districts will collect traffic volumes at the same time as PTI assessment. • FY 17/18 through FY 18/19 performance metric and traffic volume results will become the baseline from which districts will establish Goals for routes and route segments. • Before the end of FY 18/19, districts will set PTI and optional throughput and delay reduction Goals by route and by route segment. It is anticipated that PTI Goals may range from 1.1 in rural areas to 4.0 or even higher in urban core areas. FY 19/20 and beyond: • Districts will collect the performance metrics analysis results relative to route and route segment Goals at least monthly and report quarterly and annually to the TSM&O Division. • For segments not meeting Goals, districts will review causal factors, identify, and implement TSM&O operation improvements. These improvements are focused management, Standard Operating Procedure (SOP) changes, Road Ranger Service Patrol (RRSP) assignment changes, Rapid Incident Scene Clearance (RISC) changes or other tactics. If none of these tactics result in improvement relative to Goals, then the districts will look at additional TSM&O strategies. A multi-disciplinary, independent approach to solving mobility and safety challenges is often productive. One such example is the CHART program. See Section III, TSM&O Snapshot - Where We Are Today, for additional details.
Data Sources	• RITIS • District probe-based travel time systems • Traffic detectors

Mobility ⇨ All Lanes Cleared Goals

Application	Limited access roadway segments managed from the district RTMC. Other routes as determined by the districts.
Performance Metrics	All Lanes Cleared time.
Path to Goal Setting	FY 17/18 through FY 18/19: • Districts will select all or crucial segments of their RTMC managed roadways to monitor. • Districts will begin to assess and report average all lanes cleared times relative to selected routes and route segments. • Districts will set all lanes cleared goals for critical roadways and/or roadway segments. FY 19/20 and beyond: • Districts will collect and assess all lanes cleared times on selected routes and route segments at least monthly and report results of the analysis quarterly and annually to the TSM&O Division. • Districts will collect traffic volumes at the same time as all lanes cleared assessments. • Goals will vary by location. Goals ranging from 30 minutes to 60 minutes are anticipated. • For segments not meeting Goals, districts will review causal factors and identify and implement TSM&O operations improvements. Focused management, SOP changes, RRSP assignment changes, RISC changes or other tactics are examples of operational improvement strategies. If these tactics do not result in improvement relative to Goals, then the districts will look at additional TSM&O strategies.
Data Sources	SunGuide® event log and database.

Safety ⇨ Secondary Crash Goals

Application	Limited access roadway segments managed from the district RTMC. Other routes as determined by the districts.
Performance Metrics	Secondary crash rate.
Path to Goal Setting	FY 17/18 through FY 18/19: • Districts will select all or crucial segments of their RTMC managed roadways to monitor. • Districts will review and, as necessary, revise RTMC SOPs and make recommendations for SunGuide software updates to ensure consistent identification and recording of secondary crashes within SunGuide. • Districts begin to assess secondary crash rate relative on selected routes and route segments. • Districts will set secondary crash rate Goals for critical roadways and/or roadway segments. • It is expected Goals will vary by location. Data to estimate possible Goal ranges will become available as districts begin to analyze existing conditions. FY 19/20 and beyond: • Districts will collect secondary crash results on selected routes and route segments at least monthly and report quarterly and annually to the TSM&O Division. • Districts will collect traffic volumes at the same time as secondary crash rate assessment. • For segments not meeting Goals, districts will review causal factors and identify and implement TSM&O operations improvements such as focused management, SOP changes, RRSP assignment changes, RISC changes or other tactics. If these tactics do not result in improvement relative to Goals, then the districts will look at additional TSM&O strategies.
Data Sources	SunGuide® event log and database.

ITS/communication network Maintenance ⇨ District Uptime Availability Goals

Application	Limited access roadway segments managed from the district RTMC. Non-controlled access arterials for which the districts are using AAM, ASCT, or other TSM&O strategies. Other routes as determined by the districts.
Performance Metrics	• Field equipment uptime availability (hours of uptime divided by total hours during reporting period, expressed as a percentage). • RTMC equipment uptime availability (hours of uptime divided by total hours during reporting period, expressed as a percentage). • Communication infrastructure and network uptime availability (hours of uptime divided by total hours during reporting period, expressed as a percentage).
Path to Goal Setting	FY 17/18 through FY 18/19: • Districts will select all or crucial segments of their RTMC managed roadways to monitor. • Districts will identity AAM and adaptive corridors that they intend to monitor. • Districts will begin to assess uptime availability on designed routes, route segments, and the RTMC. • The TSM&O Task Team will review optional reporting and Goals to establish a uniform process for measuring and reporting statewide. • Districts will set update availability Goals for designated roadways and/or roadway segments. • It is expected Goals will vary by location. Data to estimate possible Goal ranges will become available as districts analyze existing conditions. FY 19/20 and beyond: • Districts will collect uptime availability results relative to Goals on selected routes and route segments at least monthly and report results quarterly and annually to the TSM&O Division. • For segments not meeting Goals, districts will review causal factors and identify and implement changes to maintenance and replacement procedures with the intent of achieving Goals.
Data Sources	District and/or maintenance contractor network and asset management systems.

ITS/Communication Network Maintenance ⇨ Statewide Uptime Availability Goals

Application	Statewide ITS Wide-Area Network (WAN). Public-facing elements of FL511 (website, Interactive Voice Response (IVR) phone system, smart phone applications). Statewide data archival and analysis tools. Data Integration and Video Aggregation System (DIVAS).
Performance Metrics	Uptime time availability (hours of uptime divided by total hours during reporting period, expressed as a percentage). Use of secondary metrics such as number of times and percent of time WAN was operating on a back-up communication path are also recommended.
Path to Goal Setting	FY 17/18 through FY 18/19: • TSM&O Division will assess current status of these systems. • TSM&O Division will set uptime availability Goals. • It is anticipated that Goals will range from 95% to 99%. FY 18/19 and beyond: • TMS&O Districts will collect uptime availability results relative to Goals on statewide and/or ITS/communication network vendor network and asset management systems at least monthly and report results quarterly and annually. • For ITS/communication networks not meeting Goals, TSM&O Division will review causal factors and identify and implement changes to maintenance procedures with the intent of achieving Goals.

D. Performance Enhancement Goals (PEG)

PEG apply to operational TSM&O strategies or programs not functioning at or meeting operational or maintenance Goals. The intent is to set PEG to reach Goals through operations and/or maintenance practices and monitoring. As appropriate, districts will establish PEG for mobility performance measures, safety performance measures and district ITS/communication network performance measures. As appropriate, the TSM&O Division will set PEG for statewide ITS/communication network performance measures. PEG results are assessed monthly and reported quarterly and annually with Goals reports. Districts are encouraged to set PEG prior to establishing Goals to become familiar with PEG assessment and reporting.

E. Project-Performance Enhancement Goals (P-PEG)

P-PEG apply to TSM&O strategy planning and implementation. The intent is to identify the optimal set of TSM&O strategies to cost-effectively achieve safety and mobility goals for the project areas and/or region. P-PEG also apply to projects for improved ITS infrastructure and communication network reliability and redundancy. The following table provides P-PEG guidance for safety and mobility performance metrics.

Table 1: P-PEG Performance Metrics and Goals

System or Strategy	Performance Metric(s)	Application	P-PEG (1)
Any TSM&O strategies where mobility is a need addressed by the strategy	Throughput, PTI, Speeds	Routes, corridors, and/or modes for which TSM&O strategies are applied	Greater than 5% improvement resulting from the TSM&O application(s)
Any TSM&O strategy where safety is a need addressed by the strategy	Crash rates, Crash Severity	Routes, corridors, and/or modes for which TSM&O strategies are applied	Minimum P-PEG thresholds will be sent in future Strategic Plan updates
Any project intended to improve performance of ITS infrastructure or communication networks supporting TSM&O strategies	Uptime availability	ITS infrastructure and communication networks supporting TSM&O strategies	Minimum P-PEG thresholds will be set in future Strategic Plan updates

Table Note (1): Districts are encouraged to set higher and/or additional P-PEG to support district and regional TSM&O strategic planning.

Section II demonstrates high-level alignment with other FDOT strategic plans, and policy plans.

A. TSM&O Strategic Plan Context

The *Strategic Plan* is considered an "update" because it builds on substantial history of ITS and TSM&O strategic planning. Previous plans include:

ITS Strategic Plans
(http://www.fdot.gov/traffic/ITS/Projects_Deploy/Strategic_Plan.shtm)

- Florida's ITS Strategic Plan – Aug 1999
- 2005 Update – May 2005
- 2014 Update – Nov 2014

TSM&O Strategic Plans
(http://www.fdot.gov/traffic/TSMO/TSMO-strategic_plan.shtm)

- TSM&O Tier II Business Plan – Mar 2011
- 2013 Florida TSM&O Strategic Plan – Dec 2013

Many of the themes in the previous plans are carried into the *Strategic Plan,* such as development of a TSM&O Leadership Team, mainstreaming TSM&O, staff resources, capacity building, measuring success, and focus areas. The *Strategic Plan* places an emphasis on outcome-based performance metrics, mainstreaming, resource needs, focus areas, funding and project selection, implementation, follow-through, innovative and emerging technologies, and measure and reporting outcomes.

The *Strategic Plan* also directly supports the goals and emphasis areas of the FTP as shown in Tables 2 and 3.

Table 2: FTP and TSM&O Goal Alignment

Florida Transportation Plan Goals	TSM&O Strategic Plan Goals
Transportation Solutions that Support Florida's Global Economic Competitiveness.	Achieve mobility Goals, PEG, and P-PEG.
Transportation Solutions that Support Quality Places to Live, Learn, Work, and Play.	Achieve mobility Goals, PEG, and P-PEG. Continue support for SunGuide® and FL511.
Transportation Solutions that Support Florida's Environment and Conserve Energy.	Achieve mobility Goals, PEG, and P-PEG.
Safety and Security for Residents, Visitors, and Businesses.	Begin to assess the impacts of TSM&O on frequency of secondary crashes.
Agile, Resilient, and Quality Infrastructure.	Achieve mobility Goals, PEG, and P-PEG. Achieve system availability (up-time) Goals and PEG.
Efficient and Reliable Mobility for People and Freight.	Achieve mobility Goals, PEG, and P-PEG.
More Transportation Choices for People and Freight.	Achieve mobility Goals, PEG, and P-PEG.

Table 3: FDOT Statewide and TSM&O Focus Area Alignment

FDOT Strategic Focus Areas	TSM&O Program Supporting Elements
Embrace Innovation	Implement CV strategies, ASCT, Automated Traffic Signal Performance Measures (ATSPM), Hard Shoulder Running (HSR), ramp meters, Integrated Corridor Management (ICM), and AAM, etc.
Maximize Efficiency	State, local and private collaboration for TSM&O project delivery, O&M, and TSM&O mainstreaming activities.
Enrich Culture	Implement, maintain and enhance the next generation FLATIS, RRSP, and Traffic Incident Management (TIM) programs. Develop training materials, programs, and guidance materials for workforce development.
Leverage Exceptionalism	FMS, Arterial Management Systems (AMS), express lanes, pilot and early implementation for CV roadside elements, and DIVAS.
Prioritize Customers	Use of real-time probe data from RITIS, probe data travel time systems, and CV to refine project development, management, and evaluation/assessment strategies.

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Source HNTB

Finally, the *Strategic Plan* was developed within the context of other FDOT functional-area strategic plans. As a result of the safety, management, and operations focus on the FTP, these themes flow into other strategic plans whether or not TSM&O is specifically mentioned. FDOT plans that reference safety, management and/or operations are listed in Table 4.

Table 4: Other FDOT Strategic Plans

Plan Name	Owning Office	Date
FDOT Mission and Vision	Executive Board	Undated
Florida Strategic Highway Safety Plan	Safety	2016
Transit 2020	Transit Planning	Undated
Traffic Incident Management Strategic Plan	Traffic Engineering and Operations	Feb 2006 (Update in progress)
Florida Aviation System Plan	Aviation	2005
Information Technology Strategic Plan	Information Technology	August 2015
Strategic Intermodal System	Policy Planning	2015
Florida Seaport System and Waterways System Plans	Seaport	Aug 2016
Freight Mobility & Trade Plan	Freight, Logistics, and Passenger Operations	Jun 2013
Motor Carrier Safety Plan	Rail and Motor Carrier Operations	2016
Transportation Asset Management Plan	Maintenance, Policy Planning	Oct 2015

The next section summarizes where Florida's TSM&O program is today along with a few national TSM&O program resources and examples.

Section III summarizes FDOT's recent TSM&O program CMM assessments. Section III describes FDOT's significant investment in real-time data resources, data archiving, and data analysis resources. Section III also describes FDOT's nascent efforts regarding CV planning and pilot projects. Finally, Section III summarizes TSM&O best practices.

A. Organizational Snapshot

A March 2016 district-wide CMM self-assessment survey provided a current snapshot of the four CMM levels: level 1 - ad hoc, level 2 - managed, level 3 - defined, and level 4 - optimized. The results, summarized in Figure 1, show the status of 10 TSM&O program areas.

Freeway management, incident management, and O&M received the highest capability scores. These programs are generally well understood and well implemented. Arterial management is evolving from ad hoc projects to managed programs. FDOT, MPOs, and local agencies are working to identify consistent, sustainable arterial operations and maintenance funding resources. FDOT provides funding support for maintenance of traffic signals on the State Highway System (SHS).

Other categories that scored lower are in the early planning or trial stages in most regions. In view of the TSM&O PFAs, FDOT is expected to need significantly higher staffing resource capabilities over the next two to five years for AMS, CV, and TSM&O policy development.

Each district TSM&O team will engage and collaborate with local and regional stakeholders to purposefully increase regional capabilities for AMS such as AAM, ATSPM, ASCT, and ICM. Local and private collaboration will lead to transit, freight and inter-modal projects and introduce CV applications for arterials such as Signal Phase and Timing (SPaT) implementation projects.

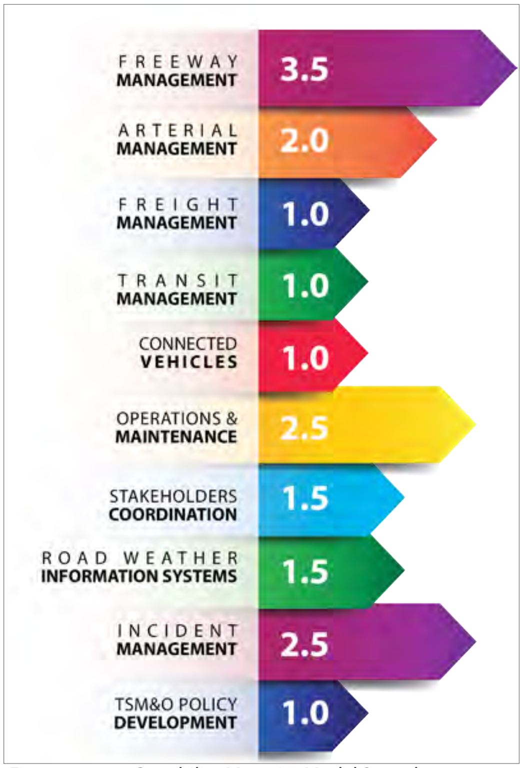
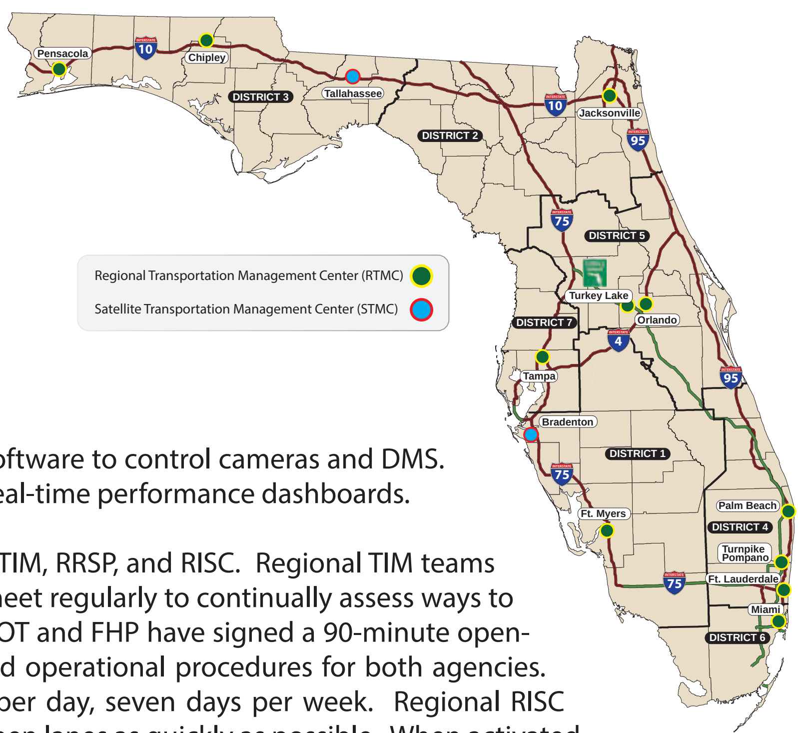


Figure 1: 2016 Capability Maturity Model Snapshot

B. Freeway Management Systems (FMS)

FDOT's FMS now covers approximately 77% of the interstate and limited access and toll roadway mileage. FDOT is on schedule for 100% coverage within the next few years. The FMS infrastructure includes fiber optic cable communication networks, CCTV cameras, DMS, traffic detection systems, electrical power systems, and other technologies.



