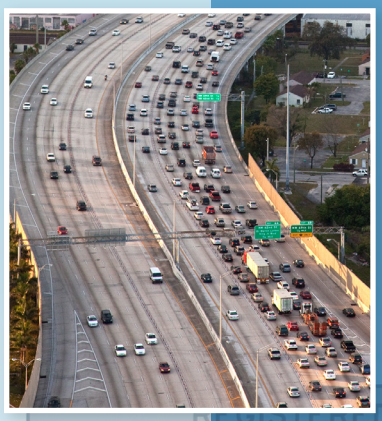
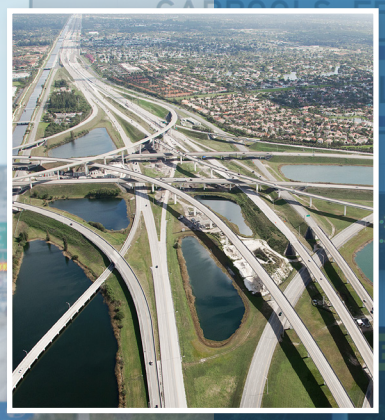
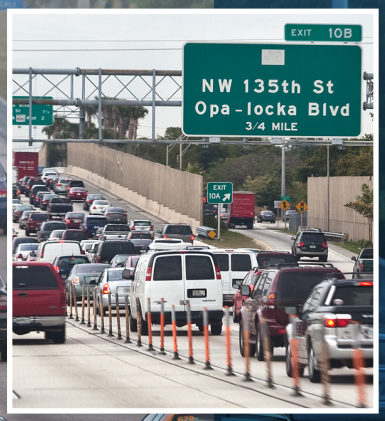
Managed Lanes **GUIDEBOOK**

2022







FLORIDA DEPARTMENT OF TRANSPORTATION
SYSTEMS IMPLEMENTATION OFFICE

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1 INTRODUCTION

1.1 Preface

In support of the Florida Department of Transportation's (FDOT's or Department's) vision of providing a safe and congestion free transportation network, it is the policy of the Department to employ managed lanes on appropriate facilities that currently, or are expected in the future, to experience significant congestion. Because every corridor or system is different with its own unique operating characteristics, the Department will operate managed lanes in a manner individually designed to increase capacity and maximize throughput on the specific system. Managed lanes are defined as highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions.

The Department will prioritize congestion management and maximize throughput on these key facilities through managed lanes vehicle eligibility standards, access control, pricing, incentives, and other available techniques. This is a key policy used to achieve the Department's mission. In order to achieve the Department's mission and to remain one of the top DOTs in the country, the Secretary has implemented the Department's Vital Few: improve safety, enhance mobility, inspire innovation, and foster talent.

The Department's Vital Few should be at the forefront of everything the Department does as it continues to serve the residents and visitors of Florida. Consistent with the Vital Few, the Department continues to implement managed lanes statewide to provide congestion relief in areas experiencing prolonged periods of congestion that cause increased travel delays and impact quality of life. In many of these key locations, transportation demand is increasing and opportunities for future widenings are limited.

1.2 Purpose

The purpose of the ***FDOT Managed Lanes Guidebook*** (Guidebook) is to provide guidance for implementation of the Department's *Managed Lanes Policy, Topic No. 000-525-045*. This Guidebook is intended to be used during the development, implementation, and operations of managed lanes on the following facilities:

- Interstate System,
- Florida's Turnpike Enterprise (FTE) System, and
- Non-interstate limited access facilities on Florida's State Highway System (SHS).

This Guidebook is designed to work in conjunction with other FDOT manuals, procedures, handbooks, guidebooks, and design criteria used in the development, implementation, and operation of FDOT projects.

1.3 Scope

This Guidebook is intended for use by Department staff and practitioners who conduct work on behalf of the Department in the area of managed lanes. It includes information and guidance on project identification and development, operational strategies, facility types, screening of managed lanes, tolling, express lanes software, design considerations, operations and maintenance (O&M), mobility performance reporting, and funding and financing.

The following types of managed lanes facility types are discussed in this guidebook:

- Express Lanes- Express lanes are a type of managed lanes where congestion is managed with vehicle eligibility, separation and access control, and pricing incentives
- Bus Only Lanes- According to NCHRP Research Report 835, bus-only lanes, transitways and busways are managed lanes dedicated primarily for buses. The goal of bus-only lanes is to make public transportation a more desirable option by reducing trip times and improving travel time reliability.
- Long Distance Trip Lanes (Thru Lanes)- Thru lanes are separated from GUL with limited entrance and exit points that serve long distance trips by isolating traffic that does not need to access a certain area within the corridor.
- Truck Only Lanes- Truck-only lanes are a managed lanes facility type that separate heavy vehicles from mixed-flow traffic along a highway mainline and allows for the exclusive use of trucks.
- Part Time Shoulder Use (PTSU)- PTSU is the temporary use of the left or right shoulders of an existing roadway for travel, typically during the peak periods when capacity is needed most. All requests to implement PTSU are made on a case-by-case basis and must be approved by the Chief Engineer.
- Connected and Automated Vehicle (CAV)- CAV only lanes use vehicle eligibility strategy by providing one or more separate lanes exclusively for CAVs.
- Reversible lanes- Dedicated freeway lanes that serve directional peak period demands.
- Carpool 3+ lanes- Lanes reserved or dedicated for passenger vehicles carrying a minimum of three people in the vehicle.

2 PROJECT IDENTIFICATION AND DEVELOPMENT

2.1 Project Identification

Project identification for managed lanes, as part of new capacity on the SHS, initially includes a high-level consideration of various planning, traffic operations, geometric, and other factors that are specific to each corridor. The screening of managed lanes strategies starts in the Planning phase of the project development process and is primarily based on the future anticipated traffic demand, both cars and heavy vehicles, along the corridor. Traffic, along with the other considerations, helps identify whether a particular managed lanes strategy should be further evaluated during the PD&E phase of the process. The initial planning and programming of improvement projects is performed by the Districts. Some of the basic considerations for managed lanes project identification are summarized in ***Figure 2-1*** below.

Managed Lanes Guidebook

CONSIDERATIONS

FDOT

Key Considerations

The more considerations that can be answered "Yes", the more favorable the project is to managed lanes.

If these considerations cannot be met, some mitigation may be implemented before developing the project as managed lanes. Any particular "No" answer does not mean a managed lanes project is not warranted.

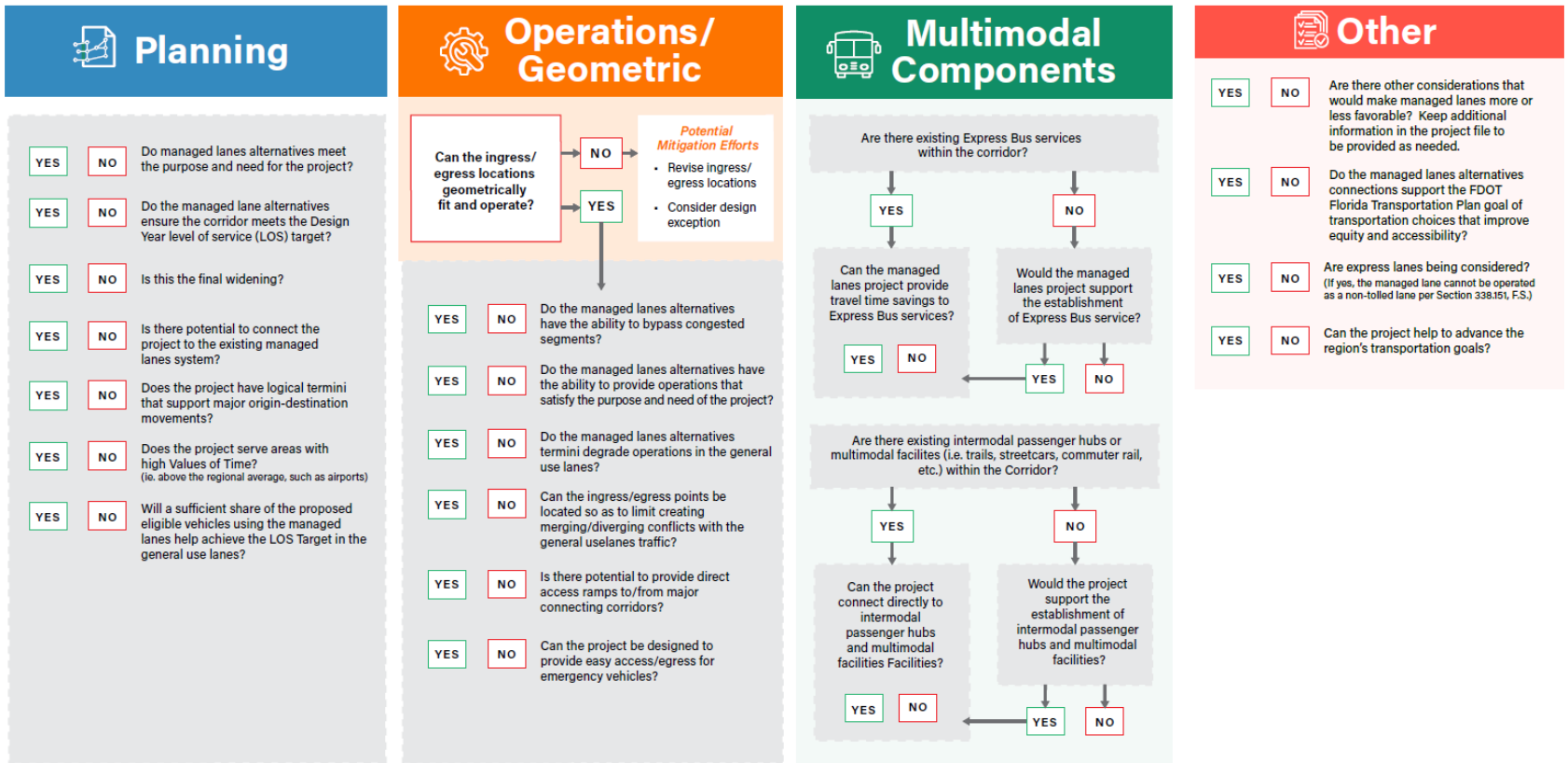


Figure 2-1 Project Identification Considerations

The project identification process is closely coordinated with the ***SIS Plan***. The ***SIS Plan*** includes a funded, cost-feasible component, known as the SIS Funding Strategy, as well as an unfunded, long-term needs component. Coordination with the SIS planning process ensures statewide consistency and facilitates prioritization of project funding needs.

If managed lanes are identified, it is important to coordinate during the Planning and PD&E phases, or as early as practical, regarding the managed lanes strategy proposed for the corridor. The preferred approach is to provide two (2) managed lanes in each direction. This allows the recommended managed lanes strategy to operate safely while achieving the desired mobility goals. Evaluation of pricing incentives is recommended if no additional capacity projects are anticipated for the corridor after the current project, but may also be considered for any managed lanes project. The number of general use lanes (GUL) or general toll lanes (GTL) should remain the same as under the No-Build scenario if express lanes are the recommended strategy.

2.2 Project Coordination

Managed lanes projects require coordination with multiple offices within the Department.

2.2.1 Managed Lanes Planning Team

The Managed Lanes Planning Team coordinates agencywide to facilitate statewide consistency for managed lanes project development. This team consists of representatives from the SIO, the TEO, and FTE.

2.2.2 Central Office

Managed lanes projects are also coordinated with other offices to include the subject matter experts (SMEs) from offices including Project Finance Office (PFO), TEO, Maintenance, Design, Freight Logistics and Passenger Operations, and Planning. The Managed Lanes Planning Team will coordinate with these offices and SMEs as well as with the General Counsel's Office, as needed. Communication with the Chief Engineer will also be coordinated through the Managed Lanes Planning Team.

2.2.3 District

The District is responsible for identifying a multi-disciplinary core team that will be involved throughout project development, including representatives from Planning, PD&E, Design, Construction, Operations, Maintenance, and Public Involvement.

The District is responsible for leading all feasibility assessments for a proposed project. Refer to Chapter 3 for other considerations. Design elements that must be considered during the Planning phase include:

Network Connections – Network connections provided by direct access to other facilities of regional significance expands the potential number of facility users by providing continuous trips to major roadways and facilities like park-and-ride lots and transit facilities.

Access Points – Determine the appropriate amount, distance between, and location of access points to the managed lanes. The District responsibilities include considering the end users when defining segments of the managed lanes and understanding the market share that will be captured based on the access provided. (See Section 3.2.2)

Tolling Locations (if applicable) – Managed lanes access points are the preferred location of tolling and data gantries. The location and length of individual segments of the managed lanes will also be considered when determining additional tolling locations. The District responsibilities include considering the trips that are being provided based on segmentation and how the tolling configuration layout must be provided to capture all trips and major network connections. (See Section 6.3)

The District Transportation Systems Management and Operations (TSM&O) Office will provide support during the design phase with direct input on design features including, but not limited to, ITS, signage, ingress and egress, incident management staging, and other operational features specific to the project. Additionally, the District TSM&O Office will support the updates and development of Systems Engineering documentation. (See Chapter 8)

During the construction phase of a managed lanes project the District TSM&O Office will utilize their resources as needed to serve as a liaison between the contractor responsible for system implementation and the design team. The District TSM&O Office will work with the construction engineering inspection (CEI) team to support construction in reviewing shop drawing submittals and responding to comments.

The District TSM&O Office is responsible for integrating all new ITS field devices into SunGuide®, as well as configuring the express lanes facility in the Statewide Express Lane Software (SELS).

The District will coordinate, as required, with FTE as it relates to the construction, testing, and acceptance of the tolling devices, toll building, and toll gantry. The District will coordinate with FTE on the preferred location of tolling and data gantries (access points are a factor that determine where gantries are placed). The District will also coordinate with FTE to facilitate end-to-end testing for each tolling corridor.

Operational strategies that impact the managed lanes will also be the responsibility of the District TSM&O Office to plan for and manage. This includes Traffic Incident Management (TIM) services, management, and coordination of Road Rangers, and facilitating Florida Highway Patrol (FHP) hire back contracts (if warranted). Other operational strategies include management of ramp metering and arterial operations when applicable.

2.2.4 Florida's Turnpike Enterprise

If the proposed managed lanes include pricing, coordination with the Managed Lanes Planning Team is required. The Managed Lanes Planning Team will facilitate the coordination with FTE. Coordination should be initiated during Planning, PD&E, or as early as practical during project development, but no later than the start of toll plan development. For more information on coordination with FTE for tolling projects. (See Chapter 6)

2.3 Project Development

The project development process for managed lanes includes preparation of a corridor phasing plan, data collection, and traffic analyses, as well as a detailed access plan.

2.3.1 Corridor Phasing Plan

A corridor phasing plan identifies the ultimate corridor configuration as well as the individual projects that can be constructed and operated on an interim basis until the ultimate corridor is fully operational. Corridor phasing plans identify the project sections, the order in which these will open to traffic, and the phasing of the managed lanes

components within each section. The traffic analysis and the access plan, as well as other factors, help facilitate development of the corridor phasing plan. Phasing of the project may result in refinements to the project limits originally identified in the Work Program or early planning efforts, such as a Master Plan.

Each phase of the project should be designed in consideration of the ultimate corridor configuration in order to minimize rework and utilize as much of the interim infrastructure as possible. Access points, sign structures, and toll/data gantries (if applicable) are placed in their ultimate locations, when feasible. Each phase of the corridor phasing plan is documented in a managed lanes diagram, as detailed in Section 2.3.2.1.

2.3.2 Access Plan

An access plan is a key input to traffic analysis as it helps to identify eligible trips. Development of an access plan begins during Planning and PD&E and is finalized when the project moves forward in Design.

Locating access points should be based off an origin-destination (O-D) study and include input from various technical disciplines, including Planning, PD&E, Design, and Operations. It is also important to communicate potential access point locations with the public during a project's public involvement and outreach efforts. The access plan development is coordinated with the Managed Lanes Planning Team.

A key objective of an access plan is to minimize weaving and provide a safe condition for users entering and exiting the system. The access plan should also reflect the unique operating characteristics of the corridor and be used to achieve project-specific goals, such as encouraging longer-distance trips or promoting carpooling and transit usage. The access plan includes the number of managed lanes, location of access points, access types, and separation type. The final access plan should be consistent with the final traffic analysis and reflect the final corridor phasing plan.

When developing an access plan for managed lanes, it is important to consider the number of interchanges along the managed lanes corridor, as well as the length of the corridor segments and the percentage of trips estimated to be eligible to use the managed lanes. Eligible trips are defined as trips that have the ability to enter and exit the managed lanes based on their origin and destination.