FDOT has implemented 11 RTMC and 2 STMC throughout the state. Each RTMC provides traffic surveillance and supports incident response and management 24 hour per day and seven (7) days per week. RTMC operators use the SunGuide central software to control cameras and DMS. Video display walls provide camera views and display real-time performance dashboards.

Several TSM&O strategies support FMS. These include TIM, RRSP, and RISC. Regional TIM teams comprised of first responders and towing companies meet regularly to continually assess ways to improve responder safety and all lanes clear times. FDOT and FHP have signed a 90-minute open-roads agreement that guides resource deployment and operational procedures for both agencies. RRSP cover most FMS miles, in some cases 24 hours per day, seven days per week. Regional RISC contracts with towing companies are another tool to open lanes as quickly as possible. When activated by the RTMC or FHP, RISC contractors are paid a bonus when they arrive and clear crash scenes within specific time periods. It is expected that these programs will expand as the FMS and express lanes mileage grows.

C. Express Lanes

The goal of express lanes is to ease congestion, improve the flow of traffic and give drivers travel options. Tolls in the express lanes are dynamically priced to help maintain traffic flow and change based on the amount of traffic in the express lanes. Dynamic pricing is designed to provide more predictable drive times, particularly during peak travel. FDOT has several express lane systems either in operation, under construction, or in planning. In operation: 95 Express in Miami-Dade and Broward County and 595 Express in Broward County. Under construction: Palmetto Express in Miami-Dade County; 75 Express in Broward County; 295 Express in Duval County; 4 Express in Orange County; Beachline Express in Orange County; Turnpike Express in Orange County; Veteran's Express in Hillsborough County; and Homestead Extension of Florida's Turnpike (HEFT) Express in Miami-Dade County. Procedures for express lane planning, design, operations, and maintenance are being developed in an Express Lane Manual.


Source FDOT

D. FDOT Statewide Arterial Management Program (STAMP)

STAMP focuses attention on arterial management and operational needs. The TSM&O Division created and filled a position entitled Arterial Management Program Engineer to support STAMP. The STAMP Team was created for statewide collaboration and knowledge sharing.

Arterial roadways (non-interstate, non-toll, non-limited access) constitute the majority of the SHS centerline miles and Daily Vehicle Miles Traveled (DVMT) within the State of Florida. Due to the magnitude of the arterial network, arterial management is a PFA of this TSM&O Strategic Plan. FDOT and local agencies are investing in SHS arterial management through technologies such as ITS infrastructure and communication infrastructure improvements and upgraded traffic signal controller technologies. Additional investments are being made in TSM&O strategies such as AAM and ICM and through traffic signal retiming and traffic signal maintenance programs.

The TSM&O Division is working with the DTOEs and the STAMP Team to support implementation, management, and O&M of performance-based arterial networks. The STAMP Action Plan will focus on TSM&O strategies such as AAM, ICM, and ATSPM to provide safe and efficient arterial networks. The STAMP Action Plan will address ITS infrastructure and communication needs, TMC needs, and O&M needs to support TSM&O strategies on arterials to achieve the throughput, efficient multi-modal operation, reduced travel time, increased traffic and bicycle/pedestrian safety, and increased system uptime outcomes envisioned in this Strategic Plan.

E. Research and Pilot Projects

The FDOT Central Office has identified several specific pilot projects for implementation, evaluation and O&M support over the next three to five years.

ASCT Pilot Projects:

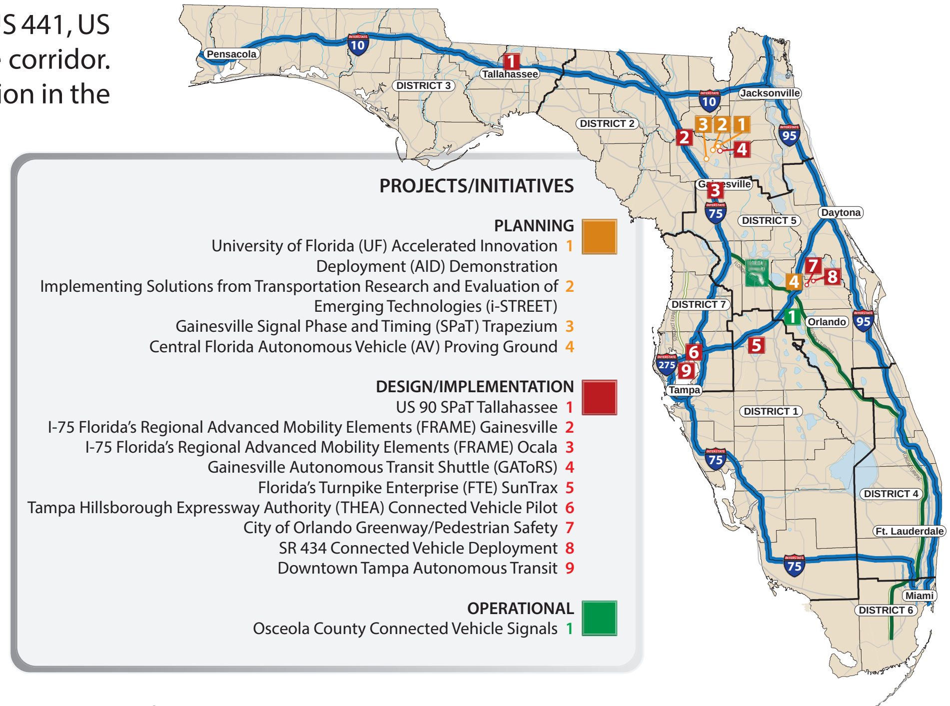
Several ASCT pilot projects are cooperatively implemented, operated and maintained by FDOT and local agencies. The University of Florida (UF) is evaluating the pilot ASCT projects. Lessons learned from these pilots will lead to guidance for additional ASCT implementation.

CV Pilot Projects:

FDOT is leading and supporting several CV pilot projects:

- US 90 (Mahan Drive) SPaT operational test: The Mahan pilot will demonstrate SPaT through testing at the FDOT Transportation Engineering Research Laboratory (TERL) in Tallahassee and through a live operational test on US 90 from downtown Tallahassee to I-10 east of Tallahassee. The SPaT pilot will utilize Dedicated Short Range Communication (DSRC) to provide vehicle to infrastructure (V2I) communication. This project is a collaboration between the Central Office, District 3, and the City of Tallahassee.

- I-75 Florida's Regional Advanced Mobility Elements (FRAME) Project: The I-75 FRAME project will provide TSM&O infrastructure on I-75, US 441, and US 301 from US 441 in Alachua County to the Florida Turnpike interchange in Sumter County. The pilot will include V2I Roadside Equipment (RSE) along I-75 and along US 441, US 301 and several east-west routes in the corridor. It will also include ATSPM implementation in the City of Gainesville and in the City of Ocala. This project is a collaboration between the Central Office, TSM&O Division, District 2, District 5, the City of Gainesville, the City of Ocala, and Sumter County. Other stakeholders include the local transit agencies. UF will provide the performance assessment.



- Tampa Hillsborough Expressway Authority (THEA) CV Pilot Deployment Project: THEA is deploying V2I equipment on the Selmon Expressway and on City of Tampa streets that have potential to improve safety on curves, wrong way entry detection, traffic signalization, transit priority, pedestrian crossing safety and probe vehicle data use. Vehicle to vehicle (V2V) safety applications will also be tested. The learning experience with partners in Florida will help FDOT to lead nationally and in the deployment of CV applications statewide. The University of South Florida (USF) and United States Department of Transportation's (USDOT) independent evaluator are providing performance assessments.

- The SunTrax Test and Toll Facility: The SunTrax project includes the construction of a 2.25 mile oval tolls testing track on a 400-acre site in Polk County near Florida Polytechnic University. The track is designed to support high speed testing of toll technologies with multiple lanes and parallel tolled express lanes similar to other systems being implemented across Florida. This testing facility will include four toll zones that support hardware and software testing and development as well as facilitating national and local certification for tolling technologies. It is anticipated that the interior of the track, in partnership with Florida Polytechnic University, will create a high-tech hub for the research, development, and testing of emerging transportation technologies related to tolling, ITS, and connected and automated vehicles (CAV). SunTrax is part of the Central Florida Automated Vehicle Proving Grounds, a designation awarded in January 2017, that includes numerous FDOT and Florida Turnpike Enterprise (FTE) facilities along with the Kennedy Space Center, the City of Orlando, and the LYNX transit system.

FDOT will provide technical guidance and coordination to ensure lessons learned are shared between champions and stakeholders as other Florida regions explore CV applications.

F. Real-Time Data for Management and Operations

FDOT is increasingly a data-rich organization and is rapidly learning how to manage and use data to develop programs, assess performance, and measure outcomes. Safety and congestion data archives have several years of data that are available for analysis.

Congestion Data

Congestion, speed, and travel time reliability are performance measures featured in the FTP. FDOT has a contract with the University of Maryland to use RITIS to archive real-time traffic data collected from vehicle detection systems and real-time traffic data from the HERE open location platform. RITIS analysis tools are available to identify problem locations and for before-and-after studies. These data are used for calculating PTI which is also used in the ITS Performance Measures Annual Report. Some districts and local agencies have installed vehicle probe data collection technologies along interstate and arterial corridors to collect travel time and speed data. These systems also provide data analysis tools. FDOT has installed detection systems along the interstate and toll highways and in some cases toll tag readers to collect volume, speed, and travel-time data. Some districts and local agencies have or are planning to install ATSPM. These tools allow TSM&O strategy effectiveness measurement using real-time data sources to supplement traditional data collection sources such as floating car speed and delay studies.

Source FDOT

The TSM&O Division and the FDOT Forecasting and Trends Office are using real-time data sources and tools to analyze performance and assess outcomes.

Incident and Safety Data

SunGuide® software collects and archives traffic incident data on roads managed by each District. SunGuide® data are useful for:

- Problem identification and before-and-after studies.
- Calculation of all lanes clear times for the ITS Performance Measures Annual Report.
- RRSP activities in the ITS Performance Measures Annual Report.
- Daily data archiving for analysis by route, by route segment, by time of day, and by date intervals.

For the past few years, SunGuide® has allowed identification of events as "secondary" through association with previous or causal events. For example, a lane-blocking crash event can result in secondary crashes. Due to the data collection and analysis capability within SunGuide®, reduction of secondary crash rates was chosen as a safety performance measure in this Strategic Plan. Also, the Crash Analysis Reporting System (CARS) and SIGNAL-4 provide crash data for safety analysis.

Each district will use real-time data and analysis tools to perform TSM&O before-and-after analysis for at least one project completed within the past two years. The secondary crash and congestion impacts occurring will be compared to the impact ranges for the strategies shown in Appendix A. The TSM&O Task Team will coordinate strategy assessments. The goal is to create a history of impacts for TSM&O strategies commonly used in Florida

G. National Policies, Priorities and Best Practices

This section outlines national TSM&O policies and priorities identified by organizations such as the FHWA and the American Association of State Highway and Transportation Officials (AASHTO). FDOT is currently evaluating and implementing many of these concepts and tools.

FHWA

The FHWA encourages integration of TSM&O within transportation planning. The FHWA's "Planning for Operations" web page includes information for integrating operations into planning and programming and an objectives driven, performance-based approach to TSM&O project development and delivery. FHWA's "Planning for Operations" web page can be found at: http://www.ops.fhwa.dot.gov/plan4ops/focus_areas/planning_prog.htm.

FHWA Everyday Counts (EDC-4) Innovations (2017-2018)

EDC-4 Innovations include several TSM&O strategies including ATSPM, road weather management, safe transportation for pedestrians, and using data to improve incident management. FHWA recommends ATSPM to improve traffic signal operations and maintenance. FDOT supports EDC-4 and is working to implement ATSPM and other EDC-4 Innovations.

FHWA Crash Avoidance Metrics Partners LLC (CAMP)

Originally called the V2I Coalition, CAMP represents a broad range of light vehicle, heavy truck, and global viewpoints. CAMP activities are expected to enhance deployment of driver assistance systems to potentially improve safety, mobility, sustainability, and vehicle control through improvements in performance made possible by V2I connectivity.
Sample CAMP projects, include:

- Cooperative Adaptive Cruise Control (CACC) Project
- V2I Safety Applications (V2I-SA) Project
- Road Weather Management Program (RWMP) Connected Vehicle-Infrastructure Research (CVIR) Project
- Applications for the Environment: Real-Time Information Synthesis (AERIS) Eco-Approach and Eco-Departure Project
- CACC Small-Scale Test (CACC-SST) Project

FDOT supports the goals of CAMP and is closely tracking testing of V21 applications.

FHWA Turner-Fairbank Highway Research Center (TFHRC)

TFHRC is a federally owned and operated national research facility in McLean, Virginia. The center houses more than 16 laboratories, support facilities, and data sets. TFHRC conducts applied and exploratory advanced research covering a wide range of topics including transportation operations and intelligent transportation systems. Recent research topics include: Active Traffic Management Study, Advanced Freeway Merge Assistance – Harnessing the Potential of Connective Vehicles, and Advanced Traffic Signal Control Algorithms. TFHRC also conducts research on CV, dynamic mobility applications and SPaT. See the TFRCF webpage for more information: https://www.fhwa.dot.gov/research/tfhrc/about/

National Operations Center of Excellence (NOCoE)

The NOCoE is a partnership of AASHTO, the Institute of Transportation Engineers (ITE), and the Intelligent Transportation Society of America (ITSA) with support from FHWA. The NOCoE suite of resources to serve the TSM&O community including peer exchange workshops and webinars, ongoing assessments of best practices in the field, and on-call assistance that can be accessed at: http://transportationops.org/overview-nocoe-and-its-programs .

AASHTO Subcommittee on Transportation Systems Management and Operations (STSMO)

STSMO serves as the AASHTO focal point for promoting and supporting integrated implementation of transportation systems management and operations (TSM&O) by engaging state DOTs, other AASHTO committees, and other partner organizations. STSMO has five technical working groups (TWGs): Systems Operations Strategies, Performance Measures, TSM&O Research, Traffic Incident Management and Connected Vehicles. FDOT is an active participant in STSMO TWGs. See the following web page for additional details: http://systemoperations.transportation.org/

Maryland Department of Transportation (MDOT)

An example of a best practice cited on the NOCoE website provides information about the MDOT – State Highway Administration TSM&O program. Their program includes outcome-based metrics and use of the CHART program to conduct independent evaluations and responses. In 2013, the reduction in delay due to CHART activities was 32.65 million vehicle-hours, and the average incident duration was 21.64 minutes. Additional details can be found at:
http://transportationops.org/blog/headline-news/maryland-state-highway-administration-interview-performance-measurement-dimension.

Washington Department of Transportation "Gray Notebook"

The Washington Department of Transportation (WSDOT) publishes a quarterly progress report on transportation systems and programs called the "Gray Notebook." It provides dashboards, graphs and articles about a variety of TSM&O topics such as safety, incident response, congestion, throughput productivity and reliability indexes.
http://wsdot.wa.gov/publications/fulltext/graynotebook/Sep16.pdf

The next section summarizes safety, mobility and mainstreaming challenges impacting the TSM&O program.

Section IV summarizes safety and congestion challenges facing travelers on Florida's transportation systems. Most of the challenges reference other FDOT plans, studies, and reports. Every challenge, no matter how daunting, offers an opportunity for improvement.

A. Safety Challenges

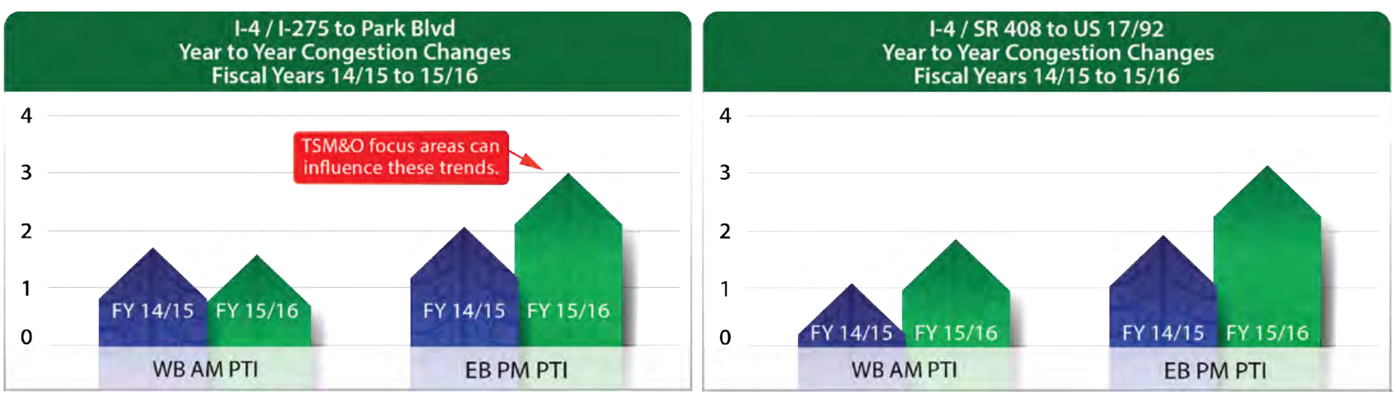
The FDOT 2016 Core Measures Highlights for Safety[(1)] shows serious injury and fatality crash frequencies and rates in Florida trending upward after a few years of solid reductions. This challenge requires systematic use of TSM&O strategies with proven safety benefits to influence these trends in a positive direction. Examples of TSM&O measures widely used in Florida that reduce crashes are TIM practices to clear roadway lane blockages as safely and efficiently as possible, FMS with Dynamic Message Signs (DMS) to alert motorists of lane blockages and congestion, and optimally timed and coordinated traffic signal systems. Emerging technologies and programs such as RM, adaptive signal control, AAM, and CAV systems promise additional crash reductions. This *Strategic Plan* identifies freeway management, arterial management, and CV as PFAs.

[(1)] http://www.fdot.gov/agencyresources/performance.shtm

B. Congestion Challenges

The TSM&O Division's annual ITS performance measures report shows similar trends with peak period PTI suggesting increased congestion between FY 2014/2015 and FY 2015/2016 for three of the four samples in the charts below. PTI is a travel time reliability performance measure defined by the ratio of an actual 95th percentile travel time to the free flow travel time. PTI conceptually represents the congested travel time travelers must spend compared to an uncongested travel time to arrive at their destination on time 95% of the time (a value of 3.00 indicates a traveler should allow 60 minutes to make an important trip that takes 20 minutes in uncongested traffic). See Florida's Mobility Performance Measures" (http://www.floridampms.com/) for additional details on FDOT's performance measurement program along with definitions of PTI and other mobility performance measures.

Figure 3: PTI Trend Challenges on Controlled-Access Routes with RTMC Coverage



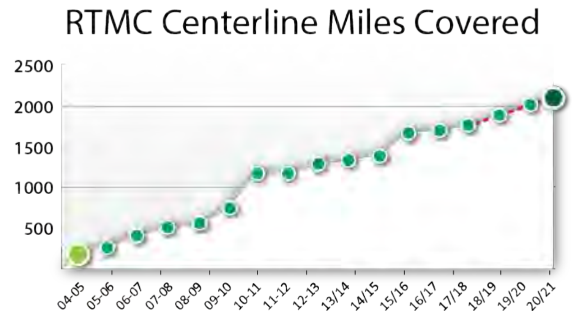
These challenges point to systematic use of TSM&O strategies with proven mobility benefits such as travel time reliability and throughput to minimize impacts of growing traffic volumes and to influence these trends in a positive direction. Examples of TSM&O measures widely used in Florida that influence mobility trends are TIM practices to clear roadway lane blockages as safely and efficiently as possible, FMS with DMS and FL511 to warn motorists of lane blockages and congestion, and optimally timed and coordinated traffic signal systems. Emerging technologies and programs such as express lanes, ramp meters, HSR, ASCT, AAM, and CAV systems promise additional mobility improvements. The *Strategic Plan* identifies freeway management, arterial management, express lane, information systems, and CV as PFAs.

C. Mainstreaming Challenges

FDOT is organized around functional program areas covering the transportation spectrum ranging from planning through O&M. This structure has resulted in technical and program excellence within each functional area. In relation to TSM&O mainstreaming challenges, FDOT has improved cross-functional area collaboration. Mainstreaming implies systematic incorporation of TSM&O strategies throughout project development, implementation, and O&M. As a result, the *Strategic Plan* identifies mainstreaming as a TSM&O PFA. Activities to address TSM&O mainstreaming challenges are discussed in detail in Section VIII.

D. RTMC Operations: Challenges

RTMCs are impacted due to the increased functionality created as new TSM&O strategies are implemented. The increased functionality results when more miles are added to FMS and AMS networks and when new strategies are implemented such as HSR, RM, managed lanes, and CV systems. Increased functionality generates the need for more RTMC resources including operators and network managers along with supporting services such as training and SOP updates. These additional strategies will also impact roadside resources needed for routine and major maintenance activities.



This *Strategic Plan* provides guidance to FDOT for moving towards outcome-based management and operations. Real-time assessment and reporting of outcome-based performance measures is described in Section I. FDOT District Four has made progress towards real-time performance assessment and monitoring within their RTMC environment. The district devotes a significant portion of their RTMC video wall to display real-time performance status.

Some of the information depicted includes:

- Number of level 1, 2, and 3 incidents in each section of the district (real time).
- Number of events by type per calendar year (updated every AM).
- Number of ITS devices out of service (real time).
- Number of field generators on line (real time).
- Average incident clearance time by section of district, year to date (updated every AM).
- I-595 Express status, flow direction, displayed toll, ramp status (real time).
- Clock.
- Local digital TV over the air weather only sub-channel.
- Generator status, color coded (real time).
- State Express Lanes Software (D6 status, real time).
- Fiber network status (real time using network management software).

Having access to this real-time information allows RTMC managers to focus operator and maintainer attention on critical O&M needs.

System automation, decision support systems, and CVs may change resource needs in the future. While these emerging transportation technologies may reduce the number of RTMC operators, it is likely they will increase education, experience, and training requirements for the operators who remain. Future updates to the Strategic Plan will monitor and address these trends as their clarity increases.

E. Opportunities

In keeping with FDOT's focus on innovation, efficiency and safety, this TSM&O Strategic Plan presents opportunities for the future. Emerging technologies and external factors such as CV and autonomous vehicles (AV), transportation as a service, "big data," ubiquitous high speed satellite internet, next generation high-speed cellular service, and real-time performance data for system management and operations will fundamentally change the way FDOT meets safety and congestion challenges in the future. Nationwide, automotive and information service companies are ramping up massive investments in new technologies that could revolutionize how transportation is viewed and delivered over the next decade or two. These changes create opportunities to explore private partnerships with automobile manufacturers, information providers, ride-share providers, data providers, application developers and others to support their expertise. Currently, the full extent of the impacts of these emerging technologies are unknown. Regardless, FDOT and its partner agencies have a track record of taking advantage of opportunities. Some examples are described below.

- FDOT and Waze have a mutually beneficial agreement where FDOT provides detector, incident, and work zone information to Waze and in turn, Waze provides crowd sourced event alerts to FDOT. Some FDOT RTMCs use the Waze alerts as a traffic incident detection tool. First notification for some traffic incidents comes from the Waze alerts through SunGuide® and can be accessed from the Waze website.
- FL511 was accessed more than 5.7 million times in FY 15/16 via the mobile app, website, and phone calls. The My Florida 511 system sent more than 25 million personalized alerts via text message, email, and phone calls. FL511 shares camera images and detector data with multiple public and private organizations.
- DIVAS: FDOT is planning to develop DIVAS as an enhancement to data shared through FL511. The mission of DIVAS is to allow two-way sharing of data, including data that may be generated in the future through CV. The vision is that additional data will enhance Florida transportation system safety and efficiency for the benefit of all Florida travelers.
- RITIS: FDOT is using the RITIS database and performance measurement.
- CV: There are a number of CV projects planned or underway by FDOT and its partners.

The next section provides a roadmap for achieving the TSM&O Program Goals in Section I, building on where the FDOT TSM&O Program is today.

Source FDOT

Section V is the roadmap to achieving TSM&O goals. This section identifies six PFA and provides guidance when considering new TSM&O strategies for scope and impacts and for performance metrics to support achieving the TSM&O goals in Section V.

A. Priority TSM&O Focus Areas

Through collaboration with the district offices, other FDOT offices such as planning, design, work programming, and through focused "big idea" sessions, the following TSM&O strategies are prioritized as statewide focus areas:

Table 5: TSM&O Focus Areas

Strategy	Scope	Benefits (1)		Costs (1)	
		Safety	Mobility	Implementation	Operations & Maintenance
TSM&O Mainstreaming	Statewide and Regional: Includes incorporation of TSM&O elements into all transportation projects from planning through design and work zone traffic management.	M - H	H	L - H	L - H
Arterial Management	Regional: Includes strategies such as regular retiming and coordination, ASCT, ICM, AAM and SPM. Depending on regional priorities, this could include TSM&O strategies identified in other FDOT strategic plans such as pedestrians, freight, transit, and freight. See Section II for more information.	M	H	H	H
Connected Vehicles	Statewide and Regional: Includes DSRC for V2I communication, SPaT, Basic Safety Messages (BSM), transit, pedestrian, freight and emergency vehicle priority. Realization of CV benefits are expected to begin within the next five to ten years.	H	H	M	M
Express Lanes	Regional and Interregional: Includes dynamic pricing, and reversible lanes. Includes enhanced operations, enforcement, and incident management. Depending on local priorities, express lane planning and implementation could involve other routes as well as other modes.	M	H	H	M
Freeway Management	Statewide: Includes proven and emerging strategies such as RM, HSR, and ICM and legacy strategies such as SunGuide®, FL511, RTMC operations, TIM, RISC, Severe Incident Response Vehicles (SIRV), and RRSP. Effective freeway management benefits all modes using the freeway network.	H	H	H	M
Information Systems	Statewide: Includes SunGuide® Software, FL511, DIVAS, data archival systems, and performance assessment tools.	H (2)	H (2)	L	L

Table Notes: (1) Benefits and costs will relate to how well TSM&O is integrated within other programs. H = High M = Moderate L = Low
(2) Information system will enable data collection, data sharing, data archival and data analysis to support the entire TSM&O program as well as other FDOT programs to measure and report system performance.

Most PFAs are generally viewed as high impact with low-to-moderate implementation costs. (Appendix A presents more information on TSM&O impacts.) The focus areas are guidelines for FDOT districts and local agencies. Districts, MPO/TPOs and local agencies may collaborate to implement different combinations of TSM&O strategies from the Appendix A.

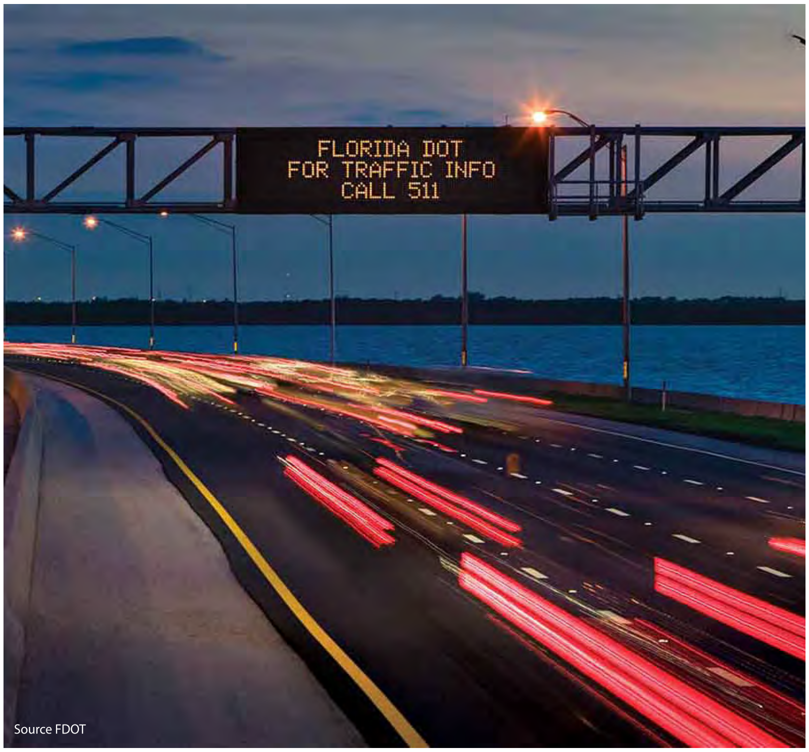
B. TSM&O Implementation

Roadmaps for realizing PFA include demonstration projects, research projects, test beds, strategic partnerships, pilot projects, and regional or statewide deployments. The following roadmaps are highlighted:

- Implement FMS ⇨ continue statewide deployment and optimize operations and infrastructure and technology maintenance to support congestion reduction and incident response goals.
- Implement AMS including ATSPM, AAM, ASCT, retiming, and other AMS strategies identified in the STAMP Action Plan ⇨ consider in metropolitan areas and elsewhere where impact goals can be achieved to optimize operations and infrastructure and technology maintenance and to support congestion reduction and incident response goals.
- Implement Express Lanes ⇨ consider in metropolitan areas of over 1,000,000 in population and elsewhere where impact goals can be achieved to optimize operations and infrastructure and technology maintenance and to support congestion reduction and incident response goals.
- Implement CV ⇨ pilot projects, develop a CV RSE deployment plan, and engage vehicle and supplier industries to promote equipping vehicles with on-board equipment in Florida.
- Develop and implement DIVAS ⇨ statewide implementation plan.
- SunGuide® software ⇨ statewide management and enhancement under guidance of the statewide ITS Change Management Board.
- Implement and support Statewide Express Lane Software (SELS) ⇨ statewide management and enhancements under guidance of SELS change management team.
- Continue FLATIS ⇨ through June 2021 and reevaluate for future support or enhancements (note: CV and other private initiatives may replace parts of FLATIS functionality).

C. Performance Metrics, Measurement, Monitoring, and Reporting

TSM&O Goals, PEG, and P-PEG have associated performance metrics such as PTI, lane clearance times, and system availability (up-time). Districts may have other performance metrics and Goals they wish to monitor. The intent is for districts to monitor Goals and PEG associated with O&M continually and report to the TSM&O Division quarterly and annually as follows:



Source FDOT

- FY 17/18 ⇨ report accomplishments toward creating ability to report and report metrics as available. At a minimum, report PTI from RITIS or other district data source and lane clearance times from SunGuide® for segments of the Interstate under RTMC management.
- FY 18/19 ⇨ Add ITS/communication network uptime availability to quarterly and annual reports.
- FY 19/20 ⇨ Add arterial performance metric monitoring results to the quarterly and annual reports for arterial network for which the district supports implementation, operation or maintenance of advanced arterial systems.

TSM&O strategies and projects selected for implementation should focus on outcomes to support achieving Goals, PEG, and P-PEG described in Section I. Many TSM&O strategies have other potential performance metrics and benefits. As appropriate, districts may establish Goals, PEG, and P-PEG for these metrics. Districts are encouraged to monitor and report results toward accomplishment of any additional Goals, PEG, and P-PEG annually.

Table 6: TSM&O Performance Metrics, Benefits and Applications

Typical TSM&O Performance Metrics	Anticipated Outcomes/Benefits	Application
Crash rates and severity (1)	Reduce rates and severity.	Crashes characterized as initial and secondary incidents
Travel delay (congestion) (1)	Reduce delay, improve travel time reliability.	All modes
Efficiency (throughput) (1)	Increase or optimize throughput.	All modes
Modal access (2)	Improve access to and/or reduce delays/impacts of barriers between modes.	All modes
Traveler information (2)	Improve access to, accuracy of, and/or timeliness of information and travel choice options.	All modes
Environmental impacts (2)	Reduce social, economic and environmental impacts of transportation systems.	All modes

Table Notes: (1) See Section I for Goals, PEG and P-P-PEG.
(2) No statewide Goals, PEG or P-PEG are set for these performance metrics in this *Strategic Plan*.

The TSM&O Division will develop an impact assessment template for before-and-after reports. Section VIII includes a plan for development of the impact assessment template.

The next section focuses on TSM&O mainstreaming activities to support achieving TSM&O program goals.

Source FDOT

Section VI addresses four important TSM&O mainstreaming topics. The first is the integration of TSM&O strategies within the project development process from planning through O&M. The second topic is to develop TSM&O manuals and guides. The third is to incorporate appropriate TSM&O content within the relevant FDOT policies, procedures, manuals, and guides. Finally, this section discusses TSM&O program outreach.

A. Integration of TSM&O within the Project Development

This section discusses TSM&O program outreach. Each phase of the project development process (planning, project development and environment (PD&E), design, construction, and maintenance) provides an opportunity to include TSM&O strategies that can improve safety, operations and maintainability of a transportation facility. In the past, many TSM&O projects were developed separately after roadway capacity or reconstruction projects were completed. For projects that had a PD&E phase, TSM&O alternatives were considered, but eliminated as viable alternatives because of failure to meet the purpose and need for the project. Once the TSM&O alternative was no longer considered, efforts to constrain scope creep required districts to consider TSM&O strategies after the project was completed or during construction.

Currently, organizational units within FDOT recognize the need and benefits of fully integrating TSM&O strategies throughout the project development process for both new construction and reconstruction projects. As such, the FDOT PD&E Manual (Part 2, Chapter 3) now encourages consideration of TSM&O strategies within the build alternatives (hybrid alternatives) prepared and evaluated during the PD&E study. Hybrid alternatives ensure build alternatives (with TSM&O strategies) are evaluated using a systems engineering approach and both existing and future operational strategies are incorporated early into the preliminary design of the project.