2.3.2.1 Managed Lanes Diagram

A managed lanes diagram shows the number of lanes, access points, destination signs, first available interchange exit and entrance, separation type, and work program financial project identification (FPID) project limits. Each interim phase should be independent and fully operational after construction is complete. Testing of each toll segment should occur within the associated FPID limits. An example of a managed lanes diagram is shown in ***Figure 2-2***. The managed lanes diagram is a tool used to capture the overall concept in a stick-figure format. For illustrative purposes, the diagram shown includes an example of an express lanes facility. Development of a managed lanes diagram should begin in the Planning and PD&E phases of the project. The diagram should be updated throughout project development, to reflect the latest configuration.

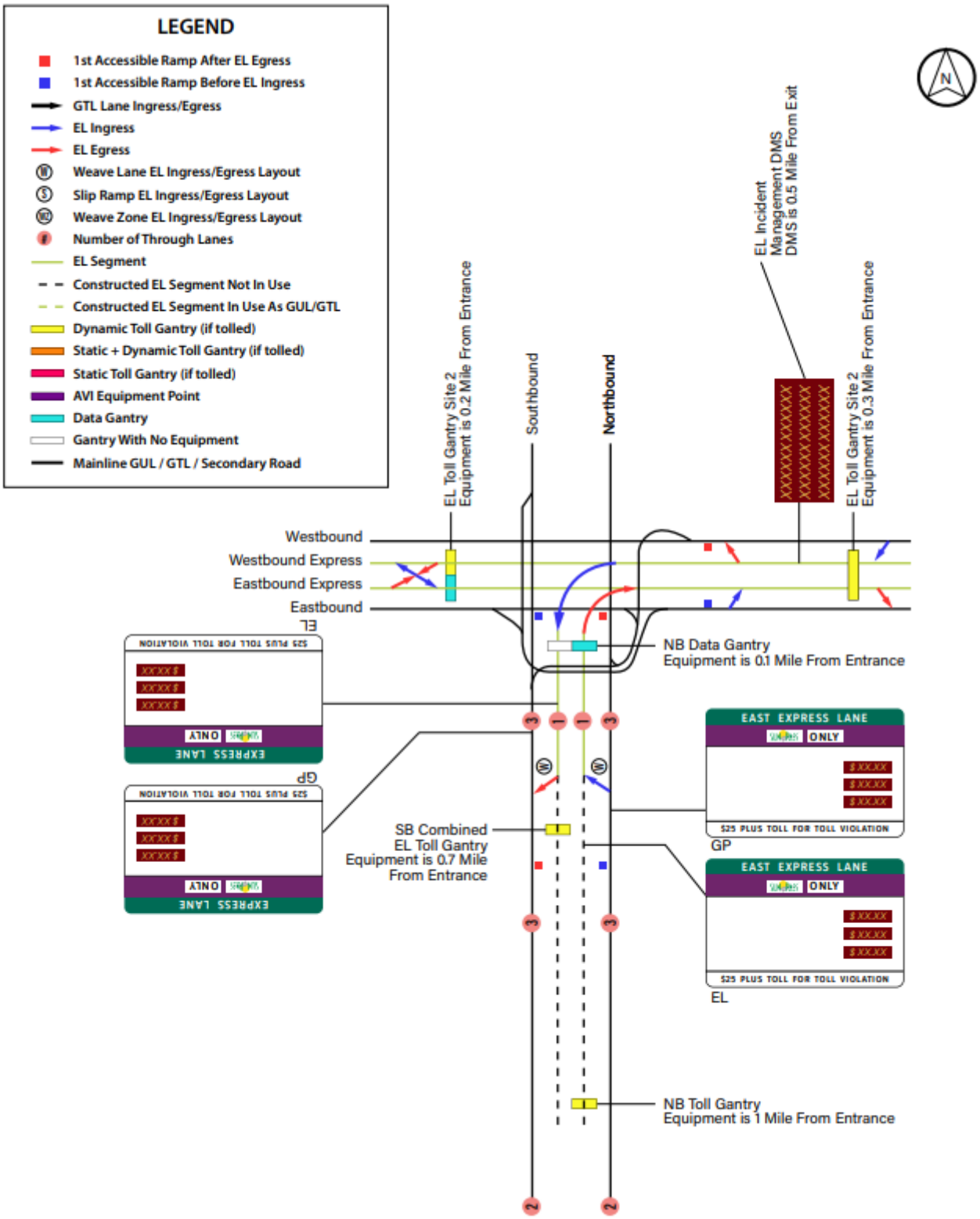


Figure 2-2 Managed Lanes Diagram Example

2.3.3 Traffic Forecasting and Analysis for Managed Lanes

A project traffic forecast and analysis is used in the development of managed lanes projects to ensure that the project will operate acceptably without adverse impacts to the adjacent GUL or GTL, as well as the existing interchanges. The demand to use managed lanes is affected by many factors including roadway network and traveler characteristics. Traffic analysis includes collection of O-D data and a traffic safety and operational analysis.

The traffic analysis can be documented in a Master Plan Planning Study, a Project Traffic Analysis Report (PTAR), and/or an IAR during the Planning or PD&E phase. Refer to the FDOT Project Traffic Forecasting Handbook, FDOT Traffic Analysis Handbook, FDOT Interchange Access Request User's Guide, the FDOT PD&E Manual Part 2 Chapter 2, the Highway Capacity Manual (HCM), and the Highway Safety Manual (HSM) for additional requirements.

2.3.4 Interchange Access Request

The implementation of managed lanes projects may result in changes or modifications to existing interchanges. Some examples include direct connections with adjacent facilities and the addition of complex weaves zones. Refer to the FDOT Interchange Access Request User's Guide for more information on the requirements and coordinate with the District Interchange Review Coordinator (DIRC).

2.4 Project Development and Environment

The managed lanes alternative developed and evaluated as part of the PD&E phase, should utilize the latest version of ***FDOT's PD&E Manual, Topic 650-000-001*** for guidance related to preliminary engineering, alternatives analysis, engineering considerations, and other PD&E requirements. Any project that includes managed lanes will require coordination with the District TSM&O Office during the PD&E phase. This includes the development of a Concept of Operations (ConOps) and system requirements as described in ***Florida's Statewide Systems Engineering Management Plan (SEMP)***. This may also include coordination with adjacent Districts for multi-jurisdictional projects.

2.4.1 Concept of Operations

In accordance with FDOT Systems Engineering and Intelligent Transportations Systems Architecture, Procedure 750-040-003c, ITS projects are required to conform to the applicable Regional Intelligent Transportation System Architecture (RITSA) and to develop a ConOps. The ConOps is the document in which the project stakeholders detail their shared understanding of the whole system to be developed and how it will be operated and maintained. It is a user-oriented document that describes a system's operational characteristics from the end user's viewpoint. A ConOps document is a system level detail of the portion of the Operational Concept (OpsCon) in the RITSA.

A ConOps is developed as part of the larger system engineering process that describes the managed lanes system, including operational scenarios, incident management, and maintenance. This planning-level document is based on the ***SEMP***. The ConOps defines system elements and capabilities, user needs, geographical and physical extent, and stakeholder roles and responsibilities. Stakeholders can include operators, emergency responders, law enforcement, maintenance providers, local governments, transit agencies, customers, and others.

The managed lanes system is defined by two (2) levels of ConOps: regional and project-specific. A regional concept of transportation operations (RCTO) may be developed to establish a high-level managed lanes network, identify

stakeholders, and roles and responsibilities. As specific projects within a corridor are identified, the District develops project ConOps during the PD&E phase. When a project is implemented in phases, or a series of closely related projects are in development along a corridor, the project ConOps is developed to address the project being implemented and the implementation of the larger system of projects. Major elements for each level of ConOps are summarized in ***Figure 2-3***.

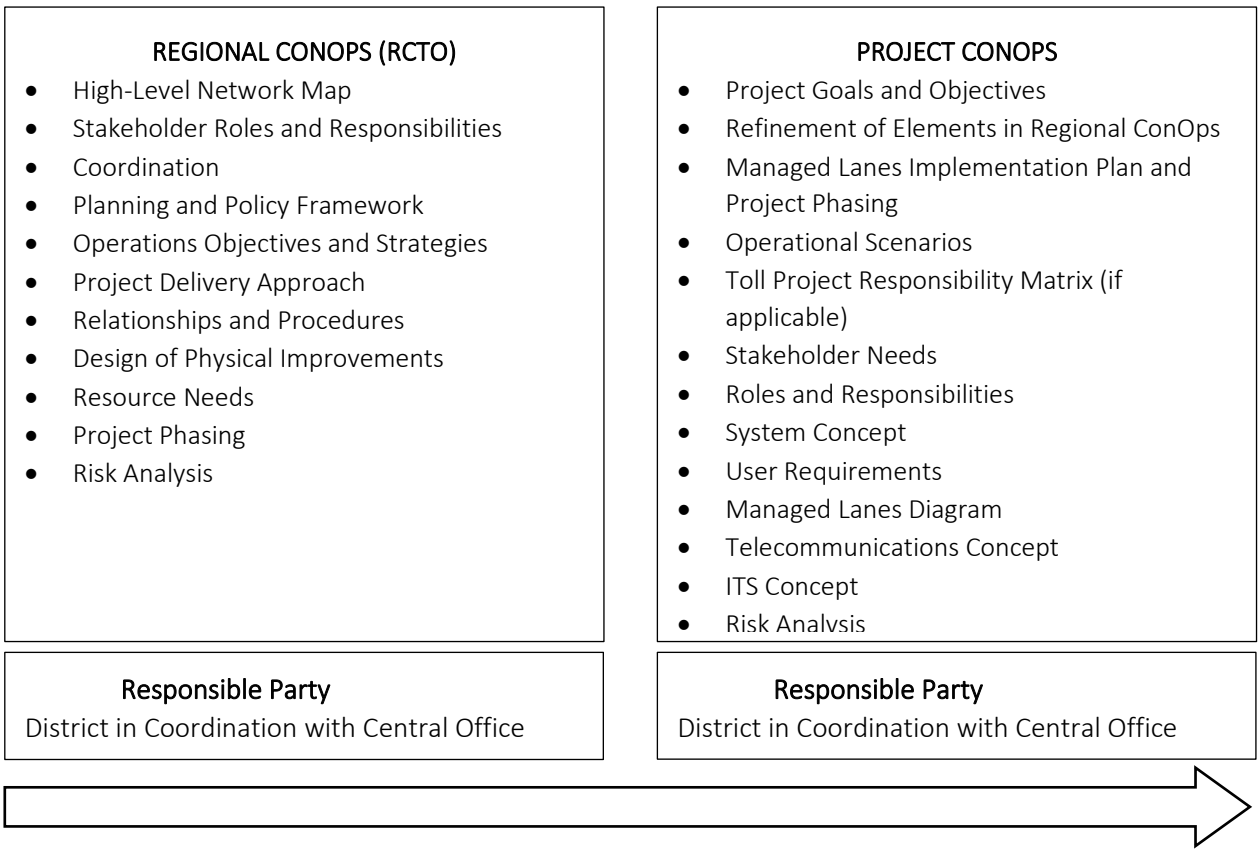


Figure 2-3 Major Elements of a ConOps

The regional and project operations influence many aspects of managed lanes design. Any change to the managed lanes, GUL, or GTL, including access, toll gantry locations, or signing, can impact the operations of the project and those of an adjacent project or the overall corridor. Therefore, all changes to these elements are reviewed against ConOps documents, as necessary. Changes identified early in the project development process have fewer cost, scope, and schedule impacts than those changes made later in the process.

2.4.2 Project Concept of Operations

The project ConOps is typically developed during the PD&E phase and considers the concept of operations for the PD&E project limits in the context of the larger network. The purpose of a project ConOps is to document user needs and operational scenarios which can be used to ensure that operational needs are considered in the design and phasing of a project. For example, some corridors will operate under interim conditions as projects initially open to traffic until all projects along the entire length of the corridor are completed. In other cases, a corridor will not open until all managed lanes projects within that corridor are ready to be open to traffic. Therefore, it is important that the managed lanes diagram for the corridor ConOps is developed for interim and ultimate configurations and align with the corridor phasing plan. The project ConOps is updated as the system and operational roles and procedures are refined.

3 MANAGED LANES OPERATIONAL STRATEGIES

Managed lanes are implemented to provide congestion relief. Because every corridor or system is different with its own unique operating characteristics, managed lanes should be operated in a manner individually designed to maximize throughput on the specific system.

The three primary operational components used for developing managed lanes are vehicle eligibility, separation and access control, and pricing incentives. Managed lanes facility types are determined on a project-by-project basis and can be implemented using any combination of these operational strategies to best meet the needs of a system.

3.1 Vehicle Eligibility

Vehicle eligibility refers to management based on the user group or vehicle type permitted in managed lanes. Vehicle eligibility controls what types of user groups or vehicles may be either allowed or restricted to increase overall throughput and achieve other transportation management goals established for the corridor.

An example of a user group eligibility restriction on managed lanes is vehicle occupancy. Minimum occupancy rates per vehicle can be required to be allowed to use the lanes. Managed lanes can also improve operations by separating vehicle types; vehicles may be allowed or not allowed to use the lanes based on vehicle classification—such as trucks, public transit vehicles, emergency response vehicles, motorcycles, and connected and autonomous vehicles. Examples from existing facilities in operation that separate vehicle types, include: requiring vehicles to have transponders, allowing public transit vehicles, and restricting multi-axle vehicles.

In addition to continuous application, vehicle eligibility may also be applied seasonally or during specified times of day.

3.2 Managed Lanes Separation and Access Control

Separation and access control work together to create separate lanes on a corridor that serve more regional, long distance trips. This is achieved through the type of separation, as well as the number and spacing of ingress and egress points along a corridor.

3.2.1 Managed Lanes Separation

Managed lanes are separated from the GUL or GTL. Determination of the appropriate separation type is typically made during the PD&E phase by the District and coordinated with the Managed Lanes Planning Team.

3.2.1.1 Separation Types

The following types of separation may be used on the Department's managed lanes projects:

A. Buffer Separation with Tubular Markers
   Pavement markings used in combination with a series of high-performance tubular pylons, called tubular markers.
B. Wide Buffer Separation
   An area of grass or pavement between the managed lanes and the GUL or GTLs. Wide buffers may include roadside safety elements such as guardrail, cable, and/or tubular markers.
C. Barrier Separation
   Continuous concrete walls with access gates provided periodically for emergency management.

D. **Grade Separation**
An elevated or depressed section of roadway, completely distinct from the adjacent corridor.

E. **Buffer Separation with Pavement Marking**
Use of double skip or solid striping. See Continuous Access in **Section 3.2.2.1**. **The use of pavement markings with no tubular markers to separate managed lanes may be considered; but require additional coordination and approval by the State Traffic Operations Engineer.**

3.2.1.2 Factors for Determining Separation Type

Design of separation types is included in FDM 211. The use of tubular markers must conform to the guidelines published in ***FDOT Standard Specification 704***.

The separation type is a critical design decision that influences the operation and constructability of a managed lanes project. Access type, construction cost, right of way (ROW) needs, operation and maintenance costs, safety and operational characteristics, enforcement needs, and TIM must be considered in determining the appropriate separation type.

Additional considerations should include maintaining corridor consistency, flexibility to accommodate future corridor growth and multimodal envelopes. Considerations of the different separation types are provided in ***Table 3-1***, below.

Table 3-1 Considerations of Separation Types

TYPE OF SEPARATION	CONSIDERATIONS
BUFFER SEPARATION WITH TUBULAR MARKERS	– Possible access violations – Reduced construction costs and ROW needs – Potential for additional costs for maintenance and enforcement – Improved access – Limited area for staging during recovery operations – Potential friction between high-speed managed lanes and low-speed general use lanes
WIDE BUFFER SEPARATION	– Possible access violations and wrong way driving maneuvers – Additional ROW requirements – Improved access – Additional staging area for emergency responders – Improved safety and operations
BARRIER SEPARATION	– Eliminates access violations – Additional ROW requirements – Increased response time due to limited access – Limited area for staging during recovery operations – Improved safety and operations
GRADE SEPARATION	– Eliminates access violations – Additional ROW requirements – Increased response time due to limited access – Limited area for staging during recovery operations – Improved safety and operations
BUFFER SEPARATION WITH PAVEMENT MARKING	– Possible access violations – Reduced construction costs and ROW needs – Potential friction between high-speed managed lanes and low-speed general use lanes – Potential for additional enforcement costs

3.2.2 Managed Lanes Access Control

Access control improves safety and manages congestion by providing ingress to or egress from the managed lanes at designated access points along the corridor. Access points are located at the start, end, and at intermediate points along the managed lanes corridor. Access point locations are determined based on the purpose of the project, origin and destination patterns, and existing interchanges and roadway infrastructure.