Considerations of TSM&O strategies in the PD&E study require the TSM&O Program Engineers to coordinate closely with PD&E engineers and planning staff to identify a broad range of possible operational objectives and strategies that may be incorporated in scoping or preliminary engineering design, as appropriate. Such coordination may be facilitated through the Statewide Acceleration Transportation (SWAT) process. The SWAT process is a project management approach that streamlines FDOT's project delivery process through early coordination and communication among the various district offices and programs. The SWAT process is followed for both state and federally funded projects. TSM&O Program Engineers' participation in the district SWAT planning and strategy meetings is strongly encouraged to integrate TSM&O into projects from their inception by planning for future operational deployments. Likewise, the district SWAT Team can help ensure the operational objectives and related performance measures are feasible given fiscal, design, and environmental constraints related to the project. See Part 1, Chapter 4 of the PD&E Manual for more information regarding the SWAT process.

Figure 5: FDOT Project Development Process and Systems Engineering "Vee" Diagram Process

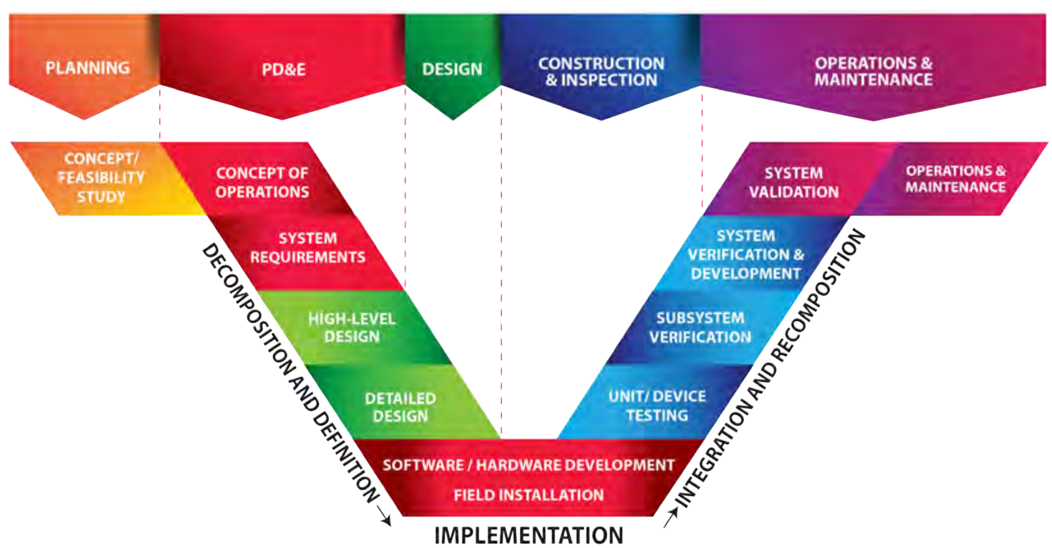


Figure 3 shows how the typical project development process relates to the generic activities of the systems engineering "Vee" diagram. The association points on the Figure are approximate. Both diagrams begin with planning and end with operations and maintenance. For the systems engineering process, planning begins with the RITSA, strategic plans and feasibility studies. FDOT Procedure 750-040-003 contains additional information on the relationship between the project development process and systems engineering "Vee" diagram. A new release of this procedure is forthcoming, titled:

Systems Engineering and ITS Architecture.

- http://fdotwp1.dot.state.fl.us/ProceduresInformationManagementSystemInternet/?viewBy=0&procType=pr#

B. TSM&O Manuals and Guides

The TSM&O Division is developing guidance documents for a number of TSM&O strategies, including HSR and RM. Guides on ICM and RTMC operation procedures are also being developed. The guides will include both information on best practices and to the extent practicable, warrants or guidelines on when, where and how to use the applicable TSM&O strategy. The TSM&O Division is also starting the process of converting the Express Lane Handbook to a Manual.

C. Updating Guides, Standards and Specifications

The TSM&O Division met with several divisions within the central office during development of this plan. A key outcome of these meetings was the identification of functional area guides, standards, and specifications that need to be updated with TSM&O content. The TSM&O Division will work with the various central offices to identify and prioritize specific opportunities to update guides and manuals with stronger TSM&O content. TSM&O will then collaborate with those offices to provide meaningful and appropriate TSM&O content.

The following table contains a complete listing of policies and manuals that will be assessed for opportunities to include or reference TSM&O content:

Table 7: TSM&O Mainstreaming Index

Offices	Plan / Handbook / Program / Manual / Policy	
Design	FDOT Design Manual (Planned 2018); Currently Plans Preparation Manual; Standard Plans	Complete Streets Policy; Complete Streets Handbook
Emergency Management	Comprehensive Emergency Management Plan; Emergency Response Guidebook	
Program Management	Utility Accommodation Manual; Standard Specifications	
Safety	2016 Florida Strategic Highway Safety Plan	
Freight, Logistics, Passenger Operations	Rail Handbook; Highway Rail-Grade Crossing Safety Plan	
Environmental Management	Project Development and Environment (PD&E) Manual	
Policy Implementation	Florida Transportation Plan; Strategic Intermodal System Policy Plan	Metropolitan Planning Organization Handbook
Systems Planning	Asset Management Plan; Interchange Access Request Users Guide	Traffic Analysis Handbook; Quality Level of Service Handbook
Traffic Engineering and Operations	Express Lanes Handbook; Traffic Engineering Manual	Systems Engineering Management Plan (SEMP)
Transportation Statistics	Roadway Characteristics and Inventory Handbook; Project Traffic Forecasting Handbook	
Work Program	Work Program Instructions	

continued on the next page

D Program Outreach

Significant strides toward mainstreaming TSM&O were made during development of this *Strategic Plan*. The result has significantly improved horizontal and vertical communication between various FDOT functional areas, including increased participation from various functional areas on both the TSM&O Task and Leadership Teams. A number of actions have already been taken to maintain progress and build on the communication developed during plan development. These actions included creating broader membership for the TSM&O Task Team to include systems planning, PD&E, design, construction, maintenance, work programming, and other central offices.

TSM&O outreach to external stakeholders, such as MPO/TPOs, local agencies, transit organizations, port authorities, airport authorities and emergency responders, can be achieved with the support of the districts. It is largely for this reason that this *Strategic Plan* does not prescribe specific TSM&O strategies beyond the PFAs. Districts will continue to work with district planning, PD&E, design, construction, maintenance, and local and regional stakeholders to better define and develop TSM&O strategies that support local and regional transportation goals and objectives. See Section VIII for SMART Action Plan for external stakeholder outreach.

During 2016, the TSM&O Division continued publishing the SunGuide® Disseminator bi-monthly. Beginning with the May 2017 issue, it will be rebranded as the TSM&O Disseminator. The Disseminator includes articles and features from a wider range of contributors to support the broader mission.

(The SMART Action Plan for policy and guidance updates are contained in Section VIII.)

The next section focuses on TSM&O resources to support achieving TSM&O program goals and mainstreaming activities.

Section VII addresses TSM&O staffing, funding for implementation and O&M, and workforce capacity development.

A. District-Level TSM&O Structure and Staffing

TSM&O projects are largely delivered, operated, and maintained at the district level. District TSM&O staffing for project management includes both FDOT employees and consultants. TSM&O in-house staff varies from dstrict to district due to differences in district organizational charts and staff turnover. In the past, traffic engineering, traffic operations, and ITS were separate units within some district offices. Past TSM&O *Strategic Plan*s recommended combining traffic operations and ITS into one district unit under a TSM&O Program Engineer.

Examples of TSM&O program core staffing (FDOT employees) with distinct differences in approach are Districts 5 and 6. District 5 staffing may be characterized as a process model with design, operations, maintenance, network, and software activities. District 6 staffing may be characterized as more of a systems model around freeway, arterial, and information systems activities. Both structures are organized under a TSM&O Program Engineer and limit FDOT employees to a few key positions with consultants providing the remaining services. Staffing related to these project management models is depicted in the table below.

Table 8: District TSM&O Staffing Options – Process and System Models

Process Model FDOT Positions	System Model FDOT Positions
TSM&O Program Engineer	TSM&O Program Engineer
TSM&O Operations Manager	TSM&O Engineer – Freeways
TSM&O Signal Timing Engineer TSM&O Signal Timing Specialist TMC Manager TSM&O Contract Manager	FMS/AMS Specialists (2)
TSM&O Production Manager	TSM&O Engineer – Arterials
TSM&O Senior Project Manager TSM&O Systems Engineering Specialist TSM&O Contract Manager	FMS/AMS Specialists (2)
TSM&O Information Systems Manager	TSM&O Information Systems Manager

The number of TSM&O support positions varies from district to district and is based on coverage area (centerline miles) and complexity of the FMS, use of express lanes, and extent of ASCT networks. Given fast employee turnover, special technical competence needs, and the aggressive schedules to deliver TSM&O projects, it is important that FDOT consider resource needs carefully. In order to ensure effective FDOT staffing, the TSM&O Division and districts should work together with Florida's universities to develop applicable degree programs for entry level professionals and with FDOT's internal Human Resources (HR) Consistent, Predictable, and Repeatable (CPR) Task Team to address position descriptions and pay structure for long term staff retention. See Section VIII for steps envisioned to ensure TSM&O capabilities are consistent across FDOT.

Core private-sector support staff for continuing service contracts, district-wide contracts, and vendor contracts include the positions and capabilities shown in the following table. These private-sector resources provide technical expertise on topics ranging from ITS Architecture to O&M.

Table 9: District TSM&O Consultant/Vendor Support Options

Consultant/Vendor Positions or Capability	Role(s)
TSM&O Design Manager	Manage and coordinate systems engineering, design and post design support
TSM&O Systems Engineer	Deliver systems engineering management plans, concepts of operations, requirement traceability verification matrices, testing, integration, acceptance
FMS/AMS Design Engineer	Design production
RTMC Operation Manager	Project manager for RTMC operations contract
RTMC Shift Supervisors	Supervise RTMC operators to ensure compliance with SOP
RTMC Operators – Freeways	Operator assigned by time of day and by freeway segment or subsystem per SOP
RTMC Operators – Arterials	Operator assigned by time of day and by arterial segment or subsystem per SOP
RTMC Operators – Express Lanes	Operator assigned by time of day and by express lanes segment or subsystem per SOP
TSM&O Maintenance Manager	Project manager for TSM&O maintenance contract
FMS Maintenance Superintendent	Supervises FMS maintenance per SOP
AMS Maintenance Superintendent	Supervises AMS maintenance per SOP
Express Lanes Maintenance Superintendent (non-toll)	Supervises AMS express lane maintenance per SOP
FMS Maintenance Technicians	Performs preventative and responsive maintenance for FMS
AMS Maintenance Technicians	Performs preventative and responsive maintenance for AMS
Express Lanes Maintenance Technicians (non-toll)	Performs preventative and responsive maintenance for Express Lanes
RTMC Network Manager	Network, desktop, servers
Network Technicians	Servers, switches
Desktop Support Technician	Trouble-shooting, repair, updates
Software Manager	SunGuide® and district-specific software updates, trouble-shooting, maintenance
Database Manager	SunGuide® database, reports

B. TSM&O Program Funding

Ten-Year TSM&O Cost Feasible Plan

The Ten-Year ITS Cost Feasible Plan will be renamed the Ten-Year TSM&O Cost Feasible Plan. The TSM&O Division manages the Ten-Year TSM&O Cost Feasible Plan which identifies Financial Identification Numbers (FIN), project limits, project descriptions, funding categories, phase numbers, phase descriptions and annual budgets. The Ten-Year TSM&O Cost Feasible Plan identifies funding sources for TSM&O implementation and RTMC Operations. It also provides funding for the equipment cost for TSM&O technology life-cycle replacement. The TSM&O Division is adding provisions for adjusting future year operations and replacement budgets based on growth of systems and indexing for inflation.

The TSM&O Cost Feasible Plan will include an amount for 100% state ITS funds called "DITS" to supplement other federal and state fund categories and codes. DITS funds are managed by the TSM&O Division and are available for all types of TSM&O strategies on any SHS, NHS or SIS route. Phases in the Cost-Feasible Plan include PE, construction, construction engineering and inspection (CEI), operations and replacement.

Implementation Funding
The key to state funding eligibility for TSM&O implementation is that projects be entirely or substantially "on-system." On-system means on an SHS route. There are, however, a few SIS segments that are not SHS routes. By definition, the term "arterial" in work programming refers to off-system or local roads that are not eligible for state funds. Local road TSM&O projects may be eligible, however, for federal and local funds. The TSM&O Division is adding provisions for adjusting future year operations and replacement budgets based on growth of systems and indexing for inflation.

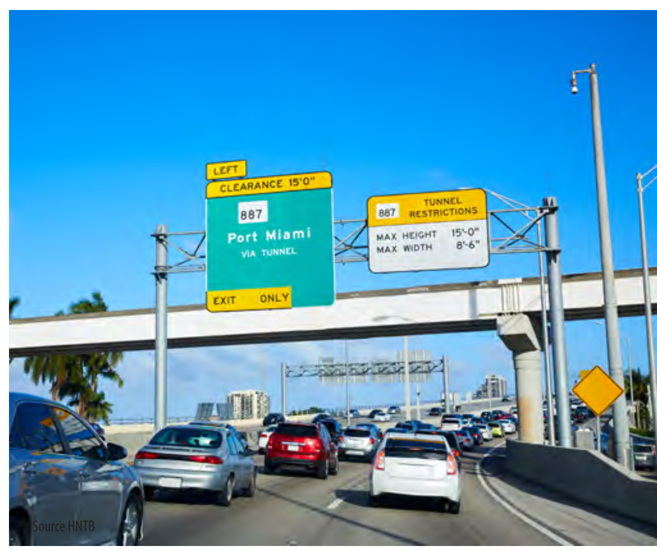
District TSM&O staff are encouraged to work closely with district work programming to take advantage of the flexibility built into the work programming instructions. The TSM&O Division is working with the Office of Work Program and Budget to provide work program guidance materials, to update the work program instructions, update work mix codes, and to update the ITS, traffic engineering and TSM&O major work group codes applicable to safety, traffic engineering, capacity, ITS, and intermodal project categories.

See the following links for additional details:
- http://www.fdot.gov/workprogram/Development/PDFInstructions/WorkProgramInstructions.pdf
- http://www.fdot.gov/workprogram/Development/PDFInstructions/AppendixD-WPACodeDefinitions.pdf

The TSM&O Division prepared a work program instructional presentation which was shared with the districts and is available from the Office of Work Program and Budget. Planning is in progress to convert this training presentation into a computer-based training (CBT) module.

Operations Funding
FDOT recognizes the need to adequately fund operations of TSM&O projects. The Ten-Year TSM&O Cost Feasible Plan identifies DITS and district funding sources for ITS operations. Additionally, FDOT intends to migrate from largely output-based (number of actions) to outcome-based operations performance measures. Activities to support operations budgeting include:

- The Ten-Year TSM&O Cost Feasible Plan is updated annually, including update of operations cost factors and funding for TSM&O implementation for FMS. Given the expenditure and cost allocation to the districts, the DITS funds may be indexed per the inflation factor determined by the work program.
- Intention to update Ten-Year Cost Feasible Plan for district-supported TSM&O/RTMC operations on SHS arterials for AMS.
- Updating the basis for RTMC operations staffing and funding for more uniformity of extent and complexity of congestion and safety issues.
- Development of a performance-based RTMC operations scope.



Source HNTB

Operations applies to a range of projects including ITS/RTMC operations, RRSP, RISC, computer-based traffic control systems, ITS software integration and maintenance, traffic signals/systems, and SIRV programs. Statewide and district funds set aside for operations are included in the Ten-Year Cost Feasible Plan.

Maintenance Funding
FDOT recognizes the need to adequately fund maintenance of TSM&O strategies implemented on SIS and other SHS routes whether controlled access, toll, or arterials. Maintenance includes asset management, recurring routine preventative maintenance, minor responsive maintenance and emergency response and replacement. Maintenance also includes the labor and equipment for life-cycle replacement of aging TSM&O technologies. The ITS maintenance Workload Formulas are the primary tools to develop budgets and fund maintenance contracts. Maintenance funds included in the Maintenance Workload Formulas are budgeted "off the top" from FDOT's maintenance set-aside funds. The funds are budgeted from requests from districts through the TSM&O Division coordination with the Office of Maintenance and FDOT's Executive Leadership Team.

Another maintenance funding approach in use in some districts is incorporated in AAM contracts using district and/or local implementation and operation budgets. Some maintenance elements included in AAM contracts range from identification of potential maintenance problems to trouble-shooting, diagnosis and minor repairs. AAM contracts are largely budgeted with funds that are allocated to the districts and/or to local agencies through the MPO/TPOs.

The TSM&O Division is supporting several maintenance funding activities, including:

- Management and updating recently adopted ITS Maintenance Workload Formulas based on consistent maintenance procedures to consistently predict annual maintenance costs for field equipment, communication networks, and RTMC for freeway and AMS maintained by FDOT. Formulas are also updated to include indexing of unit rates for inflation.
- Recently updated the ITS maintenance scope of services template.
- Conducting a study on feasibility of performance-based ITS maintenance and potential development of a performance-based ITS maintenance scope of services template to migrate from a largely output-based (number of actions) to outcome-based maintenance performance measures.