3.2.2.1 Access Types

The types of access on managed lanes projects include the following:

A. **Slip Ramps**
   A dedicated lane that accommodates movement either into or out of the managed lanes. Slip ramps do not allow for two-way movements.
B. **Weave Lanes**
   A dedicated lane that allows movements both into and out of the managed lanes.
C. **Weave Zones**
   A break in the managed lanes separation that allows for movements both into and out of the managed lanes. No additional pavement is provided.
D. **Direct Connect Ramps**
   A dedicated ramp used for high volume system-to-system connections, park-and-ride lots, and other major roadways.
E. **Continuous Access**
   Designed and operated much like GUL. Vehicles can enter and exit at any point. The use of continuous access may be considered; but must be coordinated with the Managed Lanes Planning Team and approved by the State Traffic Operations Engineer. This type of access is not compatible with managed lanes with a tolling component.

3.2.2.2 Factors for Determining Access Types

The advantages and disadvantages of each access type must be evaluated on a project-by-project basis and may also be evaluated for consistency among projects within a corridor. Selection of access types should be done in conjunction with the determination of separation type, as detailed in **Section 3.2.1**. Access points are designed in accordance with the criteria established in the FDM 211 and considerations in the FDOT Traffic Analysis Handbook.

Considerations for determining the access type are provided in ***Table 3-2***, below.

Table 3-2 Considerations for Determining Access Types

TYPE OF ACCESS	CONSIDERATIONS
SLIP RAMPS	– Additional pavement width required – Commonly used with barrier separation but can also be used with other separation types – Reduces the potential for unstable flow created by the speed differential between the managed lanes and the GUL or GTL
WEAVE LANES	– Allows the weaving and speed changes required for merging between the GUL or GTL and the managed lanes to occur in a separate lane – Consideration for transit operations when designing the required weave
WEAVE ZONES	– Does not require extra roadway width – Consideration for transit operations when designing the required length of weave – Not recommended for barrier-separated facilities due to safety and operational issues
DIRECT CONNECT RAMPS	– Requires sufficient demand for the ramp – High construction costs
CONTINUOUS ACCESS	– Low construction costs – May require increased enforcement – Prohibited for express lanes – Safety benefit from less weaving

3.2.2.3 Factors for Determining Access Locations

Factors that should be considered when choosing the most appropriate access locations and access types include, but are not limited to, the following:

A. **Project Traffic and Corridor Demand**
   Project traffic is used to determine how many lanes are needed in each direction. Project traffic forecasting methods are detailed in the FDOT Project Traffic Forecasting Handbook.

B. **O-D Patterns**
   O-D data analysis defines study area travel patterns for existing and design horizon years. O-D data can be collected and analyzed at the Planning or PD&E phase of a managed lanes project. Preliminary access points are proposed after O-D data analysis at locations with high frequency O-D pairs.

C. **Geometric Characteristics of the Corridor**
   For managed lanes, important geometric characteristics for locating access points are corridor length and spacing of interchanges. Access points should encourage long distance trips, bypassing two or more interchanges with each segment.

D. **Operational Characteristics of the Corridor**
   Traffic analysis identifies any potential operational or safety issues related to access locations. A tiered traffic analysis for access locations is recommended, with preliminary analysis during Planning and PD&E phases, and a detailed analysis during the Design phase. Consider interim and ultimate configurations during operational traffic analysis. Refer to the FDOT Traffic Analysis Handbook and FDOT Interchange Access Request User's Guide for guidance on operational analysis of access locations and weave segments.

E. Early Design Considerations

Locating access points requires an early review of possible design and ROW constraints. Maintain a minimum weave length of at least 1,000 feet per lane change for vehicles entering or exiting the corridor to or from the managed lanes, as specified in the FDM 211. Access points are located to avoid congestion points and high-incident locations and minimize queues at managed lanes termination points. Proposed access locations are evaluated using established design criteria as detailed in the FDM 211.

F. ITS/Signing

The signing sequence for managed lanes may extend several miles in advance of access points. Access points are located with adequate space for interim and ultimate signing requirements. For information regarding express lanes sign types and access signing sequences, refer to the Section 8.2 and Chapter 2, Signs, Section 2.42 Guidelines for Express Lanes Signing, Traffic Engineering Manual.

G. Transit Service and Park-and-Ride Lot Locations

Transit services in managed lanes increase capacity and person throughput and help reduce overall corridor congestion. Consider locating park-and-ride lots in alignment with the corridor's major origins and destinations to encourage use of transit services. A transit ridership forecast helps ensure adequate demand for transit services. For express bus service planning guidelines, see the FDOT Express Bus / Express Lanes Systems Planning Guidelines.

H. Impacts to the Environment

The environmental impacts of managed lanes projects, including the location of access points, are evaluated through the PD&E process. For more information, refer to the PD&E Manual, Topic No. 650-000-001.

I. Construction Cost

Construction cost varies depending on the type of access and lane separation technique provided. While cost is an important consideration in the process of locating ingress and egress points, traffic volume and safety should be considered before cost when selecting the appropriate access type.

J. Tolling Infrastructure (Express Lanes Only)

For express lanes, toll gantries are located within one (1) mile to the ingress point to minimize travel time from the Toll Amount Sign (TAS) to the toll gantry. Identifying tolling infrastructure, including locations, is coordinated with FTE through development of a Toll Siting Technical Memorandum (TSTM). Additional information on tolling for express lanes is included in Chapter 6.

It is important to communicate potential access point locations to the public during a project's public involvement and outreach efforts. During the Planning phase, managed lanes strategies are identified based primarily on the future traffic demand along the corridor. Data such as speed, volume, and O-D are collected. An initial managed lanes diagram including initial location of access points, number of managed lanes, and type of separation is prepared. A high-level screening of the managed lanes strategies is performed using a planning tool such as HCS.

During the PD&E and Design phases of the project, the design concept is developed including elements such as ROW, signing, and tolling, if applicable. A project ConOps is also prepared. Internal stakeholder meetings are held throughout the process to obtain agreement on the concept and the general locations of the access points. Following this, the project moves to the Public Alternatives Meeting.

A detailed analysis is performed next using microsimulation to finalize the managed lanes concept and access point locations. An internal stakeholder meeting is held to discuss the final managed lanes concept and the access

locations. If revisions are suggested, then the concept is reanalyzed. Upon agreement by the stakeholders, the project proceeds to public hearing/meeting.

With all these considerations, a methodology for determining access points is outlined in ***Appendix C***. This flowchart shows the project phases and the major tasks to be completed within each phase. A simplified version is shown below.

3.2.2.4 Considerations for Direct Connect Evaluation

Providing a direct connection between managed lanes and the GUL or managed lanes of another system requires an evaluation of traffic in the corridor to determine whether there is sufficient demand for the ramp. The following are considered when evaluating the feasibility of direct connect ramps:

A. **Assessment of Directional Design Hourly Volume**
   If the directional design hourly volume (DDHV) on managed lanes to managed lanes ramps exceeds 400 vehicles per hour (vph) for a single lane, then a ramp is feasible. DDHVs greater than 1,700 vph warrant dual lane ramps.

B. **Determination of Benefits**
   The determination of the incremental benefits of a proposed managed lanes to managed lanes ramp is assessed through a comparison with a slip ramp connection. Once demand projections are determined for each scenario, an operational analysis is performed in accordance with the FDOT Traffic Analysis Handbook. The demonstrated tangible benefits to the operation of the system are assessed through reduced weaving volumes and improved speeds.

C. **Consideration of Cost**
   The total additional costs attributed to the implementation of the managed lanes to managed lanes ramps are compared to the potential incremental benefits.

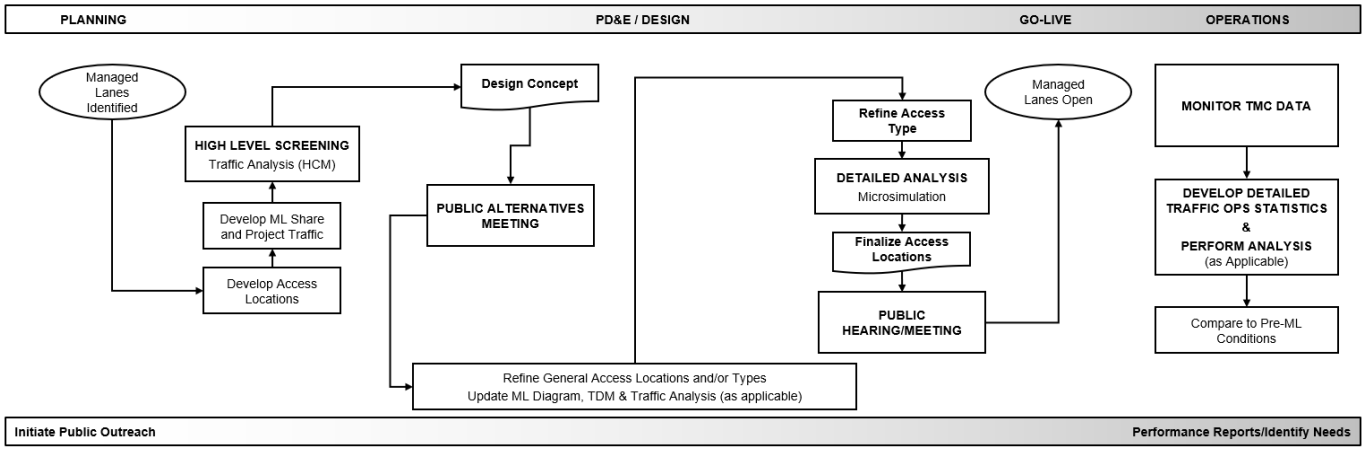


Figure 3-1 Access Point Location Flowchart (Simplified)

3.3 Managed Lanes Pricing

Managed lanes that use pricing, or tolling, as a way to manage congestion to provide a more predictable travel time are called express lanes. For limited access non-Turnpike facilities, pricing can be used to promote free-flow travel, which is the Department's primary performance measure for express lanes. Per 14-100.003 FAC, free flow for express lanes means conditions under which travel is unimpeded and motor vehicles can safely operate at speeds of at least 45 miles per hour (mph) in the express lanes.

3.3.1 Tolling Strategies

A corridor's tolling strategy may evolve over time to address the changing needs of the system. See **Chapter 7** for more information on Statewide Express Lanes Software (SELS) and Toll Setting Parameters, respectively.

Dynamically priced express lanes are tolled based on demand in the express lanes, with a goal of maintaining safe operating speeds of at least 45 mph. The minimum toll amount is $0.50 per express lanes toll segment, as stated in 14-100.003, FAC. If the average travel speed in express lanes falls below 40 mph (average travel speed is calculated from the customer's entry point to the customer's exit point), the minimum toll amount is charged, as stated in Section 338.166 (5), F.S.

Different types of tolling strategies used for Florida's managed lanes include:

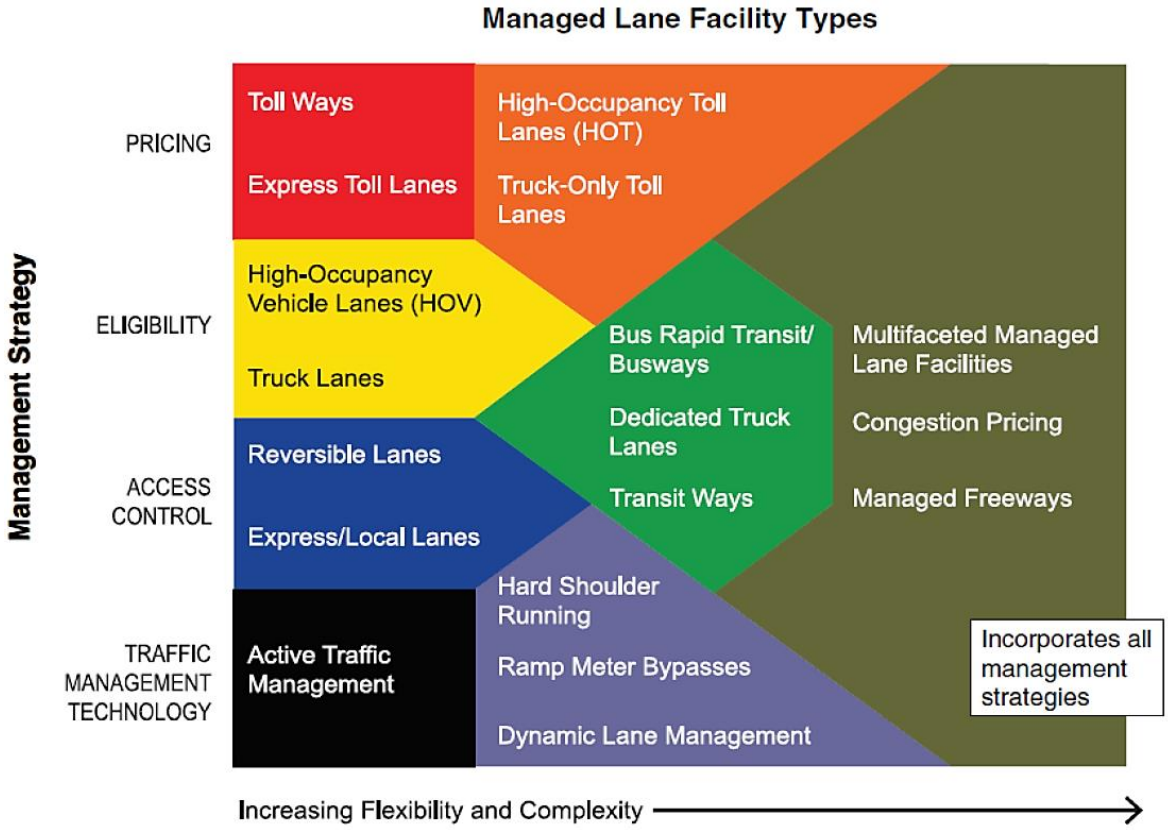
A. **Static Tolling**
   Fixed toll amounts that are pre-determined and applied during all hours of the day.

B. **Time of Day (TOD) Tolling**
   Fixed or varying toll amounts that are adjusted according to a pre-determined established schedule.

C. **Dynamic Tolling:**
   Varying toll amounts are adjusted based on real-time monitoring of traffic conditions in the express lanes.

4 MANAGED LANES FACILITY TYPES

The purpose of managed lanes is to provide a proactive alternative to improve or maintain operations along a facility. ***Figure 4-1***, is an example of how different operational strategies can be combined to create managed lanes facilities.



Source: NCHRP Research Report 835: Guidelines for Implementing Managed Lanes

Figure 4-1 Managed Lanes Facility Types and Strategies

Managed lanes can implement one or more of the above strategies, depending on limitations and complexity. The following sections describe the managed lanes facility types typically considered in Florida.

4.1 Express Lanes

Express lanes are a type of managed lanes where congestion is managed with vehicle eligibility, separation and access control, and pricing incentives. Express lanes are implemented to address existing and future congestion, enhance transit services, accommodate future regional growth and development, and improve system connectivity between key limited access facilities. Express lanes are separated from GUL and provide optional travel lanes for vehicles with two axles such as passenger cars. In addition to vehicle eligibility, express lanes also use access control and pricing. Access is controlled using limited entrance and exit points that usually serve longer, regional trips. Pricing refers to static, TOD, or dynamic tolls during times with high demand such as peak travel periods. The two examples of express lanes shown below in ***Figure 4-2*** are of I-95 Express Lanes in Miami-Dade and Broward County, Florida, which use a 2–4-foot buffer and tubular markers for lane separation.

Figure 4-2 Express Lanes Examples

4.1.1 Additional Considerations for Express Lanes

The additional considerations for express lanes are based on project experience and lessons learned from project development, implementation, maintenance, and operations. Additional considerations specific to other types of managed lanes will be developed in future iterations of this Guidebook based on the state of the practice.

4.1.2 Express Lanes Demand

In addition to the factors for managed lanes, the demand to use express lanes is also affected by socioeconomic data, value of travel time savings (VTTS), and value of reliability. These factors help to determine the existing and future demand for express lanes. Refer to Chapter 8 of the FDOT Project Traffic Forecasting Handbook for details on project traffic forecasting for express lanes.

4.1.3 Vehicle Eligibility

According to 14-100.003, FAC, only two-axle vehicles, buses, and motorcycles equipped with a properly mounted SunPass® (or other interoperable transponder) are eligible to travel in express lanes. In Florida, vehicles with three or more axles and passenger cars pulling trailers or boats are not permitted in express lanes.

4.1.4 Tolling Exemptions

Properly registered public transit buses, school buses, over-the-road buses, and vanpools are exempt from paying the express lanes toll based on 14-100.006, FAC. According to Section 338.155, F.S., other exemptions are allowed for law enforcement and emergency vehicles on official business.

4.2 Long Distance Trip Lanes (Thru Lanes)

To facilitate long distance trips, Long Distance Trip Lanes, or thru lanes, should be located on the left side next to the median to avoid conflict with local traffic on the GUL. Thru lanes give the drivers the ability to bypass congested corridor areas. These lanes can be tolled but it is not a requirement. Thru lanes are separated from GUL with limited entrance and exit points that serve long distance trips by isolating traffic that does not need to access a certain area within the corridor. This reduces the conflicts that occur due to weaving in an area with many interchanges and high congestion. This management strategy allows vehicles traveling long distances to safely maintain higher speeds by being separated using physical barriers such as buffer separation with tubular markers or pavement markings, as shown in ***Figure 4-3.***

The major benefit of a thru lane is that it allows commuters to bypass the heavy ramp merge/diverge congestion at interchange locations.

Figure 4-3 Thru Lanes Example

4.3 Truck-Only Lanes

Truck-only lanes are a managed lanes facility type that separate heavy vehicles from mixed-flow traffic along a highway mainline and allows for the exclusive use of trucks. Implementation of truck-only lanes on a highway facility creates a dual facility with physically separated inner and outer roadways. This facility type is used to improve movement of commercial goods and services and enhance safety for roadway users. Truck-only lanes reduce potential conflicts between trucks and passenger vehicles to provide operational and safety benefits. For example, truck-only lanes allow trucks to travel at proper spacing without fear of passenger cars cutting between them. According to the NCHRP Research Report 649, truck-only lanes reduce collisions by 15% and reduce fatal crashes by 44%.

Trucks are defined as vehicles having three or more axles. Truck-only lanes are also referred to as truck-preferred lanes, commercial vehicle lanes, or truck-only facilities. Truck bypass facilities, exclusive truck roadways (truckways), and climbing lanes are not considered truck-only lanes. An example of a truck-only lane is shown in ***Figure 4-4***.

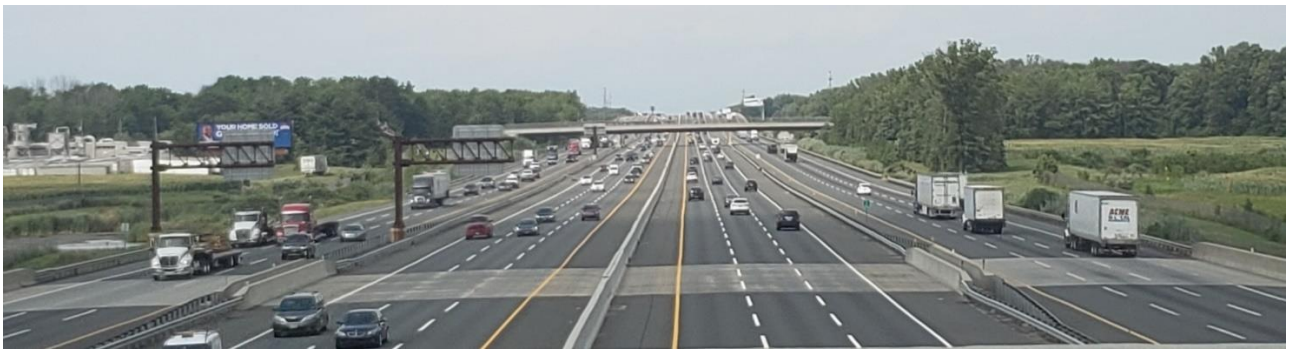


Figure 4-4 Truck-Only Lane Example (Dualized Section of the New Jersey Turnpike)

4.3.1 Benefits

Truck-only lanes offer various safety, mobility, economic development, and environmental benefits. These benefits are applicable to users of both truck-only lanes and GUL:

- Safety – Separation of trucks enhances safety by reducing risk exposure to car/truck conflicts which results in fewer and less severe crashes.
- Mobility – Separation of trucks from mixed traffic allows all vehicles to travel at their designated speeds which results in reduced delays and improved operational efficiency.
- Economic development – Truck-only lanes enhance productivity of a region by improving efficiency of freight movement.
- Environment – Reduced congestion and improved travel speeds result in reduced air pollution from emissions of stalled or slowed vehicles.

Projects that would consider truck-only lanes as an alternative should include freight-specific performance metrics that can be used to measure these benefits and compare truck-only lanes with other capacity and operational alternatives.

4.3.2 Special Considerations

Planning and development of potential truck-only lanes should include the following considerations in addition to measures and benefits discussed in Chapter 5 of this Guidebook.

- Geographic context – knowledge of regional freight issues is critical to determining whether implementation of truck-only lanes would address local or regional freight needs. Establishment of logical termini for truck-only lane alternatives should consider break points in truck volumes and independent utility of the project. The geographic limits of evaluation of candidate locations for truck-only alternatives depend on whether the truck demand is related to a single corridor or a regional network. If a regional network is desired, the evaluation of truck-only lane alternatives should cover a broader geographic area in order to provide the greatest opportunity to enhance regional freight mobility.
- Policy considerations – type of eligible vehicles and whether the facility will be tolled need to be considered in the planning and project development process.
- Technology considerations – truck-only lanes provide opportunities for technology deployment, including connected and automated vehicles, in controlled settings.
- Location and design – truck-only lanes may be designed in various physical configurations depending on ROW, environmental and other physical constraints. In general, truck-only lanes may be placed in the median of existing roadways, in the outer sides of the existing roadway lanes, or vertically separated from existing roadways. Interchange configurations are considered during concept development and preliminary design to address issues related to queueing, weaving, merge/diverge, and other types of limited geometry such as short radius loops. Planning and design of truck-only lanes should include provisions to remove stalled trucks and handling of incidents involving hazardous materials. Generally, two lanes in each direction for heavy vehicles is preferred. When one truck-only lane is proposed in each direction, provisions for staging areas and opening of barrier walls to divert trucks back into GUL in case of emergency are necessary. Additionally, consideration may be given to adding passing lanes in areas where some trucks may be expected to operate at lower than the maximum speed limit due to their weight.

- Operations and maintenance (O&M) – truck-only lanes experience a higher degree of pavement degradation, and the extra O&M cost should be taken into consideration when evaluating managed lanes alternatives. At the same time, removing trucks from the GUL will increase pavement life.
- Environmental impacts – aside from the reduction of fuel consumption and air pollution discussed in the benefits section, it is important to consider potential environmental issues that may be created by implementation of truck-only lanes. These issues may include increased noise pollution and potential impact to natural and cultural environments.
- Stakeholder engagement – gaining early stakeholder support is one of the important success factors of truck-only lanes. Freight stakeholder outreach, including the trucking industry, is critical for understanding stakeholder needs and garnering support for the project. Public acceptance of these facilities is another important consideration in the planning and project development process.

4.4 Bus-Only Lanes, Transitways, Or Busways

According to NCHRP Research Report 835, bus-only lanes, transitways and busways are managed lanes dedicated primarily for buses. When buses operate at high frequency, a bus-only lane may be desired. Designated bus-only lanes are often active only on certain days and times in severely congested urban areas. The goal of bus-only lanes is to make public transportation a more desirable option by reducing trip times and improving travel time reliability. Congestion is also reduced when drivers choose public transportation instead of driving alone because fewer cars are on the road. The design of managed lanes influences the types of transit service that exist and can be provided. Access connections for major transit services, such as bus terminals, park-and-ride lots and city streets, may be provided to eliminate the need for buses to weave across the GUL and reduce conflict with other traffic. Turning requirements are particularly critical for applications of direct-access ramps from transit facilities or local roads, or where turning at low speeds is required. Sight distance may also be an issue for single bus-only lanes. Location of transit stations along the route to help improve ridership and productivity of the lanes should be taken into consideration. A bus-only lane example is shown in *Figure 4-5*.

The design of stations along bus-only lanes should consider the following:

- Locating stations adjacent to major activity concentrations, park-and-ride facilities, and interchanging bus lanes.
- Maintaining the speed, reliability, and safety of the managed lanes by providing adequate spacing between stops, acceleration and deceleration lanes, and separate lanes for buses entering, exiting and stopping at stations.
- Providing adequate station platform capacity that conforms to Americans with Disabilities Act (ADA) requirements and prevents passenger overcrowding of platforms, which can be accomplished by:
  - Providing enough pedestrian access capacity to allow departing passengers to clear station platforms before the next bus arrives
  - Providing attractive and convenient pedestrian connections to major activity concentrations adjacent to the managed lanes
  - Utilizing barrier-free designs that meet American Disabilities Act (ADA) requirements

Coordinating with the local transit agencies for routes and schedules for maximum person throughput is critical.

Figure 4-5 Bus-Only Lanes Example

4.5 Part Time Shoulder Use

Part Time Shoulder Use (PTSU) is the temporary use of the left or right shoulders of an existing roadway for travel, typically during the peak periods when capacity is needed most. PTSU is also known as hard shoulder running or dynamic shoulder use. This managed lanes facility type addresses congestion and reliability issues while preserving the shoulder for its traditional safety and incident management function during the remainder of the day. This facility type relieves congestion and improves safety because reduced congestion tends to reduce crashes. PTSU has been used for buses and general traffic and can be used for predetermined hours of operation or dynamically based on live traffic conditions. The shoulder must have adequate width, vertical and horizontal clearances and adequate pavement structure to carry the necessary additional vehicle loading to be utilized for this facility type. If PTSU is considered on a corridor with existing or proposed toll facilities, additional consideration should be given to providing safe access for toll equipment maintenance. PTSU can also be activated when an incident along the roadway occurs. PTSU lanes are not common in Florida. **All requests to implement PTSU are made on a case-by-case basis and must be approved by the Chief Engineer**. A PTSU lane example is shown in ***Figure 4-6***.

Source: Use of Freeway Shoulders for Travel – Guide for Planning, Evaluating, and Designing PTSU as a Traffic Management Strategy, FHWA-HOP-15-23

Figure 4-6 Part Time Shoulder Use Example

4.6 Transit PTSU

In a Transit PTSU facility type, buses will travel in the shoulder in certain locations when speed falls below a threshold set by the TEO. Buses traveling on the shoulder in this facility type are prohibited from exceeding the speed of the adjacent traffic by more than 15 mph as per the FHWA guidance.

4.7 Connected and Automated Vehicle-Only Lanes

Connected and Automated Vehicle (CAV)-only lanes use vehicle eligibility strategy by providing one or more separate lanes exclusively for CAVs. Connected vehicles use vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-everything communications to exchange information between vehicles, drivers, roadside infrastructure, bicyclists, and pedestrians. The Society of Automotive Engineers defines six levels of automation. Levels 0 and 1 vehicles have no, or very little, automation. Levels 2 and 3 automated vehicles are equipped with advanced sensors and computing abilities to assist the human driver in driving tasks. Levels 4 and 5 automated vehicles complete the driving tasks with little or no human intervention, respectively. The use of CAVs allow for the vehicles to travel more closely together than a typical GUL. Factors that influence CAV-only lanes:

- CAV market penetration
- Roadway geometry, including ingress/egress, number of lanes, etc.
- Enforcement
- Toll collection
- Hours of operation
- CAV technology

Managed lanes may be leveraged for CAVs because the infrastructure is already present. The Michigan Department of Transportation is exploring this with its the CAV Corridor Concept. In Florida, for road segments with two managed lanes, one could be repurposed for CAV while the other could be used as an express lane.

Furthermore, managed lanes could be used to demonstrate a connected vehicle tolling application or a map-based tolling application that could be universally adopted by the automobile original equipment manufacturers (AOEMs) and toll authorities.

The FDOT is creating a vehicle-to-everything data exchange platform to support FDOT's future CAV project corridors. The system includes taking CAV data to make real-time and predictive decisions and assist stakeholders in the auto industry, research, traffic engineering, and in other areas. This system will provide safety and mobility data to all road users; thus, increasing the productivity in transportation operations. This data could be useful for developing tolling applications and future managed lanes.

Currently, CAV market penetration is low. As the vehicle fleet turns over, AOEMs are manufacturing new vehicles with technology that will be able to communicate with roadside infrastructure, smartphones, and other devices.

4.7.1 Market Penetration

NCHRP Research Report 891, found that at lower CAV market penetration, sharing lanes with HOVs would prevent oversaturation of the GUL. When there is 10% market penetration, consider a shared managed lanes, and at higher

CAV market penetration, consider CAV-only lanes. Refer to **Chapter 5** for additional discussion on screening criteria for CAV-only lanes.

4.8 Reversible Lanes

Reversible lanes are dedicated freeway lanes that serve directional peak period demands. These lanes are physically separated from GUL and typically operated on a set schedule to provide consistency to the traveling public. If pricing is used, the lanes are considered reversible express lanes.

Reversible lanes are most appropriate on freeways that experience large directional traffic imbalances and/or are forecasted to do so. These facilities are usually one to three lanes operating in one direction. The direction of traffic can then be changed based on the peak direction of traffic. These lanes typically require barrier channelization, gating, or flyover structures to prevent wrong-way movements. The lanes can be located between opposing directions, elevated or in the outer roadway, depending on the ROW available. This is a less costly alternative to adding GUL capacity for the peak direction of traffic. Reversible lanes require a significant amount of time to safely reverse the direction of the reversible lanes, as needed. Therefore, it is recommended that reversible lanes be implemented on roadways where the traffic shifts are predictable and recurring in the direction of peak demands for the entire peak period. In Florida, the Lee Roy Selmon Expressway in Tampa and the I-595 expressway in Davie utilize reversible lanes. ***Figure 4-7*** shows the reversible lanes for the I-595 expressway.

Figure 4-7 Reversible Lane Example

4.9 Carpool 3+ Lanes

Carpool 3+ lanes are lanes reserved or dedicated for passenger vehicles carrying a minimum of three people in the vehicle. The passenger vehicles traveling in the carpool lanes can include motorcycles, registered carpools, registered vanpools, and buses. Where permitted, passenger cars with a single occupant can travel in the lane by paying a toll. The goal of Carpool 3+ lanes is maximizing person throughput. Carpool lanes may be continuously accessible from the GUL or access can be limited to specific access points.

5 SCREENING OF MANAGED LANES

Managed lanes may be implemented to accomplish various goals for the project corridor. Mobility goals, focused on demand and accessibility, aim to improve the overall mobility of the facility or system. Safety goals aim to reduce crashes by mitigating congestion, limiting lane changes, and minimizing vehicle conflicts. Community goals aim to incorporate local interests into the development of the managed lanes corridor. The following list provides examples of possible goals and objectives for managed lanes:

- Provide a transportation system that can handle current and future demand
- Increase mobility and accessibility by offering travel options
- Provide additional facility capacity
- Optimize existing managed lanes capacity
- Provide congestion relief
- Modify travel demand
- Enhance alternative modes
- Improve accessibility
- Improve the safety of corridor travel
- Minimize environmental impacts
- Preserve neighborhoods
- Maintain land use patterns

Screening criteria help identify which types of managed lanes will accomplish the project goals. These criteria were developed through a review of NCHRP Research Reports 649 and 835, the HCM 6th Edition, and FHWA Publications. General screening criteria are listed below and detailed screening criteria for the managed lanes facility types are discussed in the following sections.

- Physical constraints
- Truck characteristics
- O-D patterns
- Land use
- Funding

5.1 Express Lanes

Express lanes may be a viable solution when additional widenings on the corridor are no longer possible, due to ROW or other constraints. Connectivity with the regional managed lanes and tolling network is also a strong consideration for the use of express lanes. An understanding of traffic patterns along the corridor and major O-D movements is critical to determining the feasibility of express lanes. Refer to the Project Identification Considerations Chart in *Figure 2-1*.

5.2 Long Distance Trip Lanes (Thru Lanes)

The following screening thresholds are considered when determining if thru lanes are viable.

The capacity of a thru lane is assumed to be the same as a GUL. For example at 70 mph, this capacity value would be 2,400 pc/hour/lane based on HCM 6th Edition. As per the criteria listed above, the thru lane volume should be at least 50% of the capacity or equivalent to 1,200 pc/hour/lane.