Funding for TSM&O Program Technology Replacement

As noted above, TSM&O technology life-cycle replacement is funded in two parts. The cost for replacement technologies or devices is included within the Ten-Year TSM&O Cost Feasible Plan. The cost for labor, equipment and traffic control is included in the TSM&O Maintenance Workload Formulas.

C. TSM&O Capacity and Workforce Development

The advancement of TSM&O in Florida has created the need for new tools to support workforce development, capacity building, and program excellence. The STEP was conceived to meet these needs.

STEP Mission

The STEP mission is fourfold:

1. Identify and prioritize TSM&O training and guidance needs and target audiences;
2. Resource, schedule, and deliver TSM&O training and guidance materials to meet priorities;
3. Work with partners for sustainable TSM&O training delivery and management; and
4. Continually update training and guidance as state of the practice evolves and as new, innovative TSM&O programs emerge.

STEP Needs and Target Audiences

The following training and guidance needs have been identified, along with their target audiences. Level of details and length of each training module should be adaptable depending on the target audience. For example, training on ITS Design for Planning and Work Programming attendees would only discuss the scope and outcomes of design. For designers, the module would provide appropriate design-level details.

It is anticipated the list of needs categories will grow over time.

Table 10: STEP Needs and Target Audiences

Needs Categories and Descriptions	Target Audience(s)
ITS design, cost estimating, CEI for: • Fiber optic and Ethernet networks and equipment • Optimized equipment placement, testing and inspection • Electrical power supply • Lightning protection • Surge protection and grounding • Generators and Uninterruptible Power Supply (UPS).	District TSM&O, Planning, Work Program, PD&E, Design, Construction, and Local Agency Program (LAP) staff and local agency staff, and consultants.
Guidance for TSM&O strategies such as HSR, RM / signaling, and ICM.	District TSM&O, Planning, Work Program, PD&E, Design, Construction, and LAP staff and local agency staff, and consultants.
Traffic Signals, ASCT including adaptive and other traffic control strategies.	District TSM&O, Planning, Work Program, PD&E, Design, Construction, and LAP staff and local agency staff, and consultants.
ITS/TSM&O work programming guidance.	District TSM&O, Planning, Work Program, PD&E, Design, Construction, and LAP staff and local agency staff, and consultants.
RITIS Data Analysis and Performance Measure Tools.	District Planning, PD&E, TSM&O, LAP, Design and Construction staff and local agency staff, and consultants.

STEP Resource Development

Section VIII provides the SMART Action Plan for all high priority STEP resources currently underway or planned. The list of STEP materials and schedules will be updated at least quarterly.

Sustainable Training Delivery and Management

FDOT intends to work with academia and industry to deliver the STEP training courses. FDOT is currently working to identify potential partners. The STEP training material shall be the copyright of FDOT and will be solely owned with a provision for distribution and usage rights. The partnering agency will also administer the full cycle of training courses including logistics, delivery, record maintenance, evaluation and follow-up with the trainees. Section VIII provides the SMART Action Plan for sustainable training delivery and management.

Training and Guidance Updates

As technologies, specifications, standards, and the state of TSM&O practice evolve, the TSM&O Division of the STEOO will update the training modules and guidelines. See Sections VI and VII for additional discussion and action plans for development and updates of guides, manuals, standards, and specifications.

The final section focuses on next steps and SMART Action Plans to manage updates to and delivery of the Strategic Plan.

NEXT STEPS AND ACTION PLANS

Section VIII serves as a guide to achieving the TSM&O vision, mission, and goals. The plan implementation is supported by SMART Action Plans. Following the SMART Action Plans will move FDOT closer to a fully mainstreamed, outcome-based TSM&O program. The TSM&O Division, with the assistance of the TSM&O Task Team and others identified in the action plans are responsible for delivering each action plan.

A. Plan and Process for Updating the Strategic Plan

The TSM&O Division with support from the TSM&O Task Team will assess progress accomplishing SMART Action Plans and outcomes. The TSM&O Division will report progress at the quarterly TSM&O Leadership Team meetings, the TSM&O Task Team meetings, and at DTOE meetings. As guidelines and training programs are delivered and as new and emerging technologies, such as CVs are better understood, the TSM&O Division will assess the plan annually with updates expected on two or three year cycles. With the renewed horizontal communication occurring during preparation of this plan, it is anticipated that other FDOT functional areas will also provide input toward future plan and progress updates.

The intention of this plan is to elevate the use of data and performance measures to identify issues and measure results. TSM&O Plan updates and focus areas will be influenced by results of the implemented TSM&O strategies to optimize impacts toward reducing deaths, serious injuries, congestion, and delay.

The SMART Action Plan to keep this *Strategic Plan* up to date, as new information and results of project performance assessments are available, is shown in this section.

B. SMART Action Plans

Action items assigned to the TSM&O Division will provide general coordination and tracking of each Action Plan. The TSM&O General Consultant will provide program and technical support. Status and accomplishments for each Action Plan will be discussed at TSM&O Task and Leadership Team meetings until they are accomplished or replaced with new Action Plans. The intent of the Task Team reviews is to ensure not only that the Action Plans are accomplished but that they provide and continue to provide value toward delivery of and realization of benefits anticipated from the PFAs.

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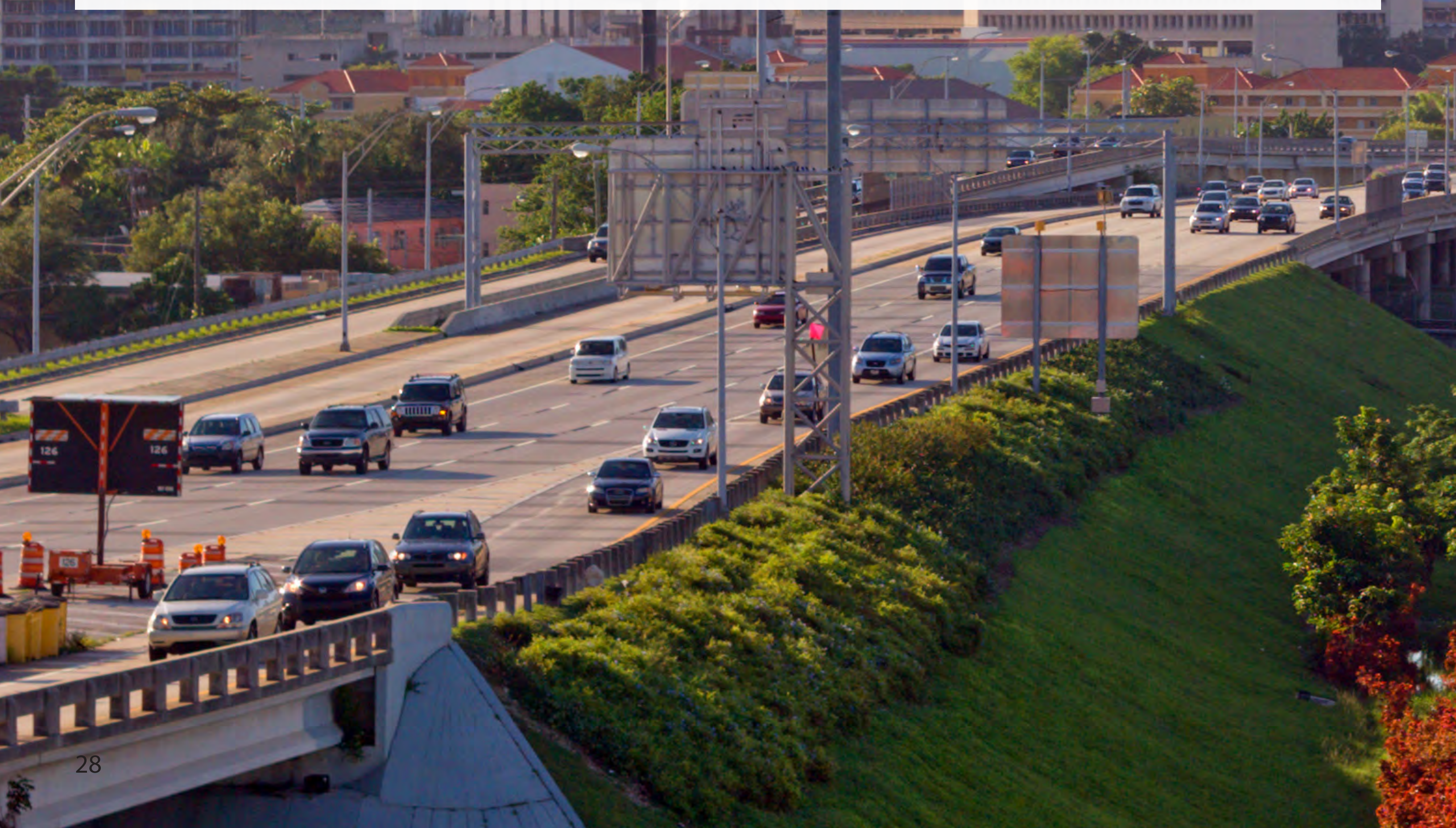
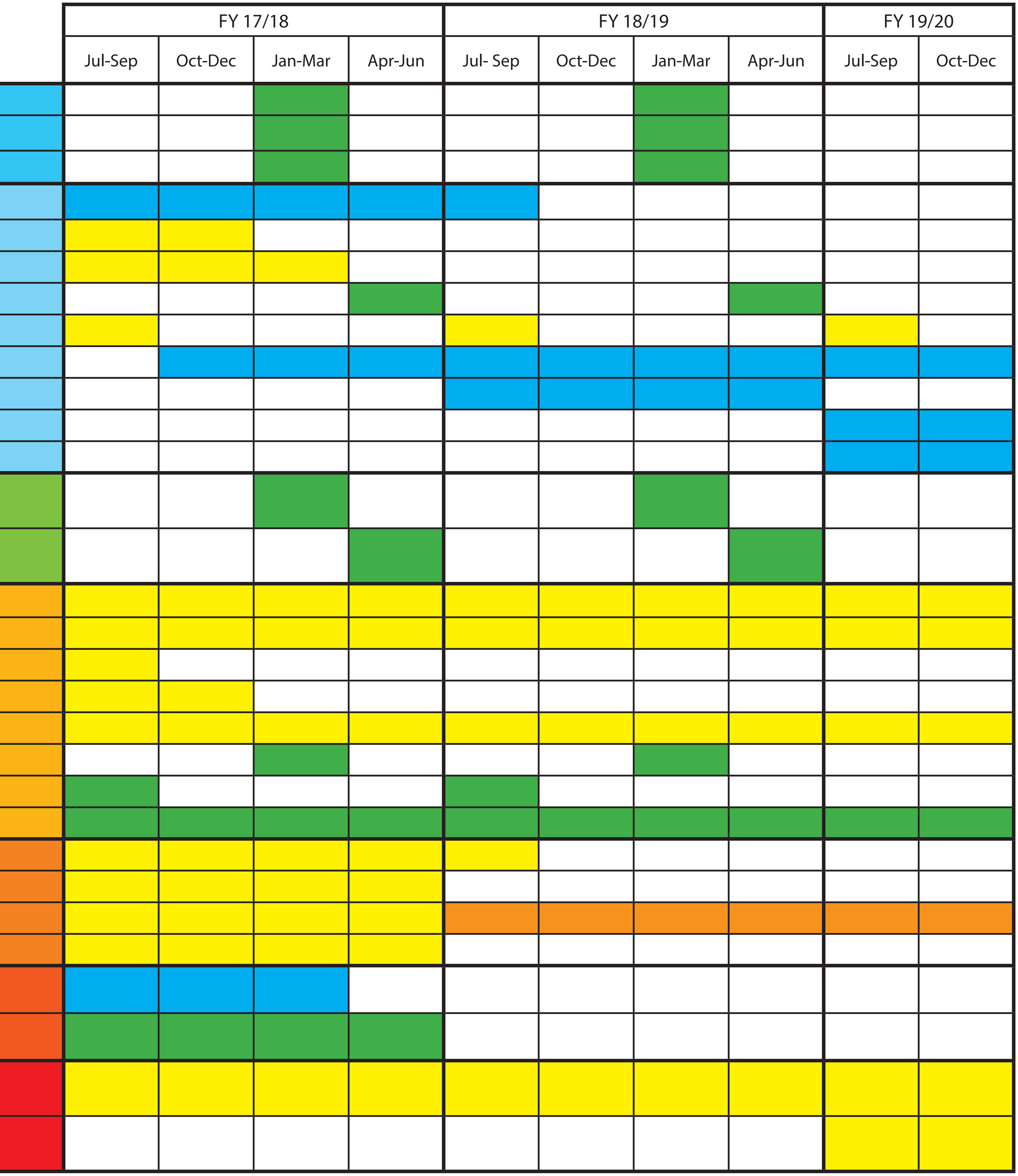


Source HNTB

SMART Action Plans

Funding	1.1	10-Year TSM&O Cost Feasible Plan for Implementation, Operations and Replacement.
	1.2	Five-Year Workload Formulas for Maintenance Funding.
	1.3	Work Program Instruction Reviews and Updates.
Performance Assessment	2.1	Districts Define and Validate Mobility and Safety Data Sources for Freeways & Arterials.
	2.1.1	Develop TSM&O Performance Assessment Guides/Templates.
	2.1.2	Develop Data Analysis Tool Training and Support Structure.
	2.2	Legacy and New TSM&O Impact Assessments for Freeway and Arterial TSM&O Strategies.
	2.3	Initiate, Maintain, and Post Log of Florida TSM&O Impacts for Freeways and Arterials.
	2.4	Districts Conduct Performance Assessments for Mobility, Safety, and Uptime Availability.
	2.5	Districts Selected Performance Metrics, Goals, and PEG for Freeways and Arterials.
	2.6	Districts Begin Assessing Outcomes Relative to Goals for Freeways and Arterials.
	2.7	Districts Begin Initiating Strategies to Achieve PEG and Goals for Freeways & Arterials.
Outreach	3.1	Annual Capability Maturity Model Self-Assessment Regional Workshops.
	3.2	Regional Connected Vehicle Workshops.
Mainstreaming	4.1	Invite functional Area Managers to TSM&O Task Team and Annual Meetings.
	4.2	TSM&O Participation in Statewide and Regional Functional Area Meetings.
	4.3	Identify Guides, Manuals, Standards, Specifications to Update with TSM&O Content.
	4.4	Prioritize and Initiate Updates.
	4.5	Complete and Repeat Updates as needed.
	4.6	Work with Planning to Incorporate TSM&O in Capacity Project Planning.
	4.7	Work with PD&E to Incorporate TSM&O in Capacity Projects Development.
	4.8	Work with MPO/TPO Liaisons to Include TSM&O in Regional Transportation Plans.
STEP	5.1	STEP ITS CEI Training Development.
	5.2	STEP ITS Design Training Development.
	5.3	STEP Sustainable Training Delivery & Management.
	5.3	STEP TSM&O Guide Development.
TSM&O Staffing	6.1	TSM&O Staffing Assessments.
	6.2	TSM&O Staffing Updates.
Strategic Plan Update	7.1	Manage, Monitor and Report SMART Action Plan Progress to Executive Board, TSM&O Leadership Team, and DTOEs.
	7.2	Strategic Plan Update.

See subject-area plans and schedules for more details: Districts & TSM&O Division | Districts



TSM&O Division & Task Team

Outside Organization

Source HNTB

Appendix A – TSM&O Strategy Toolbox

Appendix A provides basic definitions for over 50 TSM&O strategies or tools that have potential to support achieving TSM&O Program Goals, PEG and P-PEG. While Appendix A is comprehensive, it specifically covers major or commonly implemented tools that support achieving the *Strategic Plan* mobility Goals. Planning, implementation, O&M of these TSM&O strategies are anticipated individually or in groups and in the context of broader "capacity" improvement projects or as stand-alone projects. Some strategies such as FMS and ASCT are more general and include other defined strategies. Actual TSM&O strategies implemented are determined through a collaborative planning and project development process involving multiple offices within FDOT and often regional and local stakeholders. For successful implementation, the Systems Engineering Process is followed. Systems engineering steps common to TSM&O project development and implementation include RITSA, a Concept of Operations (ConOps) and other systems engineer documentation. See FDOT Systems Engineering and ITS Architecture Procedure Number 750-040-003 for details.

Facility-Centric Safety and Congestion Tool Definitions

1. **Freeway Management Systems (FMS):** FMS include fiber-optic communication networks, Closed-Circuit Television (CCTV), traffic detectors, and DMS to actively monitor traffic conditions, detect traffic incidents, and warn travelers of hazardous conditions. FMS are used in conjunction with RTMC, RRSP, RISC and SIRV to detect, verify and manage traffic incidents.
   Performance Metrics: Safety ⇨ Secondary Crashes; Mobility ⇨ travel time reliability; System/Agency Efficiency
   References:
   http://www.ops.fhwa.dot.gov/freewaymgmt/index.htm
   http://www.ops.fhwa.dot.gov/freewaymgmt/publications/frwy_mgmt_handbook/fmoh_complete_all.pdf
   https://tmcpfs.ops.fhwa.dot.gov/cfprojects/uploaded_files/Reference%20List%20TMC%20Manual.pdf
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/.