5.3 Truck-Only Lanes

Truck-only lanes are a potential solution when traffic volumes are high with a significant percentage of heavy vehicles. Truck-only lanes should be considered as a potential alternative for evaluation when at least three of the following criteria are met:

- Total annual average daily traffic (AADT) greater than 120,000
- Truck AADT greater than 25% of the total AADT
- Truck AADT greater than 20,000
- Peak-hour truck volumes are greater than 500 trucks/hour/lane
- Truck crash rate greater than statewide average
- Combination truck planning time index greater than 1.2

A Combination Truck Planning Time Index (PTI) is defined as the ratio of the 95th percentile peak period or peak hour travel time to the free flow travel time. This measure represents the additional time that a shipper should budget to ensure on-time arrival 95% of the time. The reporting period is the peak period (4:00 p.m. to 6:00 p.m.) for the urbanized areas of the seven largest metro areas and the peak hour in other urbanized areas and elsewhere.

$$PTI = \frac{Travel\ Time_{95th\ percentile}}{Travel\ Time_{free-flow}}$$

Data Source: FDOT Traffic Characteristic Inventory and HERE Technologies-Travel Time Data
Data Coverage: National Highway System (NHS) and other major roadways

Additionally, understanding of truck travel patterns (O-D) is a prerequisite for feasibility determination of truck-only lanes. Proximity to major freight generators can also be an important factor for consideration.

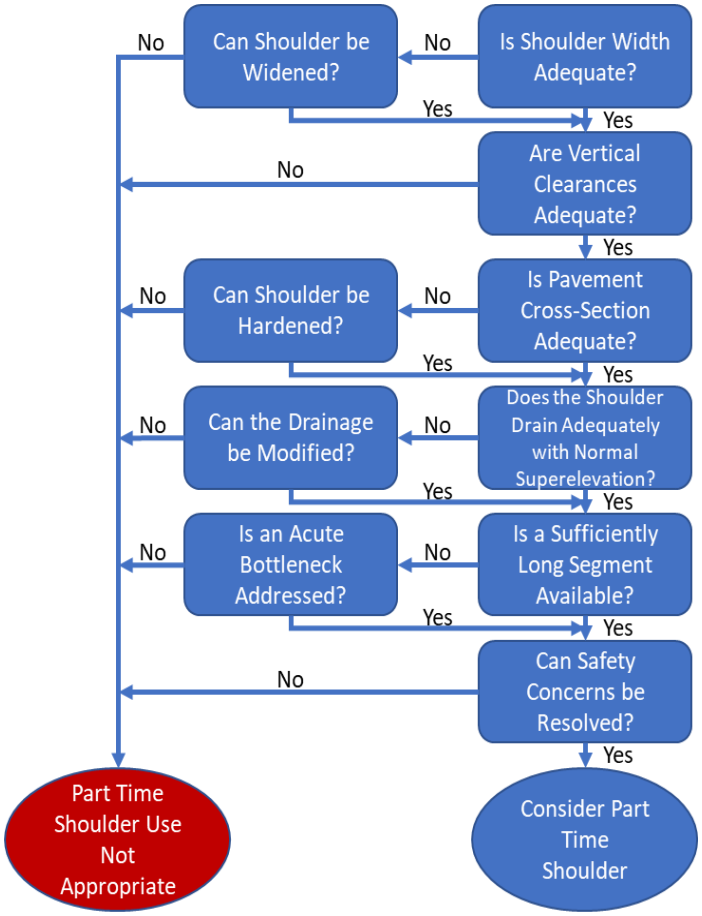
5.4 Bus-Only Lanes

The following screening criteria shall be considered when determining if a bus-only lane is a viable alternative. In the design year, the estimated peak-hour bus volumes must be greater than 30 buses/hour/lane.

Screening Thresholds
▪ In the Design Year: – Peak Hour Bus Volumes > 30 buses/h/ln

5.5 Part Time Shoulder Use

All requests to implement PTSU will be made on a case-by-case basis and must be approved by the Chief Engineer. PTSU should meet the initial screening criteria listed in the screening chart below in ***Figure 5-1*** to be considered as a viable managed lanes facility type. If the corridor currently serves a transit route, then adequate coordination should happen between the Central Office Public Transit Office and TEO, the District Transit Office, and the local transit agency prior to using the shoulder.



Source: FHWA Use of Freeway Shoulders for Travel – Guide for Planning, Evaluating, and Designing PTSU as a Traffic Management Strategy

Figure 5-1 Part Time Shoulder Use Screening Chart

5.6 Connected and Autonomous Vehicle-Only Lanes

CAV lanes are a new managed lanes facility type nationally. At this time, there are no set screening criteria. Research conducted and documented in the NCHRP Research Report 891 concluded if CAV-only lanes were implemented the following would be advisable.

- If CAV market penetration is approximately 10%, then CAV lanes can be utilized but must allow HOV to share the lane.
- If CAV market penetration is approximately 25-45%, then CAV lanes can be dedicated only for CAVs.

- If CAV market penetration is greater than 45%, dedicated CAV lanes may be provided.

5.7 Reversible Lanes

Reversible lanes are considered viable if the following screening thresholds are met.

Screening Thresholds
▪ Ratio of peak direction to reverse direction flow exceeds 2:1
▪ Reversible lanes DHV* ≥ 50% of reversible lanes capacity

*DHV-Design Hour Volume

A critical threshold that must be met is that the peak direction volume is twice the off-peak direction volume. For example, if the peak direction volume is 1,800 pc/hour/lane, the off-peak direction must have a volume of 900 pc/hour/lane or less. Another threshold that must be met is that the design hour volume of a reversible lane should be at least 50% of the capacity of the reversible lanes. At 70 mph, this capacity value would be 2,400 pc/hour/lane based on HCM 6th Edition. As per the criteria listed above, the reversible lanes volume should be at least 50% of the capacity or equivalent to 1,200 pc/hour/lane. In addition to these screening thresholds being met, the reversible lanes should preferably bypass significant merge/diverge congestion, multiple interchanges and provide access to/from freeway-to-freeway interchanges.

5.8 Carpool 3+ Lanes

For carpool 3+ lanes, in the design year, the peak-hour DDHV must be greater than 1,000 pc/hour/lane for the carpool 3+ lanes to be viable.

Screening Thresholds
▪ In the Design Year: – Carpool 3+ lanes DDHV > 1,000 pc/h/ln

6 TOLLING OF MANAGED LANES

This chapter identifies guidelines and requirements related to the various aspects of using pricing for managed lanes. When implementing tolling on managed lanes, coordination with FTE is facilitated by the Managed Lanes Planning Team.

6.1 Toll Project Responsibility Matrix

A Toll Project Responsibility Matrix is required for all toll projects and identifies responsibilities between FTE and the District(s). This includes roadway and tolling infrastructure, design, operations, maintenance, ownership, and any financial obligations. The Toll Project Responsibility Matrix is included in **Appendix E.**

6.2 Toll Collection System

FTE is responsible for collection of tolls for the Department. The toll collection system includes the Turnpike Toll System Back Office (Back Office) and the roadside toll equipment.

The Back Office includes the transaction host (Host) and the Centralized Customer Service System (CCSS). The Host serves as the clearinghouse between the toll gantries on the express lanes and the CCSS, where customer accounts are maintained. The CCSS is responsible for processing toll transactions and toll violations as well as managing accounts.

The Turnpike toll collection system interfaces with the District's Transportation Management Center (TMC) to support express lanes operations and share toll amount data. The District uses the toll amounts to operate the express lanes, and the Turnpike needs the toll amounts to process all toll transactions. The communications and interactions between the systems are defined by interface control documents (ICD) which are maintained by the FTE. The two (2) key interfaces are explained below and shown in ***Figure 6-1***.

A. Toll Amount Interface
   This interface is used by FTE to receive the final toll amount information from the TMC.

B. Customer Service Interface
   This interface allows FTE Customer Service Representatives at the CCSS to look at information that was posted on the Toll Amount Dynamic Message Sign (TADMS) when customers have questions regarding transactions.

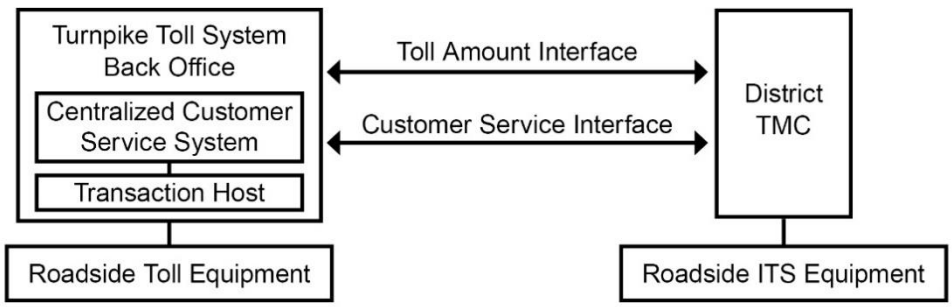


Figure 6-1 Typical Toll System Interfaces

6.3 Toll Segment Development and Access Considerations

Tolls in the express lanes are charged on a per segment basis. Tolling locations are dependent on the ingress and egress points, making them a key input into the access plan. Development of toll segments is coordinated with the access plan development covered in Section 2.3.2.

The toll segment definitions contained in this Guidebook are intended for use in corridor planning and development of express lanes. Definitions used by the SELS to operate express lanes facilities may vary from the toll segment definitions included below. The toll plan should be developed in close coordination with FTE and Central Office. Toll plans may vary to better meet the needs of the corridor and the region.

6.3.1 Basic Toll Segment

Generally, each express lanes toll segment is at least one (1) mile long and has only one (1) gantry that charges a toll. The basic express lanes toll segment begins with an ingress and ends with an egress, as shown in ***Figure 6-2*** below.

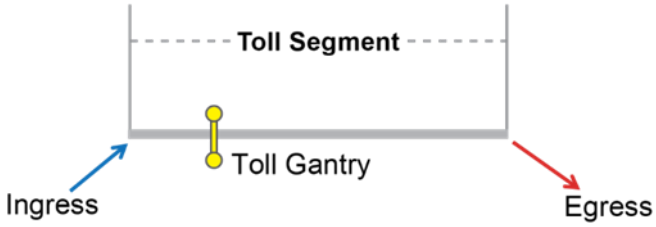


Figure 6-2 Basic Toll Segment

6.3.2 Alternative Toll Segment Configurations

For successive egresses, a toll gantry is placed before each egress, creating additional express lanes toll segments as shown in ***Figure 6-3.***

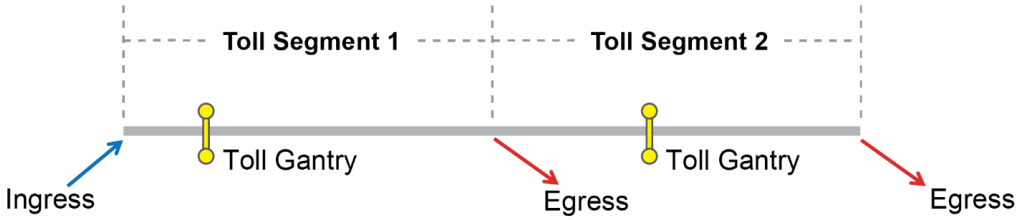


Figure 6-3 Toll Segment with Successive Egresses

For successive ingresses, the express lanes toll segment is from the first of the successive ingresses to the first egress. In this case, a data gantry is required between successive ingresses. A data gantry does not charge a toll. It collects the information needed to accurately identify the customer's entry into the express lanes. A toll gantry is placed before the egress, as shown in ***Figure 6-4.***

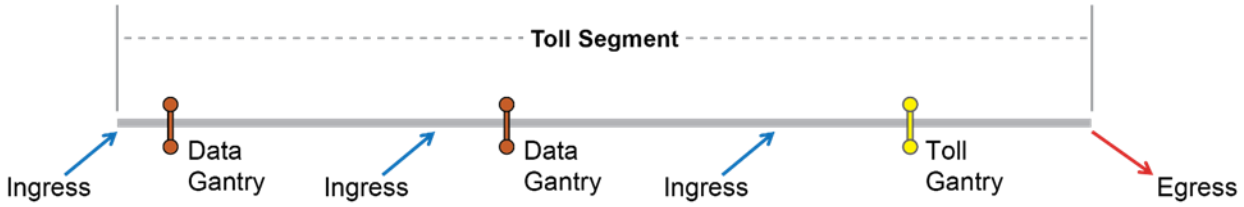


Figure 6-4 Toll Segment with Successive Ingresses

When an additional lane is added to a single express lane via an intermediate ingress, a toll gantry is placed both before and after the intermediate ingress, creating two express lanes toll segments as shown in ***Figure 6-5***. This allows for more effective congestion management of the express lanes.

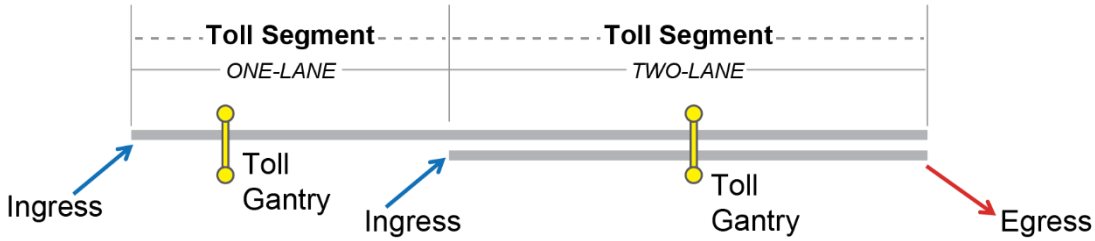


Figure 6-5 Toll Segment for Transitions from One to Two Express Lanes

6.4 Traffic and Revenue Studies

A Traffic and Revenue (T&R) study evaluates the projected traffic demand on a toll project, and estimates a multi-year, gross toll revenue forecast (typically 10-years). Each year, the FTE coordinates directly with the PFO to determine which FDOT-owned toll facilities require a T&R study. If the PFO and FTE have determined that a toll facility requires a T&R study in a given year, the FTE will contract with third-party consultants to complete the T&R study. If the PFO and FTE have determined that a toll facility does not require a T&R study, the PFO will complete an in-house update of projected toll revenue forecasts based on historical traffic and toll revenue trends.

Each FDOT District is responsible for paying for their facility's T&R study if tolls have not commenced for the relevant facility. After a facility's toll commencement, toll funds can be used to pay for T&R study updates, if available. Otherwise, the District will continue to pay for the study using District-allocated funds. Since the Districts lead the planning, design, and maintenance of FDOT-owned toll facilities, they must coordinate with PFO and FTE once the PFO and FTE have determined that a T&R study is required.

T&R study guidelines are as follows:

- Sketch level study should be conducted during the planning stage of a facility and no later than five years prior to the toll facility achieving toll commencement.
- Planning level study should be conducted no later than two years prior to the facility achieving toll commencement.
- Generally, a Forecast update should be conducted in the fiscal year when tolling commences and every fiscal year after tolls have commenced. Once tolls have stabilized, forecasts may be reduced from annually. Every year, PFO and FTE will determine whether a toll facility requires a Forecast update, which will capture considerations such as the amount of toll revenues collected in prior years.

6.5 Public Outreach

FTE has resources and materials available to support SunPass® outreach for tolling projects. The District develops outreach materials for the project in coordination with Central Office. These materials should be shared with FTE for consistency of messaging between the District and the Customer Service Representatives at the SunPass® call center.

6.6 Design

FTE Tolls Design is responsible for reviewing each toll facility design for compliance with the General Tolling Requirements (GTR) criteria when managed lanes include a tolling component. FTE Design also provides a limited review of the signing associated with toll facilities. A TSTM is required for all express lanes projects. The TSTM documents the evaluation of a project's toll site infrastructure in relation to GTR criteria. The development of the TSTM begins during PD&E and is typically completed during Design. For design-build projects, the TSTM is developed as part of the design-build Request for Proposal (RFP). The TSTM Template is available on the FTE's website, and the criteria is included in GTR.

6.6.1 Toll System Maintenance

FTE and the District(s) share the responsibility of maintaining the express lanes tolling system and infrastructure. In general, FTE is responsible for maintaining the physical toll equipment building and the tolling system. The District maintains the supporting infrastructure and funds the maintenance of the tolling system. Specific project responsibilities are defined in the Toll Project Responsibility Matrix, as included in Appendix E. When a project spans multiple Districts it is recommended that a Memorandum of Understanding (MOU) be in place to define responsibilities, in addition to the Toll Project Responsibility Matrix. Refer to Section 9.5 for more information.

7 STATEWIDE EXPRESS LANES SOFTWARE

All express lanes in Florida use the SELS to assign toll amounts. SELS uses traffic conditions in the express lanes to determine toll amounts that facilitate free-flow operating conditions, as defined in 14-100.003 FAC. SELS can be used under static, TOD, or dynamic tolling conditions.