2. **Traffic Incident Management (TIM) Program:** TIM is a multi-agency effort to improve the management of highway incidents, both unplanned events, such as crashes, disabled and abandoned vehicles, debris in the roadway, work zones, adverse weather and emergencies and also planned events such as construction or special events that impact travelers and the transportation system.
   Performance Metrics: Safety ⇨ Secondary Crashes; Mobility ⇨ travel time, travel time reliability, System/Agency Efficiency
   References:
   http://ops.fhwa.dot.gov/eto_tim_pse/about/tim.htm
   https://www.transportation.gov/sites/dot.gov/files/docs/01%20Traffic%20Incident%20Management%20US%20-%20English.pdf
   https://www.fhwa.dot.gov/innovation/everydaycounts/edc-2/tim.cfm
   http://www.ops.fhwa.dot.gov/eto_tim_pse/timtoolbox/index.htm
   http://www.fdot.gov/traffic/Traf_Incident/Traf_Incident.shtm
   http://www.fdot.gov/traffic/Traf_Incident/pdf/Open_Roads_Policy_FDOT_FHP.pdf
   http://www.fdot.gov/traffic/Traf_Incident/pdf/TIM%20Strategic%20Plan%20Final.pdf
   https://www.fhwa.dot.gov/goshrp2/Solutions/Reliability/L12_L32A_L32B/National_Traffic_Incident_Management_Responder_Training_Program
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

3. **Ramp Meters:** 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.
   Performance Metrics: Safety ⇨ Crashes; Mobility ⇨ travel time, travel time reliability, throughput
   References:
   http://ops.fhwa.dot.gov/publications/ramp_mgmt_handbook/manual/manual/5_1.htm
   http://www.ops.fhwa.dot.gov/freewaymgmt/ramp_mgmnt.htm
   http://www.dot.state.mn.us/rampmeter/
   http://www.dot.state.mn.us/rampmeter/study.html
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

4. **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 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 (see number 5 below). HSR applications require monitoring of the lane by the RTMC, RRSP and Florida Highway Patrol (FHP) and emergency stopping areas are recommended.
   Performance Metrics: Safety ⇨ Secondary Crashes; Mobility ⇨ travel time, travel time reliability, throughput
   References:
   http://www.ops.fhwa.dot.gov/publications/fhwahop15023/fhwahop15023.pdf
   http://www.ops.fhwa.dot.gov/publications/fhwahop10023/chap4.htm
   http://www.itsinternational.com/categories/detection-monitoring-machine-vision/features/hard-shoulder-running-aids-uniform-traffic-flow-and-safer-driving/
   http://utcm.tamu.edu/publications/final_reports/Kuhn_10-01-54_Interim.pdf
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

5. **Lane Control 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 is capable of displaying 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.
   Performance Metrics: Safety ⇨ secondary crashes; Mobility ⇨ travel time reliability, throughput
   References:
   http://www.ops.fhwa.dot.gov/atdm/approaches/atm.htm
   http://mutcd.fhwa.dot.gov/HTM/2003r1/part4/part4j.htm
   http://mobility.tamu.edu/mip/strategies-pdfs/active-traffic/technical-summary/Variable-Speed-Limit-4-Pg.pdf
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

6. **Variable Speed Limits (VSL) and Speed Harmonization:** 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. Speed harmonization uses VSL to slow traffic to a sustainable uniform speed approaching and through the congested area. VSL are applicable to areas of recurring congestion to reduce crashes in the congested zone and thus improve travel time reliability.
   Performance Metrics: Safety ⇨ crashes; Mobility ⇨ travel time reliability, throughput
   References:
   http://safety.fhwa.dot.gov/speedmgt/vslimits/
   http://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa12022/fhwasa12022.pdf
   http://mobility.tamu.edu/mip/strategies-pdfs/active-traffic/technical-summary/Variable-Speed-Limit-4-Pg.pdf
   http://www.ops.fhwa.dot.gov/publications/fhwahop10023/chap4.htm
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

7. **Coutermeasures to Wrong Way Driving (WWD):** Since WWD crashes are usually head-on, they are generally severe, often resulting in deaths and injuries. 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. Verification provides law enforcement with best available information to contact the wrong way driver in time to prevent a crash and to provide aid when one occurs.
   Performance Metrics: Safety ⇨ crashes
   References:
   http://www.dot.ca.gov/newtech/researchreports/preliminary_investigations/docs/wrong-way_driving_prevention_methods_preliminary_investigation.pdf
   https://www.flhsmv.gov/safety-center/driving-safety/wrong-way-driving/

8. **Express Lanes:** Express Lanes are used to add capacity to freeways and expressways during peak periods. The Florida Express Lanes Handbook provides guidance on express lanes polices, responsibilities, traffic and revenue studies, design, toll collection, operations, maintenance, and reporting. Prior to implementing express lanes, a Regional Concept of Transportation Operations (RCTO) is prepared to define how the express lanes will function within the context of the regional transportation system. FDOT is also planning to prepare an Express Lanes Manual which will define specific express lanes requirements.
   Performance Metrics: Mobility ⇨ travel time reliability, throughput
   References:
   http://www.fdot.gov/info/expresslanes.shtm
   http://floridaexpresslanes.com/wp-content/uploads/2015/08/FDOT-Express-Lanes-Handbook.pdf
   http://floridaexpresslanes.com/wp-content/uploads/2015/11/Handbook-At-A-Glance.pdf
   http://www.ops.fhwa.dot.gov/publications/fhwahop13007/fhwahop13007.pdf
   http://www.ops.fhwa.dot.gov/publications/managelanes_primer/index.htm
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

9. **Reversible Express Lanes (REL):** RELs are used to add capacity in alternating directions of travel during peak periods. RELs can alleviate traffic congestion where there is highly skewed AM-PM directional traffic. Access may be controlled by gates on freeways and expressways and/or by overhead LCS on arterials. For freeways and expressways, RELs are usually separated from general purpose lanes by barriers with very well defined entrances and exits. The process for opening and closing RELs can be complicated by frequency and types of access points and by the possibility of operating some portions in different directions at the same time.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
   References:
   http://www.tampa-xway.com/reversible-express-lanes/
   http://595express.info/
   http://floridaexpresslanes.com/wp-content/uploads/2015/08/FDOT-Express-Lanes-Handbook.pdf
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

10. **Advanced Signal Control Technologies (ASCT):** The goal of ASCT is to optimize the overall traffic signal performance on signalized arterials by continually adapting to actual traffic conditions on through lanes, cross streets and turn lanes. Examples of ASCT include adaptive signal control and ATSPM. ASCT also provide additional signal performance data to traffic signal managers to support AAM systems.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput
   References:
   http://www.fdot.gov/traffic/ITS/ArterialManagement/FDOT_ASCT.pdf
   https://www.fhwa.dot.gov/innovation/everydaycounts/edc-1/asct.cfm
   http://rebar.ecn.purdue.edu/ltap1/multipleupload/Signals/Signal%20System%20Performance%20Measure%20Report.pdf
   http://rebar.ecn.purdue.edu/LTAP1/multipleupload/Signals/Performance%20Measures%20for%20Local%20Agency%20Traffic%20Signals.pdf
   http://blog.udot.utah.gov/tag/traffic-signal-performance-measures/
   https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/atspm.cfm
   https://ops.fhwa.dot.gov/arterial_mgmt/pubs.htm
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

11. **Traffic Signal Interconnect or Traffic Signal Communication:** Traffic signal interconnect describes communication from one traffic signal controller to another. Traffic signal interconnect may be Ethernet over fiber optic cable, analog over fiber, copper cable, and finally Ethernet or analog using wireless radios and antennas. Traffic signal interconnect is used most commonly for distributed traffic signal control or operations when there is limited center-to-infrastructure communication. Traffic signal interconnect is often used for closed-loop traffic signal systems. Traffic signal interconnect is used to keep controller clocks synchronized to support coordination. Some ASCT use traffic signal interconnect to collect data from adjacent signals to determine control.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
   References:
   http://local.iteris.com/itsarch/
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

12. **Traffic Signal Coordination:** The goal of traffic signal coordination is to optimize traffic flow through a series of two or more relatively closely spaced signalized intersections. Coordination timing, in simple terms, attempts to maximize the number of vehicles arriving at a green phase while taking into consideration turning and cross street traffic. Timing and coordination plans are developed every few years to cover peak periods, peak fringes, off-peaks, and weekend. Often coordination plans are developed for special events, incident response, and for emergencies. Some signals systems use traffic responsive software that selects a predefined timing and coordination based on actual traffic conditions.
Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput
References:
http://ops.fhwa.dot.gov/arterial_mgmt/tstmanual.htm
http://ops.fhwa.dot.gov/publications/fhwahop08024/chapter6.htm
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_812.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

13. **Transportation Management Center (TMC):** TMC's may have different functions. For Florida FMS, each district has implemented one or more RTMC. Traffic signal maintaining agencies often have some level of a TSOC ranging from a work station on a desk to a fully equipped TMC. RTMC and larger local agency TMC 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 traffic signal controllers. FDOT RTMC are equipped with SunGuide® central system software for both control and logging of actions taken to manage traffic and inform travelers.
Performance Metrics: Safety ⇨ crashes, secondary crashes; Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
References:
http://local.iteris.com/itsarch/
http://ops.fhwa.dot.gov/freewaymgmt/trans_mgmnt.htm
http://ops.fhwa.dot.gov/Publications/fhwahop15032/index.htm
https://ntl.bts.gov/lib/jpodocs/rept_mis/11494.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

14. **RTMC Operation:** RTMCs are typically staffed and operated 24 hours per day, 7 days per week, and 52 weeks per year (24x7x365) to support planned and unplanned incidents. Local TSOC and TMC are often staffed only on week days from morning to afternoon peak. Most monitor traffic signal performance. Others also monitor traffic incidents. A few TMC & RTMC have been integrated into a combined freeway and arterial RTMC.
Performance Metrics: Safety ⇨ crashes, secondary crashes; Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
References:
http://local.iteris.com/itsarch/
http://www.fdot.gov/traffic/its/projects_deploy/rtmc.shtm
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

15. **Road Ranger Service Patrol:** RRSP is a free service provided by the Department to respond to stranded motorists, disabled vehicles, abandoned vehicles, and to provide traffic control for traffic incidents. RRSP currently covers most freeways and toll routes operated by the Department and routes operated by Expressway Authorities. RRSP coverage, zone size (miles), and hours of operation are determined based on traffic volumes, incident frequency and other factors.
Performance Metrics: Safety ⇨ secondary crashes; Mobility ⇨ travel time, travel time reliability, throughput
References:
http://www.fdot.gov/traffic/traf_incident/rrangers/rranger.shtm
http://ops.fhwa.dot.gov/publications/fhwahop08031/ffsp_handbook.pdf
https://www.fhwa.dot.gov/goshrp2/Solutions/Reliability/L12_L32A_L32B/National_Traffic_Incident_Management_Responder_Training_Program
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

16. **Center to Center (C2C) Communication:** C2C connects the various TMCs, TSOCs, and RTMCs to each other to share information and assist with event response when multiple agencies are involved. FDOT has implemented the statewide ITS wide-area network (WAN) that allows C2C communication between all RTMCs. The department has also created C2C communication with the FHP, local TSOC and TMC, emergency operations centers and public safety response (911) centers. Much of the WAN runs over fiber optic cable infrastructure. Portions of the WAN run on commercial fiber networks and/or the State's microwave radio network either as primary or redundant communication paths.
Performance Metrics: Safety ➩ crashes, secondary crashes; Mobility ➩ travel time, travel time reliability, throughput; System/Agency Efficiency
References:
http://local.iteris.com/itsarch/
http://www.fdot.gov/traffic/its/Projects_Telecom/WAN.shtm

17. **Center to Infrastructure (C2I) Communication:** C2I connects TMC's, TSOC's, and RTMC to ITS and traffic signal infrastructure elements such as CCTV cameras, DMS and traffic signal controllers. These networks are often defined as local-area-networks (LAN). The department has opted to utilize Ethernet over fiber optic cable for the LAN. The fiber optic cable is often referred to as Layer 1. By using Ethernet, multiple field elements can be connected to the same pair of fibers reducing the total number of fibers needed. This device connectivity is often referred to as Layer 2. For larger networks, communication hubs are used for the final hop to the RTMC. Hub to RTMC connectivity is often referred to as Layer 3 in the development of communication architectures.
Performance Metrics: Safety ➩ crashes, secondary crashes; Mobility ➩ travel time, travel time reliability, throughput; System/Agency Efficiency
References:
http://local.iteris.com/itsarch/
http://local.iteris.com/cvria/html/applications/applications.html

18. **Vehicle to Infrastructure (V2I) Communication:** V2I refers to communication to/from RSE to/from vehicle on-board units (OBU). While this is occurring from towers to vehicles or to phones for personal uses, for transportation management it is envisioned to occur from dedicated RSE to OBU using DSRC. Near term V2I is envisioned for communication to/from traffic signal controllers to/from OBUs to provide SPaT information and ultimately to actually control SPaT to optimize traffic flow on signalized corridors. With CV technologies, V2I is envisioned to collect vehicle parameters through BSMs and to send safety warnings to drivers. Ultimately, V2I will support vehicle control systems as automated vehicle (AV) technologies become more prevalent.
Performance Metrics: Safety ➩ crashes, secondary crashes; Mobility ➩ travel time, travel time reliability, throughput
References:
http://local.iteris.com/cvria/html/applications/applications.html

19. **Intersection Collision Avoidance:** Several types of collisions are of concern at intersections. For all types of intersections, angle crashes occur and can be severe. Signalization can often reduce angle crashes but can also increase rear-end crashes which can cause injuries. In addition to vehicle-on-vehicle crashes, pedestrian and bicycle accidents occur at intersections. The goal of intersection collision avoidance is to reduce these crashes. For rural intersections on divided highways, gap detection technologies are being installed to help drivers recognize an acceptable gap to enter or cross the major highway. For signalized intersections, dilemma zone detectors and advance red signal ahead warning flashers are installed, along with other technologies. With the advent of CVs, it is anticipated that V2V and V2I communication will allow development of applications to greatly reduce intersection collisions. For pedestrians and bicyclists, the goal is to accurately detect their presence and create safe paths for them through busy intersections.
Performance Metrics: Safety ➩ crashes, secondary crashes
References:
http://local.iteris.com/cvria/html/applications/applications.html
http://www.its.dot.gov/research_archives/cicas/index.htm

20. **Routes of Significance (RoS):** RoS include Interstate, controlled-access, and toll highways and certain non-controlled access highways that are regionally significant. For federal purposes, they are the focus of real-time performance monitoring and reporting as required by the Real-Time System Management Information Program (RTSMIP). For Florida, RoS are the routes that are the primary focus for freeway and AAM strategies.
Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput
References:
http://ops.fhwa.dot.gov/1201/
http://ops.fhwa.dot.gov/publications/fhwahop13047/index.htm
http://www.fdot.gov/traffic/newsletters/2014/2014-dec.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

21. **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 sensor. In Florida, the uses of the primary sensors are visibility to detect fog or smoke, wind speed and direction and rainfall intensity. In the panhandle area of Florida, ice and pavement temperature sensors are also used. Individual RWIS/ESS report real-time conditions at the RWIS location and are placed where visibility or wind pose safety problems. 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. Snowbelt states use networks of RWIS to assist with preparation and response to snow events, in turn improving safety and reducing the total resources needed for the response.
Performance Metrics: Safety ⇨ crashes
References:
http://ops.fhwa.dot.gov/publications/ess05/
http://ops.fhwa.dot.gov/Weather/best_practices/EnvironmentalSensors.pdf
http://www.fdot.gov/research/completed_proj/summary_te/fdot_bd537_rpt.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

22. **Intersection System Detection:** There are a wide variety of traffic detection technologies used at intersections. These include inductive loops, microwave radar and vision-based vehicle detection systems. These detection systems are implemented according to the traffic management and operations goals for the intersection and/or for the corridor. Fixed-time-of-day signal timing plans do not require detection but can result in green phases unused, underused or overused. The first level of detection for a traffic responsive signal is critical detection. Critical detection is considered cross street and mainline left turn lane stop bar detection. Critical detectors allow a phase to be skipped if no traffic is detected or extended to a predefined maximum when traffic volumes are heavy. Most ASCT require stop bar detection on all approaches for every lane. Some traffic control strategies require a system detector (mid-block) and/or dilemma zone detectors. On freight corridors, dilemma zone detectors are positioned to minimize the number of trucks that are caught at the end of the green cycle. As CAV-enabled intersections and vehicles become more pervasive, the vehicle itself will become the detection system through V2I communication.
Performance Metrics: Safety ⇨ crashes, secondary crashes; Mobility ⇨ travel time, throughput
References:
http://safety.fhwa.dot.gov/intersection/conventional/signalized/tech_sum/fhwasa09008/
http://ops.fhwa.dot.gov/publications/fhwahop06006/chapter_6.htm
https://www.fhwa.dot.gov/publications/research/operations/its/06108/06108.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

Modal-Centric Tool Definitions

1. **Freight Advanced Traveler Information System (FRATIS):** FRATIS is defined in the CV Reference Implementation Architecture (CVRIA) as two specific applications:

   The Freight Drayage Optimization application covers the information exchanges between all intermodal parties to provide current drayage truck load matching, container availability and appointment scheduling at railroad and steamship line terminals. The application includes a link from drivers and freight management systems dispatchers to an intermodal terminal reservation system and integrates an appointment function with terminal queue status and load matching. The application set provides information to the dispatcher and driver concerning the availability status for pickup of a container at an intermodal terminal. The application bundle also provides drivers and dispatchers with both intermodal terminal queue length, and estimated time from the back of the queue to the gate.