SELS is currently implemented as a module within the FDOT Operations Task Manager (OTM) software system. OTM is a suite of software modules designed to assist and enhance daily TMC operations. It interacts with external systems including SunGuide®, the FTE Back Office, local email, file, and database systems. SELS is currently being updated as a stand-alone software outside of OTM.

7.1 SELS Change Management Team

The SELS Change Management Team (CMT) is a cross-functional body established to manage changes to the software. The SELS CMT is led by the State TSM&O Software Engineer and is responsible for the oversight and direction of the SELS change management process, which guides how the software is updated. The SELS CMT consists of members from each FDOT District with an express lanes project, Central Office, and FTE. SELS CMT operating procedures are outlined in the *SELS CMT Plan*.

7.2 Functions of Statewide Express Lanes Software

SELS uses traffic data received from roadside traffic detectors to perform the following:

- Calculate express lanes toll amount
- Perform toll setting for each express lane segment
- Post toll amount on TADMS and lane status on Lane Status Dynamic Message Sign (LSDMS) through the Department's SunGuide software
- Verify and document that the toll amount and lane status messages are accurate and being displayed properly
- Associate SunGuide events with tolling conditions
- Maintain toll amount records
- Communicate toll amounts to the FTE Back Office
- Provide interfaces with SunGuide to receive data from real-time monitoring devices
- Analyze historical traffic patterns
- Generate reports

7.3 Establishing Toll Setting Parameters

7.3.1 Static Pricing

In some cases, a static toll amount, which does not change based on traffic conditions or TOD, may be the desired tolling approach for a segment or corridor. This is known as Static Pricing.

7.3.2 Time of Day Pricing

TOD Pricing implements a toll amount that varies based on the TOD and day of the week, according to a pre-determined schedule established in a TOD table.

A TOD Table Automates the changing of the toll amounts based on a schedule determined by the District which specifies the toll amount in effect based on the TOD and type of day (Weekday, Weekend, or Holiday/Special Event).

7.3.3 Dynamic Pricing

Dynamic Pricing uses varying toll amounts adjusted based on real-time monitoring of traffic conditions in the express lanes.

If utilizing dynamic pricing, there are three (3) configurable tables used by SELS to determine the toll amount in different situations: (1) Level of Service (LOS) Table, (2) Delta-Density Table, and (3) TOD Table. These tables contain the toll setting parameters described below.

(1) LOS Table

This table contains the traffic density (TD) values and the corresponding variable toll ranges associated with each LOS value, A through F. Changes in toll amounts correspond to changes in the roadway's LOS. A statewide default LOS table is available for use as a starting point in establishing the toll setting parameters.

(2) Delta-Density Table

This table contains toll increments (either an increase or a decrease) used to calculate the toll for a specific time interval based on a change in traffic density. The table makes incremental changes to the toll amount by comparing the current TD to the density in the previous interval. It then matches that delta in density to the appropriate toll amount.

(3) TOD Table

Like TOD pricing, dynamic pricing can also use a TOD table. However, in this mode the TOD table is only used on a temporary basis. Specifically, when there is no data available from detectors for the software to calculate the toll. When utilizing dynamic pricing and that scenario occurs, the system will implement rates from a TOD table. As soon as detector operation has been restored, SELS automatically reverts to pricing dynamically.

7.3.4 Establishing and Amending Toll Setting Parameters

The District Traffic Operations Engineer (DTOE) is responsible for developing the initial tolling approach, including the type of tolling, toll amount, and LOS or TOD tables (if applicable) in accordance with the process outlined below. Once a tolling approach is approved, changes must be coordinated with the state TEO. This includes changes to the type of tolling, toll amount, LOS tables, and/or TOD tables.

A. DTOE, Turnpike DTOE, and Director of Traffic Engineering and Operations

The DTOE prepares a Draft Toll Setting Parameters Memorandum to initiate a request for establishing or changing toll setting parameters. The memorandum is circulated to the Turnpike DTOE and the Director of the TEO for review, they are responsible for circulating the memorandum for other input at the Turnpike and

Central Office, respectively. If the Turnpike DTOE and the Director of Traffic Engineering and Operations concur with the memorandum, it is submitted for recommendation by the District Secretary.

B. District Secretary
Once the District Secretary approves, the memorandum is submitted to the Executive Director of the Turnpike for review and approval.

C. Executive Director of the Turnpike
Once the Executive Director of the Turnpike approves, the memorandum is submitted to the Chief Engineer for review and approval.

D. Chief Engineer
Once the Chief Engineer approves, the memorandum is submitted to the Secretary for approval.

E. Secretary
The Secretary provides the approval signature on the memorandum prior to implementation.

If concurrence is not reached at any step in the process outlined above, the District, the FTE, and Central Office work together to address any concerns and revise the memorandum. The revised memorandum will then begin the process again. Please see **Appendix F** for an example of a Toll Setting Parameter Memorandum Template.

8 DESIGN CONSIDERATIONS

Consistency in the design of managed lanes is essential to project success from safety, operational, and customer perspectives. The design of managed lanes facilities needs to provide operable managed lanes segments under both interim and ultimate conditions. During conceptual and final design, consider proposed connections to adjacent managed lanes, GUL, or GTL, and any infrastructure needs for subsequent implementation phases of the managed lanes (e.g., signing, ITS infrastructure, and toll sites, as applicable). Specific design criteria, standardized construction plans and specifications, and other guidance can be found in the following documents:

- FDOT Design Manual (FDM)
- FDOT Standard Plans for Road and Bridge Construction
- FDOT Standard Specifications for Road and Bridge Construction
- FDOT Traffic Engineering Manual (TEM)
- General Tolling Requirements (GTR) (if applicable)
- Manual on Uniform Traffic Control Devices (MUTCD)
- Turnpike Design Handbook (TDH) (if applicable)

Managed lanes projects are subject to additional design considerations as described in Chapter 3.

8.1 Separation Type

The use of tubular markers must conform to the guidelines published in ***FDOT Standard Specifications 704.*** At specific locations where stopping sight distance criteria cannot be met with markers that are 36 inches in height, the height of the marker above the pavement surface should be 24 inches. A Modified Special Provision to Specification 704 must be processed for the 24-inch height tubular markers.

8.2 Signing, Pavement Markings and Intelligent Transportation Systems

Managed lanes are subject to additional requirements for signing, pavement marking, and ITS design. Within the ***MUTCD***, express lanes are referred to as priced managed lanes, and sign guidelines are categorized under ***Chapter 2G – Preferential and Managed Lane Signs***. The Department's express lanes signs are detailed in TEM 2.42. Pavement marking guidelines are included in TEM 4.5 and FDM 230. ITS requirements are detailed in FDM 233.

8.3 Direct Connections Between Managed Lanes Facilities

For managed lanes-to-managed lanes project connections, additional signing may be needed to alert drivers to the status of the ramp and the connecting system. There are several options to communicate the managed lanes status to drivers. Any available three-line Dynamic Message Sign (DMS) may be used to inform the driver of a closed system on connections between systems. A LSDMS may also be used to alert drivers of the lane status. If needed, a single-line DMS may be added below the managed lanes exit sign panel.

These strategies may be combined as needed to meet the needs of the system. Each connection will be handled on a project-by-project basis, requiring coordination between design and traffic engineering and operations at both the District and the FTE. The final decision is made by the DTOE and coordinated with the TEO and the Managed Lanes Planning Team.

9 OPERATIONS AND MAINTENANCE

O&M needs for managed lanes impact key project development decisions from planning through implementation of the project.

9.1 Operations

Coordination between Design and Traffic Operations assures that the preferred geometric design concept supports incident management and enforcement operations. These operations are examined on a project-specific basis to identify and incorporate required design elements. Incident management plans are also critical design inputs for the managed lanes project. Design elements such as roadside toll equipment (if applicable), emergency turnaround areas, access to the managed lanes, and emergency refuge areas (ERAs) may be necessary to support the operational needs of a managed lanes project.

ERAs that include staging and incident investigation areas may help improve safety and reduce impacts to operations on constrained facilities. See FDM 211 for emergency refuge area criteria.

Project-specific characteristics can result in operational differences that need to be considered early in the planning phase of the project development process. These characteristics include, ingress and egress design and location, separation type between the managed lanes and the general use or GTL, reversibility of the managed lanes segment, and the use of other TSM&O strategies along the corridor.

9.2 Project Concept of Operations and System Validation

The project ITS architecture and the project ConOps, as required by FDOT Systems Engineering and Intelligent Transportations Systems Architecture Procedure (750-040-003c), and detailed in Chapter 2, are used for further development of additional operational documents such as incident management plans, standard operating guidelines and procedures, and interagency communication guidelines.

When construction is complete, and the managed lanes system is in operation, a system validation is performed using the criteria and high-level requirements outlined in the project ConOps. The system validation answers the following question: Was the right system built to accomplish the user needs expressed in the ConOps?

9.3 Transportation Management Centers and Standard Operating Guidelines

9.3.1 Transportation Management Centers

The TMC disseminates traffic information to the traveling public. It houses operators and coordinates closely with other operations and dispatch partners such as FHP, local law enforcement, and fire and rescue personnel.

Additional TMC resources may be needed for operation of some managed lanes projects. If needed, a plan is developed for adding personnel (e.g., operators) and infrastructure (e.g., building, equipment, and workstations), in the early stages of project development - prior to opening of the managed lanes system. This plan is developed as

early as possible to allow enough time for the training of TMC operators and implementation of any infrastructure modifications. The District TMC staff is responsible for the following:

- Monitoring the traffic and roadway using cameras and vehicle detectors
- Performing incident management including incident response coordination
- Dispatching Road Rangers to clear incidents, remove debris, and assist stranded motorists
- Monitoring vehicle detection devices and other ITS equipment in order to identify any equipment failures
- Conducting freeway traffic management, ramp signal operations, and arterial operations coordination
- Monitoring the health of the ITS device and communication systems
- Reporting damage to the facility and tolling system, if applicable

9.3.2 Standard Operating Guidelines

Regional TMC Standard Operating Guidelines (SOG) are published by the Central Office TEO to help facilitate the proper operation of Florida's roadway transportation system by providing general guidance to TMC administrative and management personnel. Standard Operating Procedures (SOP) are developed by the local TMCs and define specific operational procedures that will be followed at each TMC.

9.4 Traffic Incident Management for Managed Lanes

During incidents and crashes the managed lanes will operate per incident management procedures established in the Regional TMC SOGs. The managed lanes project ConOps, as defined in Chapter 2, provides project level details on the roles and responsibilities.

TIM SOPs for emergency response and incident management clearance are influenced by separation type and shoulder width. Incident management personnel may use the paved shoulder as a pull off area. For barrier-separated facilities, gates are provided at intermittent locations for access to the managed lanes. For facilities that are buffer-separated with tubular markers, incident management personnel access the managed lanes by temporarily removing or driving over the tubular markers. Gates, Road Rangers, Asset Maintenance Contractors, and Law Enforcement Officers may be used to enforce hard closures at managed lanes access points. TIM SOPs should be coordinated with incident management and law enforcement stakeholders.

9.5 Maintenance

Managed lanes maintenance is performed for the ITS equipment and the portion of the roadway that is operating as managed lanes. Such roadway features include assets such as drainage, guardrails, crash cushion, pavement marking, rigid or flexible pavement, signs, tubular markers, concrete barriers, etc.; inspections are also included. Every effort should be made to coordinate scheduled maintenance activities and repairs and minimize managed lanes closures. The following sections cover maintenance requirements for all managed lanes. For additional maintenance requirements for express lanes, see Chapter 6. When a project spans multiple Districts, it is recommended that an MOU be in place to define responsibilities.

9.5.1 Types of Maintenance

In general, there are two (2) types of maintenance activities on managed lanes:

Routine Maintenance: Consists of routine, scheduled ITS equipment and roadway maintenance with the intent of preventing or minimizing a future equipment failure and preserving, repairing, or replacing roadway features.

Responsive Maintenance: Occurs in response to equipment failure or an incident. This type of maintenance cannot be scheduled in advance and typically must be attended to quickly, to address the failure and return the system to full functionality.

9.5.2 Intelligent Transportation Systems

ITS maintenance is important for managed lanes operations, because any interruption of ITS services can result in operational failures. Maintenance work on managed lanes ITS equipment is done in accordance with the maintaining District's TMC SOPs, as well as with the manufacturer's recommendations and industry best practices.

9.5.3 Routine ITS Maintenance

Routine maintenance reduces equipment failures and extends the life of the ITS system. It includes daily, weekly, monthly, or semi-annual inspections of the systems, and detailed procedures for field checks of all the ITS components. Maintenance intervals may need to be adjusted based on location, equipment type, and the criticality of the device to managed lanes operations.

For each managed lanes system, the following preventive ITS maintenance is conducted, at a minimum:

A. Dynamic Message Signs (DMS)
   Maintenance of displays, battery backup, AC power, trimming of any trees obstructing views, and checking of all connections.

B. Cameras
   Lens and dome cleaning, pan/tilt/zoom (PTZ) assembly maintenance, communications checks, power checks, clearance of any trees obstructing views, and camera alignment corrections for maximum visibility. Districts may consider enhanced maintenance tasks for dedicated verification cameras.

C. Vehicle Detectors
   Calibration, communications checks, and power checks.

D. Communications Equipment
   Checking and repair of the fiber communications system between TMCs, and from the TMC to the field.

E. Transportation Management Center Equipment
   Maintenance of all equipment within the TMC, including the video wall, backup power, and other ancillary hardware. Districts are also responsible for the recurring system costs and general building maintenance.

F. Software and Hardware
   Updates and patches to the SunGuide® software, SELS if applicable, maintenance of the hardware for database and system management, and hardware additions for any new or expanded software patches or capabilities.

G. Access Gates
Power system, communication system, access control unit, and mechanical system maintenance.

H. ITS Cabinets
Power system, backup power system, communication system, equipment and air conditioning unit maintenance, cabinet security checks, and vandalism protection or abatement.

I. Power Subsystem and Generator Backup
Maintenance of oil, gas filters, regular run cycles, automatic transfer switch (ATS) testing, supervisory control and data acquisition (SCADA) alarm validation, and disconnect, switch, fuses, etc.

9.5.4 Responsive ITS Maintenance

Responsive maintenance is necessary when problems arise with any portion of the ITS system. A problem can be anything from a failed component that needs repair, to a portion of software that needs reconfiguring. The priority of the maintenance response is dependent on the severity of the component failure.

Typical causes of component malfunctions requiring immediate attention include lack of communication, vehicle crashes, theft, vandalism, and weather damage. Priority should be given to addressing these critical failures through expedited response.

Non-critical failures include problems that do not immediately affect the demand management of the managed lanes. Each District evaluates existing protocols for responding to critical and non-critical failures and adjusts them, as necessary, for different types of managed lanes ITS infrastructure.

9.5.5 Roadway Maintenance

Roadway features (drainage, guardrails, crash cushion, pavement marking, rigid or flexible pavement, signs, tubular markers, concrete barriers, etc.) that are part of managed lanes are maintained as part of, and in the same manner as, a limited access system. In order to minimize downtime of the managed lanes system, it is a best practice to schedule non-critical ITS maintenance tasks concurrently with roadway maintenance tasks, if possible.

9.5.6 Tubular Markers Maintenance

When a managed lanes system utilizes a buffer with tubular markers as the chosen separation type, the tubular markers must comply with ***FDOT Standard Specifications 704*** and ***991*** for tubular markers.

Special consideration is given for the maintenance of tubular markers. If a performance-based asset maintenance contract is being used to maintain the roadway portion, then it is recommended that specific performance criteria for tubular markers and other unique managed lanes roadway features be used, and for language is included as part of the scope of services for the particular contract. Maintenance of tubular markers should at a minimum comply with the Maintenance Rating Program Handbook for Object Markers and Delineators.

10 MOBILITY PERFORMANCE REPORTING

Performance monitoring for the Department's managed lanes is achieved through a combination of before and after studies, structured reporting, and Quality Assurance (QA) and Quality Control (QC). This allows projects to be evaluated against the original goals and determine if operational changes are needed to meet project objectives.

Performance reporting can be used to evaluate and track mobility and safety characteristics of managed lanes, as well as any specific project innovations. Performance reports are prepared by each District, in coordination with the Managed Lanes Planning Team, TEO, and PFO. Reports should be customized to meet the needs of each individual facility. Reports may be posted on the facility's website, or shared with project stakeholders. The reporting plan for each system can be updated as the system's reporting needs change.

11 FUNDING AND PROJECT FINANCE FOR NON-TURNPIKE, DEPARTMENT OWNED TOLL FACILITIES AND MANAGED LANES

This chapter identifies the roles and responsibilities of the Districts and PFO in the development of managed lanes projects including financial impacts and cost breakout for projects. It also establishes policies for the use of express lanes revenue in support of regional networks.

11.1 Project Finance Office

The PFO provides strategic and innovative financing solutions, analysis, and reporting. The PFO ensures the advancement of transportation projects, and accountability and consistency with the Department's policies and procedures.

The PFO must be contacted with any questions related to finance processes required for a toll facility, including, but not limited to, the following: managed lanes finance plans to include both the capital and on-going operating and maintenance costs; funds specific to managed lanes and programming of those funds; the Department's Transportation Financing Corporation (TFC); loans from the State Transportation Trust Fund (STTF); repayment of debt; major project financial plans required by FHWA; Public-Private Partnerships (P3); and State Infrastructure Bank (SIB) Loans.

The PFO is involved in the early stages of project planning for all managed lanes projects, in part, to assist in determining the best financing approach for project delivery, but just as important, the planning for on-going operation and maintenance costs, and the funds to pay for those project costs. All discussions regarding project revenue distribution on a network are also coordinated through the PFO.

11.2 Flow of Funds

Unless otherwise specified in a legally binding contract to which the Department is a party (e.g., a toll facility's bond indenture), the Department applies toll revenues against a toll facility's costs in the following order:

- operations and maintenance
- debt service payments (if applicable)
- renewal and replacement costs (e.g., ITS replacement, resurfacing, etc.)

Section 338.166, F. S. dictates how the flow of funds is implemented once a facility's debt has matured. Under this statute, the Department is permitted to continue collecting tolls on a facility after retiring any project debt (as applicable). Toll revenues are first used to pay O&M and subsequently renewal and replacement costs. Any remaining toll revenue (excess revenue) is used by the Department for the construction, maintenance, or improvement of any road on the SHS within the county or counties in which the revenues were collected, or to support express bus service on the facility where the toll revenues were collected. *Figure* 11-1 illustrates the flow of funds for a generic toll facility.

Generally, the Department will not require repayment of a project's original capital costs (i.e., construction) that are funded with SIS unless otherwise required by law or bond documents. Exceptions will be determined on a case-by-case basis.

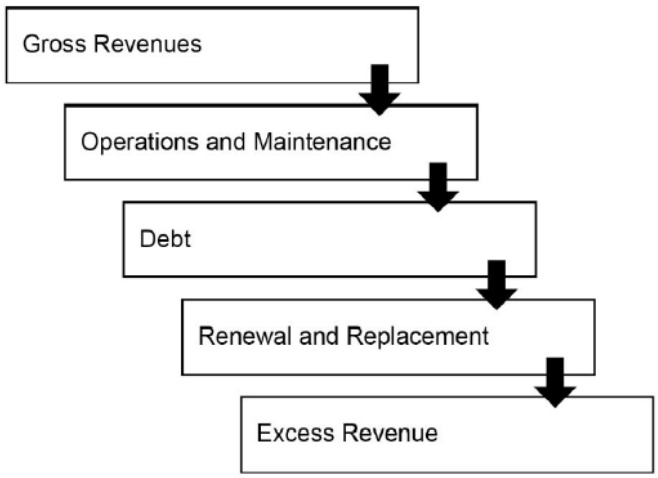


Figure 11-1 Flow of Funds

Tolls collected on FTE System are required to be used on the FTE System as defined by Section 338.22, F. S. (also known as ***Florida Turnpike Enterprise Law***).

11.3 Constructing New Facilities When Debt is Issued

When constructing new facilities, the Department may enter into service contracts with the FDOT Financing Corporation, or other debt instrument, in connection with approved projects. Debt accrues to the STTF and a District must use funds received from toll revenues to cover the debt. Repayment of debt will occur after payment of O&M of the facility until debt is repaid. Until such time that toll revenues are sufficient to cover all facility costs, the costs not paid from toll revenue will accrue as Long-Term Debt to STTF. The Deputy Comptroller, General Accounting Office, will track debt due.

11.4 Managed Lanes Traffic and Revenue Studies

In conjunction with the District(s), the PFO develops toll facility finance plans pertaining to all sources and uses of revenues for the facility. The initial finance plan is to be developed at the time construction is programmed and should include forecasted revenues from a T&R sketch level study paid for by the District, with oversight provided by FTE. A T&R sketch level study should also be provided five years before the facility is open. Within five years of the facility opening, a T&R planning level study be provided and paid for by the District. Once the facility opens to traffic, there will be T&R updates scheduled and paid for by the facility, if funding is available.

Targets and Production Accomplishment Report (PAR) Program Targets are program dollar level requirements, by District and program area, that establish specific programming objectives to be attained in developing the Tentative and Adopted 5-Year Work Program. Targets are derived from the objectives developed pursuant to Section 334.046, F.S., through needs assessments and related statutory criteria, and are implemented using individual allocations, or by requiring mandatory use of specific levels of other allocations. Program targets are published in Schedule B of the

Work Program Instructions. Schedule B is a schedule that shows the allocation of program targets by District and fiscal year.

A Production Accomplishment Report (PAR) and Target are established for the construction of new express lane facilities to ensure that the cost of the express lane portion of any project is covered first with Toll Revenues. To use toll revenues, funds must be swapped to toll funds. The Work Program Instructions, Chapter 41: Florida Turnpike Enterprise, Other Toll Facilities, and Managed Lanes, contains a table called "Type of Improvement & Targets List." This table shows the type of improvements and the funds that can be swapped for toll funds. Fund allocations and program targets are also published in Schedule A and Schedule B of the Work Program Instructions. Adjustments can be made to the PAR and Target when operations begin for the following activities: Maintenance, Bridge Repair/Rehabilitation, In-House Activities, Resurfacing, and ITS. These adjustments need to be coordinated with Work Program and Budget Office and the PFO.

11.5 Operations and Maintenance of Express Lanes

All operating costs for the express lanes are accounted for by prorating the number of express lanes to the overall number of lanes. For maintenance cost estimates, an average per lane mile cost is used based on the average urban lane cost for maintenance provided by the State Maintenance Engineer.

Toll operating costs are estimated by the PFO using an average cost per transaction provided by the FTE. One hundred percent (100%) of these costs are allocated to the express lanes.

FTE estimates annual operating costs each year, but the District produces a budget for each toll facility. Operating costs are programmed using the TOXX work program fund code, and maintenance costs are programmed using the TMXX work program fund code. Planning, PD&E, construction (periodic maintenance, renewal and replacement and capital improvement), CEI, and all in-house phases are programmed using the DSBX work program fund code.

11.6 Periodic Maintenance

Periodic maintenance consists of periodic repair, rehabilitation, and capital improvements such as resurfacing and ITS replacement which uses DSBX funds. Districts must obtain approval from the PFO when they are requesting additional DSBX funds that are above their targets and allocations. The PFO will coordinate with the Finance, Program, and Resource Allocation (FPRA) group about targets and allocations. Any changes to the DSBX funds affect the allocation of the PAR.

For more information, DSBX allocations are published in Schedule A. Schedule A is a schedule of the Work Program Instructions which shows, by District and fiscal year, the allocation of each type of state and federal fund.

11.7 Finance Plan (Sources and Uses)

A finance plan, also known as the Sources and Uses forecast, is a net financial impact of a toll facility and its programming impact to the STTF. The Sources and Uses forecast is used to create the Impact to STTF Sheet which is used in the STTF Finance Plan and Cash Forecast. The Sources and Uses forecast includes the revenue forecast, toll operating costs, operating costs, maintenance costs, repayment of debt, current projects programmed in the Five-Year Work Program, and future periodic maintenance forecasts (beyond the Five-Year Work Program). It is the responsibility of the District to ensure all projected operating, maintenance and R&R costs are programmed in the Five-Year Work Program for their existing facilities, as well as facilities to be constructed and/or planned to open during the Five-Year Work Program. Once debt, if any, has been fully repaid, and all future express lanes network needs are met, remaining revenue is used in accordance with Section 338.166, F.S. with approval from the Secretary.

The Sources and Uses forecast is updated on a periodic basis after each Snapshot. Annual updates to the revenue forecasts are developed by FTE in coordination with the District that is the project owner and the PFO. Operations, maintenance, and periodic maintenance programming updates are made in accordance with the Tentative and Adopted Work Program development cycle and are the responsibility of the District to work with PFO on programming matters for toll funds (i.e., TO, TM, DSB).

11.8 FDOT Toll Facility/Managed Lanes Toll Programming Guidance

The Districts should be programming to the targets and allocations set by the Finance, Program and Resource Allocation (FPRA) group.

In the case of toll facilities and managed lanes with a net toll revenue deficit (i.e., toll funds programmed in a given Fiscal Year exceed projected toll revenues anticipated in that year), the relevant Districts will not be permitted to program toll funds beyond the toll funds that have already been programmed in the years in which a net toll revenue deficit exists. Applicable fund swaps in the Work Program Instructions (e.g., BRRP to DSB, among other fund swaps) will continue, but will need to be approved by PFO and FPRA.

For toll facilities and managed lanes with a net toll revenue deficit, toll funds required for facility costs without a target and any toll funds required above a target need to be funded by non-toll funds (e.g., District funds).

11.8.1 Excess Toll Revenues

Excess toll revenues are defined as the annual toll revenue after funds have been set aside and programmed to cover anticipated facility operational and maintenance costs, R&R costs, and if applicable, fund deposits, annual debt service, escrow deposits (accumulation of cash to cover planned deposits), and Availability Payments.

If excess revenues are anticipated for a toll facility/managed lanes, and a District would like to program toll funds based on those excess revenue estimates, the following conditions will have to be met:

- The toll facility/managed lanes must have been operational for at minimum three (3) years.
- The cumulative Debt Due to STTF must be paid down to $0.
- The toll facility/managed lanes must have two (2) consecutive years of excess revenues following debt being paid down to $0.
- The additional programming must be approved by the Assistant Secretary of Finance and Administration.

If a steady yearly stream of excess toll revenues is projected, a commitment of toll funds for future years may be permitted. However, Department staff are not to assume excess toll funds exist – it is important to consult with PFO to determine the amount of excess toll revenues that are projected and in which years excess toll revenues exist.

If excess revenue does not exist for toll facilities/managed lanes, additional toll funds may not be programmed beyond what are already programmed. These facilities must utilize District funds to accommodate additional programming needs. If District funds are unavailable, Districts should inform their respective leadership team (District Secretary) to commence executive-level discussions about alternate sources of funds that may be available (e.g., SIS funds).

If a District is seeking to remove toll fund programming or unencumber toll funds that have been programmed on an existing project for the purpose of programming new toll funds on a new/alternate project in the same dollar amounts (i.e., net zero impact on toll funds), the District should contact PFO to obtain approval for this action.

11.9 Major Projects Financial Plan

Toll facility projects that are over $500 million in total project costs and have federal funds programmed on them (past, present, future) are considered Major Projects by FHWA. Major projects are required to have an approved:

- Project Management Plan
- Cost and Schedule Risk Assessment
- Initial Financial Plan and Annual Updates

The scope of the major project includes all work under the NEPA limits (all costs, all phases). The project may not be awarded until FHWA approves the Financial Plan and grants federal authorization.

Please contact the PFO for guidance.

11.10 Memorandums of Understanding with Federal Highway Administration (FHWA)

For Department-owned federally supported facilities that are tolled, the Department is required to comply with ***U.S.C. Title 23, Section 129*** -*Toll roads, bridges, tunnels, and ferries* (***Section 129***), which identifies limitations with respect to the use of toll revenues for applicable expenses and requirements in regard to facility maintenance and reporting. FDOT and FHWA will execute a MOU for each new toll facility authorization, however previous toll agreements that were executed between FDOT and FHWA remain active and may be amended as required.

The Department must comply with ***Section 129*** and all other federal authorizations pursuant to ***U.S.C. Title 23*** more broadly in regard to the use of toll revenues – these authorizations are contained in the Work Program Instructions and MOUs with FHWA.

FDOT is required to report to FHWA yearly on each applicable toll facility's compliance with ***Section 129***.

Contact the PFO for guidance and the most recent MOU template.

APPENDICES

A. Acronyms

ACRONYM	TERM
AADT	Annual Average Daily Traffic
ADA	American Disabilities Act
ATS	Automatic Transfer Switch
CAV	Connected and Automated Vehicle
CCSS	Centralized Customer Service System
CEI	Construction Engineering Inspection
CEQ	Council on Environmental Quality
CMT	Change Management Team
ConOps	Concept of Operations
DDHV	Directional Design Hour Volume
DHV	Design Hour Volume
DMS	Dynamic Message Sign
DTOE	District Traffic Operations Engineer
ERA	Emergency Refuge Area
FAC	Florida Administrative Code
FDM	FDOT Design Manual
FDOT	Florida Department of Transportation
FHP	Florida Highway Patrol
FHWA	Federal Highway Administration
FPID	Financial Project Identification
FS	Florida Statutes
FTE	Florida's Turnpike Enterprise
GTL	General Toll Lane
GTR	General Tolling Requirements
GUL	General Use Lane
HCS	Highway Capacity Software
HCM	Highway Capacity Manual
HSM	Highway Safety Manual
IAR	Interchange Access Request
IARUG	Interchange Access Request Users Guide
ITS	Intelligent Transportation Systems
LOS	Level of Service
LSDMS	Lane Status Dynamic Message Sign
MPH	Miles per hour
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization

ACRONYM	TERM
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
O&M	Operations and Maintenance
O-D	Origin-Destination
OTM	Operations Task Manager
P3	Public-Private Partnership
PD&E	Project Development and Environment
PFO	Project Finance Office
PTAR	Project Traffic Analysis Report
PTSU	Part Time Shoulder Use
PTZ	Pan/Tilt/Zoom
QA	Quality Assurance
QC	Quality Control
RCTO	Regional Concept of Transportation Operations
RFP	Request for Proposal
RITSA	Regional Intelligent Transportation System Architecture
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
SELS	Statewide Express Lanes Software
SEMP	Systems Engineering Management Plan
SMEs	Subject Matter Experts
SHS	State Highway System
SIB	State Infrastructure Bank
SIS	Strategic Intermodal System
SOG	Standard Operating Guidelines
SOP	Standard Operating Procedures
SIO	FDOT Systems Implementation Office
SO&E	Safety, Operational and Engineering
STTF	State Transportation Trust Fund
T&R	Traffic and Revenue
TADMS	Toll Amount Dynamic Message Sign
TAS	Toll Amount Sign

ACRONYM	TERM
TD	Traffic Density
TDH	Turnpike Design Handbook
TEM	Traffic Engineering Manual
TEO	Traffic Engineering and Operations Office
TFC	Transportation Financing Corporation
TIM	Traffic Incident Management
TMC	Transportation Management Center
TOD	Time of Day
TSM&O	Transportation Systems Management and Operations
TSTM	Toll Siting Technical Memorandum
U.S.C.	United States Code
VPH	Vehicles per hour
VTTS	Value of Travel Time Savings