   The Freight-Specific Dynamic Travel Planning application 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 current status. The information will be based on data collected from the commercial fleet as well as general traffic data collection capabilities. The information, both real time and static can be provided directly to fleet managers, to mobile devices used by commercial vehicle operators, or directly to in vehicle systems as commercial vehicles approach roadway exits with key facilities such as parking. The application can also provide oversize/overweight permit information to commercial managers.

   Performance Metrics: Safety ⇨ crashes; Mobility ⇨ travel time, travel time reliability

   References:

   http://local.iteris.com/cvria/html/applications/applications.html
   http://local.iteris.com/cvria/html/applications/app96.html#tab-3
   http://local.iteris.com/cvria/html/applications/app32.html#tab-3
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

2. **Automatic Vehicle Location (AVL):** AVL uses an on-board Global Positioning System (GPS) antenna, processor and two-way communication to track and report a vehicle's position on the transportation network. AVL is used to manage transit vehicles, provide positive train control, manage commercial vehicle fleets and to interact with on-board navigation systems. AVL is used by transit for Transit Signal Priority (TSP) and by emergency vehicles for Emergency Vehicle Preemption (EVP). Vehicle location (latitude/longitude/elevation) is part of the DSRC BSM and are used in CV apps. Some CAV research and technology development includes using GPS for vehicle guidance and control. Commercially available GPS accuracy is not sufficient for vehicle control without additional data. However, relative positional accuracy is precise for two vehicles equipped with GPS. Also other parameters such as speed and direction of travel are accurate as well. 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 off the road crashes as these systems become more prevalent within the vehicle fleet.

   Performance Metrics: Safety ⇨ crashes; Mobility ⇨ travel time reliability, throughput; System/Agency Efficiency

   References:

   http://www.trb.org/Publications/Blurbs/159906.aspx
   http://local.iteris.com/cvria/html/applications/app77.html#tab-3
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

3. **Dynamic Ridesharing:** Dynamic ridesharing is defined in the CVRIA. The Dynamic Ridesharing application allows travelers to arrange carpool trips through a stand-alone personal device with a wireless connection and/or an automated ride-matching system (e.g., call center or web-based application loaded on a personal computer or kiosk at a transit facility). The application uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip. These inputs are then translated into "optimal" pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the application to improve the user's experience for future trips and monitor use of high-occupancy lanes.

   Performance Metrics: Mobility ⇨ travel time, travel time reliability

   References:

   http://local.iteris.com/cvria/html/applications/app17.html#tab-3
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

4. **Automated & Electronic Fare Collection (EFC):** Automated Fare Collection (AFC), EFC and Open-Road Tolling (ORT) systems use some form of smart card, Radio Frequency Identification (RFID) or other technologies to collect fares. In Florida, all of the toll road agencies use the SunPass® transponder and are converting to highway speed highway speed or ORT collection. The SunPass® transponder is also in use at some airports for parking fare payment. Florida's Turnpike Enterprise and others also use license-plate reading technology to identify toll road users and collect payment through invoices to motorists. Other AFC systems are in place for Sun Rail and some local transit agencies.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
   References:
   http://www.dot.state.oh.us/engineering/OTEC/2015_OTEC_Presentations/Tuesday_Oct.27/22/OTECPresentation_102315_Final.pdf
   http://www.tcrponline.org/PDFDocuments/TCRP_RRD_57.pdf
   http://www.itsbenefits.its.dot.gov/its/benecost.nsf/DisplaySummarySearchResult?OpenForm&C89302DC05678FCE852580C000525FB2&Query=Electronic%20Payment%20&%20Pricing

5. **Transit Signal Priority (TSP) and EVP:** Various types of signal priority and preemption are available to promote safety and mobility. TSP is an operational strategy that is applied to reduce the delay transit vehicles experience at traffic signals. TSP involves communication between buses and traffic signals so that a signal can alter its timing to give priority to transit operations. Priority may be accomplished through a number of methods, such as extending greens on identified phases, altering phase sequences, and including special phases without interrupting the coordination of green lights between adjacent intersections. TSP has the potential to improve transit reliability, efficiency, and mobility. Preemptive control is designed and operated to give the most important classes of vehicles the right of way at and through a signal. Signal priority and preemption are also CV applications defined within the CVRIA. See CV Mobility Traffic Signals for more details.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput
   References:
   https://ops.fhwa.dot.gov/publications/fhwahop08024/fhwa_hop_08_024.pdf
   http://www.state.nj.us/transportation/refdata/research/reports/FHWA-NJ-2004-013.pdf
   http://local.iteris.com/cvria/html/applications/applications.html
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

6. **Active Parking Management:** Active Parking Management is a part of Active Transportation and Demand Management. The goal of active parking management is to provide timely and accurate parking availability information to travelers in need of parking. The parking information includes information on spaces available and best route to access parking. Systems can also include parking reservation and payment components.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability; System/Agency Efficiency
   References:
   http://ops.fhwa.dot.gov/atdm/approaches/apm.htm
   http://ops.fhwa.dot.gov/publications/fhwahop12033/fhwahop12033.pdf
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

7. **Commercial Vehicle Operations (CVO):** CVO refers to a range of technologies intended to improve safety and efficient movement of freight by truck. CVO technologies cover weight and dimension permitting, weigh station by-passing and enforcement, tax collection and apportionment, driver rules monitoring and enforcement, and vehicle safety monitoring and enforcement. New technology applications for CVO include container tracking and theft recovery as well as truck parking availability systems (TPAS) and FRATIS.
   Performance Metrics: Safety ⇨ Crashes; Mobility ⇨ travel time, travel time reliability; System/Agency Efficiency
   References:
   See 1, 8, 9, 11 in this section.

http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

8. **Virtual Weigh-In Motion (VWIM):** The VWIM is used to collect information on numbers and weights of commercial vehicles moving along a roadway at normal speeds. This allows planners and designers to ensure the roadway network, pavement and bridges serve freight traffic effectively. VWIM is also used to identify potential weight violators. When a VWIM detects a potentially overweight vehicle, a message can be transmitted to a law enforcement officer who can verify the weight with a portable scale. A second use for VWIM is in conjunction with a truck scale on an arterial. If a VWIM detects a potentially overweight vehicle, the VWIM can activate a DMS that notifies the trucker to enter the weigh station to be weighed.
   Performance Metrics: Mobility ➪ travel time, travel time reliability; System/Agency Efficiency
   References:
   http://ops.fhwa.dot.gov/publications/fhwahop09051/sec04.htm
   http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/20-07(254)_AgencyBenefits.pdf
   http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2335
   http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/TTI-2015-8.pdf
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

9. **Freight Tracking System:** Freight tracking, similar to VWIM, has two primary objectives. The first is for roadway network planning, design and maintenance. Knowing where the loads originate and terminate allows freight routes to be identified. The second objective is for theft detection and enforcement. If a truck or container has a designated origination, route and destination, any deviations from the planned route without dispatcher intervention would be flagged as a potential theft. When theft detection occurs in real-time, probability of capture and recovery are much higher.
   Performance Metrics: Mobility ➪ travel time reliability; System/Agency Efficiency
   References:
   http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/TTI-2015-8.pdf
   http://ops.fhwa.dot.gov/Freight/intermodal/efmi/electronic.pdf
   http://ops.fhwa.dot.gov/freight/
   http://local.iteris.com/cvria/html/applications/app32.html#tab-3
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

10. **Walk Smart/Bike Smart:** Walk smart/bike smart refers to a number of low and high technology approaches to increasing walking and bicycle usage. For this TSM&O plan, pedestrian and bicycling safety are incorporated in two CV signal applications. Pedestrian in Signalized Crosswalk (vehicle detects pedestrian) and Pedestrian Mobility (pedestrian signal priority) are the two CV apps.
    Performance Metrics: Safety ➪ Crashes; Mobility ➪ travel time
    References:
    http://local.iteris.com/cvria/html/applications/app51.html#tab-3
    http://local.iteris.com/cvria/html/applications/app50.html#tab-3
    http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

11. **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 allows truckers the opportunity to maximize the number of hours moving freight down the road and minimizing time spent looking for parking for their safety-mandated non-driving times. TPAS parking availability information is conveyed to drivers by means of roadside signs and on-board displays. Parking availability is collected from parking sensors in public rest areas and other means from private truck stop operators.
    Performance Metrics: Safety ➪ Crashes; Mobility ➪ travel time, travel time reliability
    References:
    http://www.fdot.gov/research/completed_proj/summary_te/fdot-bdk80-977-14-rpt.pdf
    http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_syn_317fm.pdf
    https://www.michigan.gov/documents/mdot/MDOT_Truck_Parking_Project_Report_528340_7.pdf
    http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

12. **Grade Crossing Notification System:** The goal of a grade crossing notification system is to provide advance notification to travelers when an at-grade highway-rail intersection (HRI) will be closed. Arterial DMS and static signs with flashers are used for advance notification, even before the gate arms begin to close. At a minimum, the notification system is used to slow down fast moving traffic of the pending closure. At best, the notification can allow vehicles to reroute to a nearby grade-separated route to avoid the closure. If the bypass route has traffic signals, the notification system can activate a bypass traffic signal timing and coordination plan to efficiently move traffic through the bypass.
    Performance Metrics: Safety ⇨ Crashes; Mobility ⇨ travel time, travel time reliability
    References:
    https://www.federalregister.gov/documents/2012/06/12/2012-13843/systems-for-telephonic-notification-of-unsafe-conditions-at-highway-rail-and-pathway-grade-crossings
    http://safety.fhwa.dot.gov/xings/com_roaduser/07010/

Mobility-Centric Tool Definitions

1. **SunGuide® Software:** Florida's statewide ITS software started with freeway management but has arterial and connected vehicle applications.
   Performance Metrics: Safety ⇨ Secondary Crashes; Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
   References:
   http://www.SunGuide®software.com/
   http://www.fdot.gov/traffic/its/projects_arch/pdf/2014-SG-Brochure.pdf
   http://www.consystec.com/florida/state/web/html/proj/pr13.htm
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

2. **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.
   Performance Metrics: System/Agency Efficiency
   References:
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

3. **FL511:** Florida's statewide website and telephone system for disseminating real-time traveler information.
   Performance Metrics: Safety ⇨ secondary crashes; Mobility ⇨ travel time, travel time reliability
   References:
   http://www.fdot.gov/traffic/its/Projects_Deploy/511.shtm
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/
   https://fl511.com/

4. **Dynamic Detour System (DDS):** The goal of DDS is to collect real-time freeway and alternate route traffic conditions in order to provide real-time traveler information so travelers can exercise more control over their routes during planned and emergency lane or road closures. DDS provides tools to regional partners to effectively manage congestion during closures. A DDS is enhanced through a Decision-Support System (DSS) and ICM. The DSS would provide real-time information to stakeholders to make informed, timely and accurate network flow management decisions.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput; System/Agency Efficiency
   References:
   http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-4023-P3.pdf
   http://northfloridatpo.com/images/uploads/docs/Dynamic_Detour_Final_Report_-_without_appendices.pdf
   http://www.fdot.gov/traffic/its/Projects_Deploy/Special_Projects/080925%20DMS%20Guidelines_V1_4_final.pdf
   http://utcm.tamu.edu/publications/final_reports/Kuhn_10-01-54_Interim.pdf
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

5. **Active Arterial Management (AAM):** AAM is applying freeway management practices to major urban arterials. The goal of AAM is to identify crashes, stalled vehicles, corridor backups, phase backups, and/or maintenance problems that impact safety and capacity as early as possible and to respond quickly and effectively. AAM requires collaboration between signal operations, signal maintenance, and emergency response, all of which have the goal to respond

and complete their respective responsibilities as quickly as possible while complying with their overall mission and protocols. From a traffic operations perspective, AAM includes ensuring traffic signal timing and coordination are optimized by time of day and day of week. Timing and coordination options include manually selecting phases to match traffic patterns or using ASCT or some combination of both. ATSPM are also commonly used to support AAM. AAM could also manually override to extend specific phases when needed.
Performance Metrics: Safety ➪ Crashes, Secondary Crashes; Mobility ➪ travel time, travel time reliability, throughput; System/Agency Efficiency
References:
http://ops.fhwa.dot.gov/arterial_mgmt/
http://aii.transportation.org/Pages/AutomatedTrafficSignalPerformanceMeasures.aspx
http://www.fdot.gov/traffic/ITS/ArterialManagement/FDOT_ASCT.pdf
https://www.fhwa.dot.gov/innovation/everydaycounts/edc-1/asct.cfm
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

6. **Unified Payment System (UPS):** The goal of UPS is to be able to reserve and purchase a door-to-door trip involving multiple modes of transportation, including parking provided from diverse parking suppliers, transit from multiple transit agencies, rental cars, tolls, bike share, and even taxis and ride share services, all as one transaction. This trip would be coordinated so that any connections or modal transfers would meet the traveler's schedule. The Integrated Multi-Modal Electronic Payment CV transit application uses connected vehicle roadside and vehicle systems to provide the electronic payment capability for toll systems, parking systems, and other areas requiring electronic payments.
Performance Metrics: Mobility ➪ travel time, travel time reliability; System/Agency Efficiency
References:
http://local.iteris.com/cvria/html/applications/app37.html#tab-3
http://local.iteris.com/itsarch/html/mp/mpapts04.htm
http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

7. **Integrated Corridor Management (ICM):** The goal of ICM is to optimize 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 tools include TIM, work zone management, traffic signal timing, express lanes, real-time traveler information, and AAM. ICM helps maximize the capacity of all facilities and modes across the corridors and allows for greater mobility options and efficiency.
Performance Metrics: Safety ➪ Crashes, Secondary Crashes; Mobility ➪ travel time, travel time reliability, throughput; System/Agency Efficiency
References:
http://www.its.dot.gov/research_archives/icms/index.htm
https://ops.fhwa.dot.gov/publications/fhwahop16035/index.htm
https://ops.fhwa.dot.gov/publications/fhwahop15018/index.htm
https://www.fhwa.dot.gov/publications/publicroads/10novdec/02.cfm
http://www.fdot.gov/research/Completed_Proj/Summary_TE/FDOT-BDK80-977-09-rpt.pdf
http://ntl.bts.gov/lib/47000/47600/47670/FHWA-JPO-12-075_FinalPKG_508.pdf
http://ntl.bts.gov/lib/50000/50600/50615/30B00211.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

8. **Signal Phase and Timing (SPaT):** SPaT is a support application in the 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.
Performance Metrics: Mobility ➪ travel time, travel time reliability, throughput
References:
http://local.iteris.com/cvria/html/applications/app67.html
http://local.iteris.com/cvria/html/applications/app43.html#tab-3
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

9. **Connected Vehicle Mobility Traffic Signals:** CVRIA defines five distinct CV applications that relate to connected or smart traffic signals. Some feel that ultimately CAV will allow elimination of some if not all traffic signals. In the meantime, the five connected traffic signal applications in the CVRIA are as follows:

   a. Emergency Vehicle Signal Preemption (EVP) Application: EVP application is a very high level of priority for emergency first responder vehicles. Historically, priority for emergency vehicles has been provided by special traffic signal timing strategies called preemption. The goal of EVP is to facilitate safe and efficient movement through intersections. EVP can help clear queues and put holds on conflicting signal phases in order to facilitate emergency vehicle movement. For congested conditions, it may take additional time to clear a standing queue, so the ability to provide information in a timely fashion is important. In addition, transitioning back to normal traffic signal operations after providing EVP is an important consideration since the control objectives are significantly different.
   Performance Metrics: Safety ⇨ Crashes, Secondary Crashes; Mobility ⇨ travel time, travel time reliability
   References:
   http://local.iteris.com/cvria/html/applications/app24.html#tab-3

   b. Freight Signal Priority (FSP) Application: FSP provides traffic signal priority for freight and commercial vehicles traveling in a signalized network. The goal of the FSP application is to reduce stops and delays, to increase travel time reliability for freight traffic, and to enhance safety at intersections.
   Performance Metrics: Safety ⇨ Crashes, Secondary Crashes; Mobility ⇨ travel time, travel time reliability
   References:
   http://local.iteris.com/cvria/html/applications/app33.html#tab-3
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

   c. Intelligent Traffic Signal System (ISIG) Application: ISIG uses both vehicle location and movement information from CVs as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The application utilizes the vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection. The application serves as an overarching system optimization application, accommodating other mobility applications such as TSP, FSP, EVP, and Pedestrian Mobility to maximize overall arterial network performance. In addition, the application may consider additional inputs such as environmental situation information or the interface (i.e., traffic flow) between arterial signals and ramp meters.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability, throughput
   References:
   http://local.iteris.com/cvria/html/applications/app43.html#tab-3
   http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

   d. Pedestrian Mobility Application: Pedestrian Mobility will integrate traffic and pedestrian information from roadside or intersection detectors and new forms of data from wirelessly connected, pedestrian (or bicyclist) carried mobile devices (nomadic devices) to request dynamic pedestrian signals or to inform pedestrians when to cross and how to remain aligned with the crosswalk based on real-time SPaT and MAP information. The MAP application provides accurate location of lanes, sidewalks, vehicles and pedestrians with a pedestrian mobility application on a mobile device. In some cases, priority will be given to pedestrians, such as persons with disabilities who need additional crossing time, or in special conditions (e.g., weather) where pedestrians may warrant priority or additional crossing time. This application will enable a "pedestrian call" to be routed to the traffic controller from a nomadic device of a registered person with disabilities after confirming the direction and orientation of the roadway that this pedestrian is intending to cross. The application also provides warnings to the personal information device user of possible infringement of the crossing by approaching vehicles.
   Performance Metrics: Mobility ⇨ travel time, travel time reliability
   References:
   http://local.iteris.com/cvria/html/applications/app50.html#tab-3
   http://local.iteris.com/cvria/html/applications/app67.html
   http://local.iteris.com/cvria/html/applications/app43.html#tab-3
   http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

e. TSP Application: The TSP Application uses V2I to allow transit vehicles to request a priority at one or a series of intersections. The application includes feedback to the transit driver indicating whether the signal priority has been granted or not. This application can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.
Performance Metrics: Mobility ⇨ travel time, travel time reliability
References:
http://local.iteris.com/cvria/html/applications/app79.html#tab-3
http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

10. **Collision Avoidance Technology:** Collision avoidance technology encompasses a range of CAV technologies such as adaptive cruise control, blind-spot warning, cross traffic alert systems, lane-keeping assistance, SPaT, and assistive or automatic braking. CV will play an important role in collision avoidance through V2I and V2V communication. The RTMC can warn travelers of hazardous conditions before the vehicle itself can detect the problem. Examples include work zones where lane-keeping assistance systems may not function fully, heavy fog or rain ahead, high winds, and lane or roadway closures due to traffic incidents. Until CAV is prevalent, it is still advisable to install speed detection and warning systems for sharp curves that may be prone to tipping trucks.
Performance Metrics: Safety ⇨ Crashes, Secondary Crashes; Mobility ⇨ travel time, travel time reliability, throughput
References:
http://local.iteris.com/cvria/html/applications/applications.html
http://local.iteris.com/cvria/html/applications/app13.html#tab-3
http://local.iteris.com/cvria/html/applications/app74.html#tab-3
http://local.iteris.com/cvria/html/applications/app46.html#tab-3
http://local.iteris.com/cvria/html/applications/app67.html
http://local.iteris.com/cvria/html/applications/app43.html#tab-3
http://local.iteris.com/cvria/html/applications/app7.html#tab-3
http://local.iteris.com/cvria/html/applications/app31.html#tab-3
http://local.iteris.com/cvria/html/applications/app23.html#tab-3

11. **Access Management:** Traditional access management uses aims to reduce delay by matching land use access with travel demand on arterial highways. There also is a well-established correlation between access openings per mile and crash rates. In recent years travel demand management has been added as an access management tool. Through such concepts as ride sharing, flexible work hours, and telecommuting, demand for access to targeted congested facilities has been reduced. Technology can also be used to manage access. Tools such as dynamic route and mode assignment can reduce access to congested facilities by diverting travelers to underutilized routes or modes.
Performance Metrics: Safety ⇨ Crashes; Mobility ⇨ travel time, travel time reliability
References:
http://ops.fhwa.dot.gov/tdm/ref_material.htm
http://local.iteris.com/cvria/html/applications/app17.html#tab-3
http://local.iteris.com/itsarch/html/mp/mpatis04.htm
https://ntl.bts.gov/lib/51000/51000/51051/FDOT-BDK80-977-30-rpt.pdf
http://www.ops.fhwa.dot.gov/plan4ops/topsbctool/

12. **Dynamic Pricing:** Dynamic pricing, congestion pricing or peak load pricing, is another form of demand management. Traditional toll highways are less congested than freeways. The theory of dynamic pricing is to divert some trips to express service for a premium fee. The premium fee may be fixed by time of day or dynamically adjusted based on various congestion and travel time factors. Dynamic pricing can apply to express bus service or express lanes along a freeway.
Performance Metrics: Mobility ⇨ travel time, travel time reliability; System/Agency Efficiency
References:
http://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm
http://local.iteris.com/itsarch/html/mp/mpatms25.htm
http://ops.fhwa.dot.gov/publications/congestionpricing/congestionpricing.pdf
http://www.itscosts.its.dot.gov/its/benecost.nsf/ByLink/CostDocs

Appendix B – RITIS Performance Measurement Tools

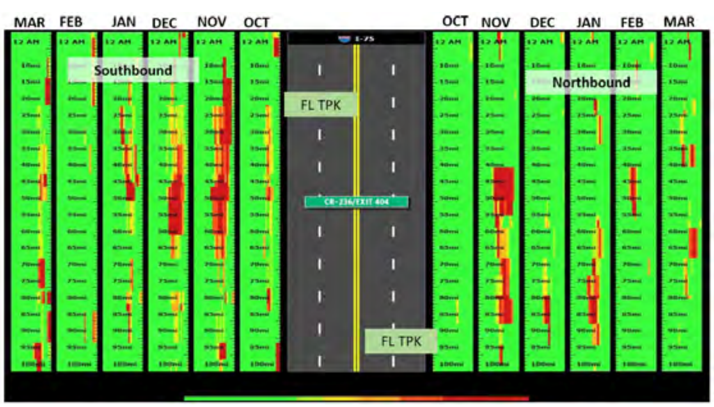
This appendix provides additional guidance on availability and use of RITIS performance measurement tools.

RITIS provides a number of data analysis tools and outputs. The table below highlights the tools and potential applications for each tool. The most common tools that support Strategic Plan Goal assessment are presented in the table.

Table 1: RITIS Analysis Tools and Applications

RITIS Tool	Application	RITIS Definition	Data Used
Planning Time Index	Compare routes or segments by time of day, day of week, monthly or annually.	Measure of travel time variability: PTI of 3.0 means a trip that normally takes 10 minutes will take 30 minutes 95% of the time.	Speed, Location and direction, Length, Date and time (5-minute intervals or longer).
Congestion	Compare routes or segments by time of day, day of week, monthly or annually.	Measured speed as a percentage of the free flow speed.	
Impact	Measure bottleneck duration.	Aggregation of queue length over time for congestion originating at each location in mile-minutes.	
Average Max Length	Measure bottleneck length.	Average maximum length, in miles, of queues formed by congestion originating at the location.	
Bottleneck Ranking	Rank bottleneck locations on the roadway.	Ranking of positions (impact is used by default).	

RITIS archives real-time traffic data collected from MVDS and real-time traffic data from HERE. RITIS analysis tools are available to identify problem locations and support before-and-after studies. This data was used for calculation of PTI and TTI in the ITS Performance Measures Annual Report.



Sample PTI Heat Map, I-75, Sundays, Oct '15 through Mar '16

Examples of the analytical tools include PTI assessments of routes by time of day, day of week, weekly, monthly and annually. Figure on the left shows monthly PTI results, or a "heat map," by direction, for I-75 in Sumter, Marion and Alachua Counties for Sundays from October 2015 through March 2016. Red areas indicate a PTI of 3.0 or higher, indicating conditions where 95% of the trips were 30 minutes or longer on a road segment where the travel time would normally be 10 minutes. In 2015, substantial portions of this segment of I-75 experienced PTI of 3.0 or higher for 8-12 hours on Sundays.

While not presented here, another "heat map" for Sundays in October 2016 shows very similar patterns to October 2015, with two of the five Sundays experiencing high PTI in the southbound direction from approximately noon to nine in the evening. Heat maps provide very understandable and useful images of traffic data for traffic engineering and TSM&O.

APPENDIX C

Acronym	Definition
AAM	Active Arterial Management
AASHTO	American Association of State Highway and Transportation Officials
AFC	Automated Fare Collection
AMS	Arterial Management Systems
ASCT	Advanced Signal Control Technologies
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management Systems
ATSPM	Automated Traffic Signal Performance Measures
AV	Autonomous Vehicles
AVL	Automatic Vehicle Location
BSM	Basic Safety Messages
C2C	Center to Center
CARS	Crash Analysis Reporting System
CAV	Connected and Automated Vehicles
CBT	Computer-Based Training
CCTV	Closed-Circuit Television
CEI	Construction Engineering and Inspection
CHART	Maryland's Coordinated Highways Action Response Team
CMM	Capability Maturity Model
ConOps	Concept of Operations
CV	Connected Vehicles
CVO	Commercial Vehicle Operation
DDS	Dynamic Detour System
DITS	100% State ITS funds
DIVAS	Data Integration and Video Aggregation System
DMS	Dynamic Message Signs
DSRC	Dedicated Short-Range Communication
DSS	Decision-Support Systems
DTOE	District Traffic Operation Engineer
DVMT	Daily Vehicle Miles Traveled
EFC	Electronic Fare Collection
ESS	Environmental Sensing Station
EVP	Emergency Vehicle Preemption
FDOT	Florida Department of Transportation
FHP	Florida Highway Patrol
FHWA	Federal Highway Administration

Acronym	Definition
FIN	Financial Identification Numbers
FLATIS	Florida's Advanced Traveler Information System
FMS	Freeway Management Systems
FMTP	Freight Mobility & Trade Plan
FRAITS	Freight Advanced Traveler Information System
FSP	Freight Signal Priority
FTE	Florida Turnpike Enterprise
FTP	Florida Transportation Plan
GPS	Global Position Systems
HERE	A company which provides mapping data and related services.
HRI	Highway-Rail Intersection
HSR	Hard Shoulder Running
ICM	Integrated Corridor Management
ISIG	Intelligent Traffic Signal System
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
ITSA	Intelligent Transportation Society of America
IVR	Interactive Voice Response
LAN	Local-Area-Networks
LAP	Local Agency Program
LCS	Lane Control Signals
MAP-21	Moving Ahead for Progress in the 21st Century
MDOT	Maryland Department of Transportation
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Device
MVDS	Microwave Vehicle Detection Systems
NHS	National Highway System
NOCoE	National Operations Center of Excellence
O&M	Operations & Maintenance
OBU	Vehicle On-Board Units
ORT	Open-Road Tolling
PD&E	Project Development and Environment
PE	Preliminary Engineering
PEG	Performance Enhancement Goals
PFA	Priority Focus Area

Acronym	Definition
P-PEG	Project-Performance Enhancement Goals
PTI	Planning Time Index
RCTO	Regional Concept of Transportation Operations
REL	Reversible Express Lanes
RFID	Radio Frequency Identification
RISC	Rapid Incident Scene Clearance
RITIS	Regional Integrated Transportation Information System.
RITSA	Regional Intelligent Transportation System Architectures
RoS	Routes of Significance
RRSP	Road Ranger Service Patrol
RSE	Roadside Equipment
RTMC	Regional Transportation Management Center
RTSMIP	Real-Time System Management Information Program
RWIS	Road Weather Information System
SELS	Statewide Express Lane Software
SEMP	Systems Engineering Management Plan
SHS	State Highway System
Signal-4	Signal Four Analytics
SIRV	Severe Incident Response Vehicles
SIS	Strategic Intermodal System
SMART	Specific, Measurable, Achievable/ Accountable, Relevant and Time-bound
SOP	Standard Operating Procedure
SPaT	Signal Phase and Timing
STAMP	Statewide Arterial Management Program
STEP	Statewide TSM&O Excellence Program
STEOO	State Traffic Engineering and Operation Office
SWAT	Statewide Acceleration Transformation
TERL	Transportation Engineering Research Laboratory
THEA	Tampa Hillsborough Expressway Authority
TIM	Traffic Incident Management
TMC	Traffic Management Center

Acronym	Definition
TPAS	Truck Parking Availability System
TPO	Transportation Planning Organizations
TSM&O	Transportation Systems Management and Operations
TSMCA	Traffic Signal Maintenance and Compensation Agreement
TSOC	Traffic Signal Operation Center
TSP	Transit Signal Priority
TTI	Travel Time Index
UF	University of Florida
UPS	Unified Payment System
UPS	Uninterruptible Power Supply
USDOT	United States Department of Transportation
USF	University of South Florida
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
VSL	Variable Speed Limits
VWIM	Virtual Weigh-in-Motion
WAN	Statewide ITS Wide-Area Network
WSDOT	Washington Department of Transportation
WWD	Wrong Way Driving

Appendix D – Strategic Plan Development Process

Strategic Plan Purpose
The purpose of the Strategic Plan is to provide the framework and tools to move TSM&O toward an optimized, mainstreamed program delivering system-wide safety and mobility benefits. The Strategic Plan covers a time horizon of three to five years.

Strategic Plan Development Approach
This Strategic Plan is a major update to previous TSM&O and ITS Strategic Plans. It was developed following direction from the DTOEs and the TSM&O Leadership Team. The Strategic Plan was developed by the TSM&O Division of the STEOO with collaboration from the TSM&O Task Team, District TSM&O Program Engineers and staff, other offices and divisions from FDOT's Central Office and District Offices, and industry stakeholders.

The TSM&O Leadership Team, comprised of representatives of FDOT senior leadership from both the Central and District Offices and DTOE, provided guidance and expectations for the plan. The TSM&O Task Team reviewed the outline and drafts and provided input on specific topics during and between Task Team meetings. Other offices and units of FDOT provided input including: Policy Planning, Systems Planning, Environmental Management (PD&E), Freight Logistics and Passenger Operations (Motor Carrier Operations and Transit), Finance and Administration (Work Program and Budget), and Traffic Services within STEOO.

Prior to adoption, the Strategic Plan was presented to the FDOT Directors at their statewide meeting and twice to the FDOT Executive Leadership team. The final presentation on August 16, 2017 resulted in adoption of the TSM&O Strategic Plan as an official FDOT document.

Strategic Plan Development Themes
Based on the input received throughout the collaborative development process, the Strategic Plan was developed to address the following general themes:

- Mainstream – enhance TSM&O mainstreaming across functional elements of FDOT.
- Identify – innovation, emerging technologies, strategies, tools and resources.
- Prioritize – statewide and regional TSM&O focus areas.
- Develop – partnership frameworks, resource realization plans, organizational frameworks, processes, standards, specifications, policies, guidelines, and training.
- Implement – PFAs including pilot projects, research projects, test beds, strategic partnerships, stakeholder development, and regional and statewide deployment.
- Operate and Maintain – quantification and allocation of resources, policies, procedures, and scope templates, funding for O&M, and leverage District support and TSM&O teams.
- Measure Effectiveness – define, monitor, and measure performance.

Mainstream TSM&O across FDOT Functional Elements
Mainstreaming is a PFA with details provided in Section VI, "TSM&O Mainstreaming".

Identify TSM&O Strategies and Tools
In response to the need for consistent TSM&O strategy definitions, Appendix A was created. It defines over 50 facility-, modal-, and mobility-centric TSM&O tools that support attainment of the Goals, PEG, and P-PEG. Appendix A provides high-level summaries of each TSM&O tool, associated performance metrics, and references for more information on development, delivery and outcomes of the TSM&O tool.

continued on next page

Prioritize TSM&O Focus Areas
In response to the need for PFAs, Section V, "Roadmap to Achieving TSM&O Goals", was developed. Section V identifies seven PFAs for achieving the Goals, PEG, and P-PEG described in Section I. The TSM&O PFAs are: TSM&O mainstreaming, arterial management, connected vehicles, express lanes, freeway management, information systems, and integrated corridor management. These TSM&O focus areas were identified through collaboration with the District Traffic Operations Offices and other units of the FDOT Central Office such as Systems Planning, Policy Planning, PD&E, Design, Construction, Maintenance, Work Program, and through focused "Big Idea" sessions.

TSM&O Program Development
TSM&O program development discussions focused on FDOT staffing resources from organizational, training, and funding perspectives. The training materials and TSM&O tool guides and manuals are the keys for continuing program development and improvement to support the TSM&O Vision and Goals. Section VII, "TSM&O Resources", addresses each of these program development topics in detail.

TSM&O Implementation
Section V, "Roadmap to Achieving TSM&O Goals", provides an approach as to where, when, and how to accomplish each of the PFAs besides mainstreaming. As noted, mainstreaming is addressed in Section VI.

TSM&O Operations and Maintenance
Section V, "Roadmap to Achieving TSM&O Goals", provides details of on-going efforts to both continue and enhance support for TSM&O O&M.

Performance Metrics and Measuring Effectiveness
Section I, "TSM&O Vision, Mission, and Goals", and Section V, "Roadmap to Achieving TSM&O Goals" identify near-term performance metrics, Goals, PEG, P-PEG and the approach for measuring effectiveness. While most TSM&O tools support multiple performance metrics and goals, the consensus reached for this Strategic Plan was to focus primarily on mobility performance metrics.

FDOT

TSM&O

Transportation Systems Management & Operations

Managing and Operating for an Efficient Transportation System