B. Definitions

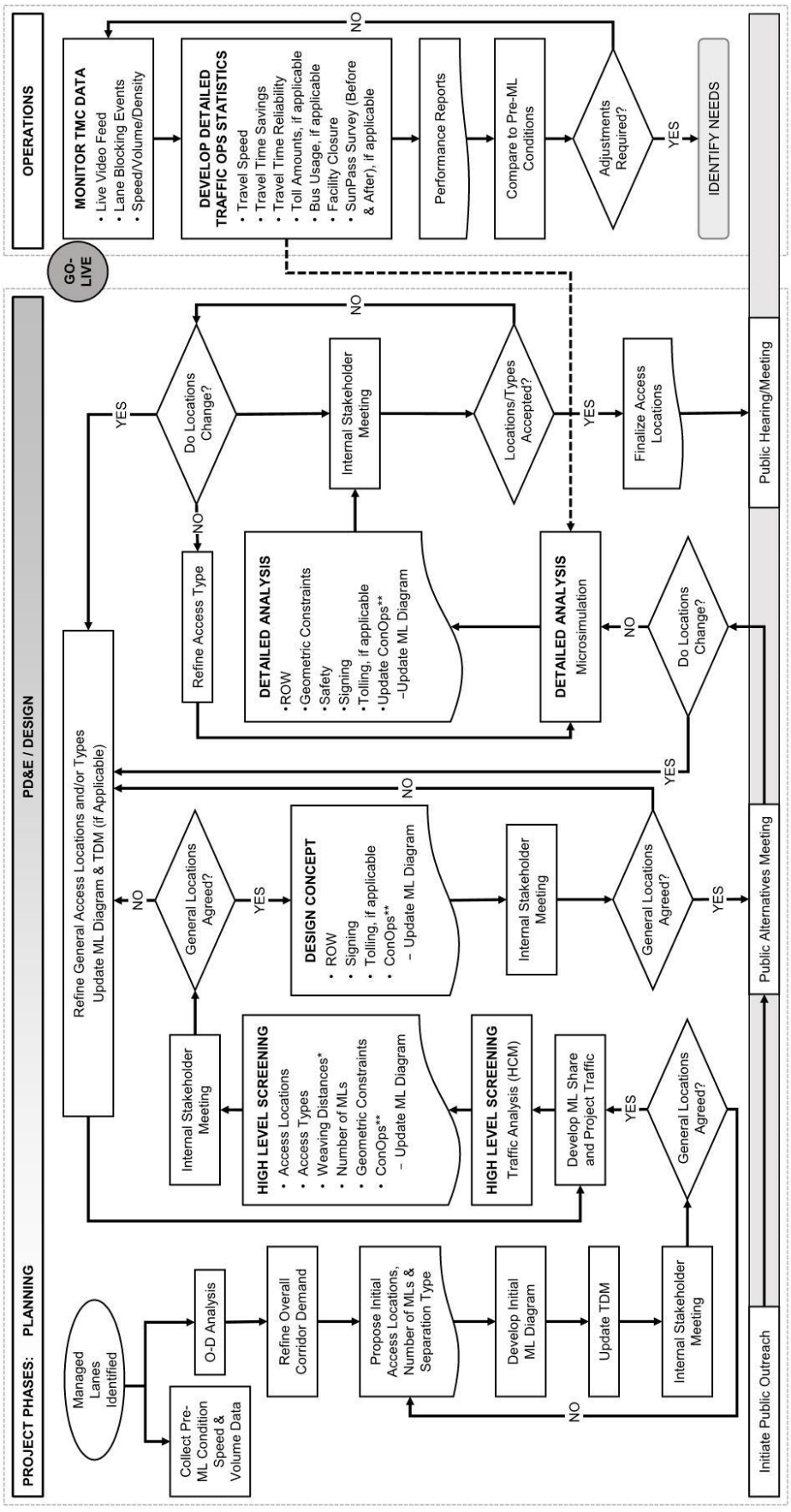
TERM	DEFINITION
Annual Average Daily Traffic (AADT)	A measurement of the number of vehicles that use a highway over a period of a year divided by 365 to obtain the average for a 24-hour period.
Average Daily Traffic (ADT)	The number of vehicles that traverse a segment of roadway over a 24- hour period.
Barrier Separation	Continuous concrete barrier that is used to separate the managed lanes from the general use or general toll lanes.
Bus-only lane	A managed lanes facility dedicated primarily for buses and are often active only on certain days and times in severely congested urban areas with the goal of reducing trip times and improving travel time reliability, and typically designed to use the fastest route between the major origination and destination points utilizing existing managed lanes to meet that goal.
Carpool 3+ Lanes	Lanes reserved or dedicated for passenger vehicles carrying a minimum of three people in the vehicle.
Data Gantry	A toll gantry that only collects information needed to accurately identify the customer's entry into the express lane. The toll site infrastructure for a Data Gantry and a Toll Gantry are identical.
Design Hour Volume (DHV)	The traffic volume expected to use a highway segment during the design hour of the design year.
Directional Design Hour Volume (DDHV)	The traffic volume expected to use a highway segment during the design hour of the design year in the peak direction.
Dynamic Message Sign (DMS)	A large electronic sign over or near roadways used to display real-time traffic information to travelers.
Dynamic Pricing	A toll amount that is adjusted based on traffic conditions in the express lanes.
Dynamic Tolling	Varying toll amounts are adjusted based on real-time monitoring of traffic conditions in the express lanes.
Eligible Trips	Trips that have the ability to enter and exit the express lanes based on their origin and destination.

TERM	DEFINITION
Exemption	Immunity from the requirements to which others must abide. For express lanes, exemptions are defined in *Sections 14-100.004(4) and 14- 100.006(3), Florida Administrative Code* which identify vehicles that are not required to pay tolls.
Express Bus Service	A service in the managed lanes with the goal of making public transportation a more desirable option by reducing trip times and improving travel time reliability, often used to carry a significant number of passengers between major origination and destination points.
Express Lanes	A type of managed and tolled travel lane physically separated from a general use or general toll lane within a roadway corridor.
General Toll Lanes	Tolled roadway lanes for which tolls are constant and not set based on traffic conditions.
General Tolling Requirements (GTR)	The General Tolling Requirements (GTR) is the source of toll infrastructure criteria/requirements for all project delivery methods including Conventional Projects (Design-Bid-Build), and Non-Conventional Projects (Design-Build, Design-Build Finance, and Public-Private-Partnership).
General Use Lanes	Un-tolled travel lanes adjacent to managed lanes.
High Occupancy Vehicle (HOV)	A vehicle carrying two or more passengers.
Highway Capacity Manual (HCM)	A publication of the Transportation Research Board of the National Academies of Science that provides concepts, guidelines, and computational procedures to determine the capacity and quality of service for various highway facilities.
Highway Capacity Software (HCS)	Software that implements most of the HCM methodologies.
Highway Safety Manual (HSM)	The Highway Safety Manual (HSM) is the premier guidance document for incorporating quantitative safety analysis in the highway transportation project planning and development processes.
Intelligent Transportation Systems (ITS)	Electronics, photonics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system. (From Section 501 of Title 23, United States Code, as amended).
Lane Status Dynamic Message Sign (LSDMS)	Notifies users if the express lanes facility is open or closed, as well as other relevant warnings prior to entering the express lanes.

TERM	DEFINITION
Level of Service (LOS)	A quantitative stratification of the quality of traffic service into six letter grade levels, with "A" describing the highest quality and "F" describing the lowest quality.
Managed Lanes	Highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing traffic conditions.
Managed Lane Diagram	A diagram that illustrates the number of managed lanes, GULs, GTLs, ingress and egress points, FPID project limits, toll sites, and conceptual signing for the corridor. Managed Lanes Diagrams should include all interim and ultimate phases to ensure traffic and tolling operations can be maintained.
Managed Lanes Toll Segment	The distance between an ingress (entry) to the managed lanes and the next point of egress (exit).
Manual of Uniform Traffic Control Devices (MUTCD)	The MUTCD contains the national standards governing all traffic control devices. All public agencies and owners of private roads open to public travel across the nation rely on the MUTCD to bring uniformity to the roadway. The MUTCD plays a critical role in improving safety and mobility of all road users.
Part Time Shoulder use PTSU	Part Time Shoulder Use is the use of the left or right shoulders of an existing roadway for travel during certain hours of the day, typically during the peak periods when capacity is needed most.
Responsibility Matrix	A table that identifies the roles and responsibilities for many elements of the express lanes facility, from planning through operations and maintenance.
Static Tolling	Fixed toll amounts that are pre-determined and applied during all hours of the day.
SunGuide	Florida's statewide advanced traffic management systems (ATMS) software that monitors traffic, manages incidents, disseminates traveler information, exchanges critical information among agencies, and collects and reports data regarding the operation of Florida's transportation system.
SunPass®	The Florida Department of Transportation's Prepaid Toll Program.
Systems Engineering Management Plan (SEMP)	A plan used by the Project Manager or ITS Engineer to manage a project with systems engineering principles and methods. For more information, refer to *Florida's Statewide Systems Engineering Management Plan, March 2005*.
Time of Day Pricing	A method of establishing an automated toll amount schedule from historical data that specifies the toll in effect for each fifteen-minute interval for each type of day.

TERM	DEFINITION
Toll Amount	The charge for using the express lanes. The toll amount can be a minimum charge or higher, as determined by the dynamic pricing software, per *Florida Administrative Code,* and *Florida Statutes*.
Toll Amount Sign (TAS)	Displays the toll amount that will be charged to the customer for traveling to one or more destinations in the express lanes.
Toll Gantry	Truss structure supporting the toll equipment over the roadway.
Truck only lanes	Truck-only lanes are a lane management strategy that separates heavy vehicles from mixed-flow traffic along a highway mainline and allows for the exclusive use of trucks.
Tubular Markers	A series of tubular pylons or delineators that separate the managed lanes from the general use or general toll lanes.
Value of Travel Time Savings (VTTS)	Refers to the perceived value of travel time saved from traveling a tolled facility instead of taking an alternate, non-tolled route for the same trip. The amount that a traveler would be willing to pay in order to save time and have a more reliable travel time.
Vehicle eligibility	Refers to management based on user group or vehicle type permitted in managed lanes. Vehicle eligibility controls what types of user groups or vehicles may be either allowed or restricted to increase overall throughput and achieve other transportation management goals established for the corridor
Violation	Occurs when a driver uses the express lanes without traveling in an eligible vehicle or without having a properly mounted, activated SunPass® or other interoperable transponder.
Violator	A registered owner of a vehicle operated in an express lane without being an authorized user.

C. Access Point Location Flowchart



D. Bus-Only Lanes

Bus on shoulder

- D6-Julia Tuttle/I-195 http://www.fdotmiamidade.com/design-projects/beaches/sr-112i-195julia-tuttle-cswy-from-e-of-sr-5biscayne-blvd-to-sr-907alton-rd.html
- D7 – I-275/Pinellas https://www.fdottampabay.com/project/466/443684-1-52-01
- MDX – outside shoulder

Business Access Transit (BAT) lanes

- Jacksonville/JTA – Blanding Blvd
- Pinellas/PSTA – Central Ave BRT https://stpeterising.com/home/2020/7/8/psta-reveals-name-for-st-petes-bus-rapid-transit-project

Bus only

- Jacksonville/JTA - Bay, Jefferson and Broad streets and Kings Avenue
- Orlando/Lynx – Downtown Orlando - https://www.golynx.com/plan-trip/riding-lynx/lymmo/
- Miami/Miami Dade Transit – South Dade Busway https://www.miamidade.gov/transportation-publicworks/routes_detail.asp?route=38

In planning

- International Drive Transit Lanes http://ocfl.net/TrafficTransportation/TransportationProjects/InternationalDriveTransitLanes.aspx
- SMART Plan - http://www.miamidade.gov/citt/smart-plan.asp

E. Toll Project Responsibility Matrix

Project No.:
Project Name:
Project Location:

Date:
Project Contacts
FDOT District:
Turnpike:

District Tolling Procedures (Not For Concession Type Projects)

Express Lanes: FDOT District (non-Turnpike)

District and Turnpike Express Lanes Responsibility Matrix TEMPLATE

LEGEND:
Turnpike (R): Limited Design and Shop Drawing Review by Turnpike
GTR: The State's General Tolling Requirements
(NA): Not Applicable

No.	Element	Description	Ownership	Design Delivery	Submittal Reviews		Construction/ Implementation / Testing	Maintenance		RCI/BMS/ Asset Mgmt	Notes
					Design Plans	Shop Drawings		Funding District	Perform		
1	**Express Lanes (EL) Performance**	Performance and accuracy statistics for speeds, incidents, ITS equipment performance, etc.	District	NA	NA	NA	NA	District	District	NA	
2	**Express Lanes (EL) Traffic & Revenue Reporting**	Traffic and revenue (T&R) reporting of express lanes traffic and toll transactions.	Turnpike	Turnpike	NA	NA	NA	Turnpike	Turnpike	NA	Turnpike will Report Traffic and Revenue to the District.
3	**Project Systems Engineering Management**	A plan for the implementation of the express lanes project using Systems Engineering Process (SEP) principles.	District	District & Turnpike	District & Turnpike	NA	NA	District & Turnpike	District & Turnpike	NA	
4	**Project/Corridor Concept of Operations**	A plan for how the express lanes will be operated.	District	District & Turnpike	District & Turnpike	NA	NA	District & Turnpike	District & Turnpike	NA	The Concept of Operations should be consistent with the overall regional plan defined in the Regional Concept of Transportation Operations (RCTO) documentation.
5	**Right of Way**	Includes all of the right of way associated with the project	District	District	District	NA	NA	District	District	District	
6	**Utility Permitting**	Includes any necessary permits for utilities associated with the toll site (e.g. leased line or power service permits), markers	NA	District	NA	NA	NA	NA	NA	NA	
7	**Toll Building Permitting**	Includes the permitting of the Toll Equipment Building	NA	Turnpike	NA	NA	NA	NA	NA	NA	Turnpike is self permitting. Coordination through FTE Building Permit Coordinator.
8	**Roadway/ Pavement**	Includes resurfacing, patching, pavement marking and other elements within the corridor.	District	District & Turnpike (R)	District & Turnpike (R)	NA	District & Turnpike	District	District	District	Turnpike (R) includes a limited review of the roadway features surrounding the toll point (100' section) including pavement design.
9	**Bridges**	Includes all bridges and bridge components, inclusion in BMS, inspection and routine and periodic maintenance.	District	District	District	District	District	District	District	District	
10	**Signing and Pavement Marking**	Includes static signs and pavement markings related to the express lanes operations.	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	District	District	District	District	Turnpike (R) includes a limited review of the toll rate signs, SunPass, and other related toll collection messaging, as well as any pavement marking (including express lane markers and rpms) for the express lanes.
11	**DMS/VMS Signs**	Includes DMS/VMS signs related to the express lanes operations.	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	District	District	District	District	Turnpike (R) includes a limited review of the toll rate signs, SunPass, and other related toll collection messaging.
12	**Sign Structures**	Includes the structure required to hold any signs related to the express lanes operations.	District	District	District	District	District	District	District	District	
13	**Adjacent/Existing Toll Facilities**	Includes existing toll facilities and impacts to express lanes operations during construction.	District/ Turnpike	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	NA	NA	NA	Turnpike (R) includes limited review of impacts to the existing express lanes facility operations during the new project construction not limited to traffic control plans, changes to the ingress/egress locations, signing, ITS and tolling impacts.
14	**District Fiber Optic Cable (FOC)**	Includes the communication back-bone for both the ITS system for traffic operations as well as the communication back-bone for tolls data.	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike	District	District	District	Turnpike (R) includes a limited review to confirm tolls data connectivity approach and architecture from toll sites to the FTE Tolls Data Center (TDC). Optical Time Domain Reflectometer (OTDR) is required as a contract deliverable per FDOT Standard Specifications. Turnpike completes a review of test documents to ensure acceptable dB losses.
15	**Turnpike (FOC)**	Includes the communication back-bone on the Turnpike for Tolls Data. In most District express lanes projects, the District will have project network communication connect to the existing Turnpike fiber optic backbone.	Turnpike	Turnpike	NA	NA	Turnpike	NA	Turnpike	Turnpike	Includes review to confirm tolls data connectivity approach and architecture from toll sites to the FTE Tolls Data Center (TDC). Optical Time Domain Reflectometer (OTDR) is required when new fiber is installed as a contract deliverable per FDOT Standard Specifications. Review test documents to ensure acceptable dB losses. The District is responsible for identifying all fiber/buffer allocations on District fiber in ITS FN.
16	**Tolls Lateral and Interconnects (FOC)**	Includes the lateral drop between the nearest splice vault and the tolls communications cabinet fiber distribution panel (FDP) inside or between toll equipment buildings	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike	District	District	District	Review test documents to ensure acceptable dB losses.

Project No.:	**Date:**
Project Name:	**Project Contacts**
Project Location:	**FDOT District:**
	Turnpike:

District Tolling Procedures (Not For Concession Type Projects)

Express Lanes: FDOT District (non-Turnpike)

District and Turnpike Express Lanes Responsibility Matrix TEMPLATE

LEGEND:

Turnpike (R): Limited Design and Shop Drawing Review by Turnpike

GTR: The State's General Tolling Requirements

(NA): Not Applicable

No.	Element	Description	Ownership	Design Delivery	Submittal Reviews		Construction/ Implementation / Testing	Maintenance		RCI/BMS/ Asset Mgmt	Notes
					Design Plans	Shop Drawings		Funding District	Perform		
17	**Leased Line Telephone Company (Telco)**	Includes the site infrastructure (pull boxes and conduit) from the toll equipment building to the nearest splice vault (SV) or point of presence (POP). If no geo-diverse fiber is provided, leased lines are required for physical redundancy on express lanes, per GTR 12.5	District & Telco (*)	District, Telco (*) & Turnpike	District, Telco (*) & Turnpike	District, Telco (*) & Turnpike	District, Turnpike, & Telco (*)	District, Turnpike, & Telco (*)	District, Turnpike, & Telco (*)	District & Telco (*)	Turnpike coordinates with the Telco and communicates need based on forecasted traffic volumes and toll system bandwidth requirements. Telco (*) requires 200 days advanced coordination notice prior to turning the site over to the toll equipment contractor. This effort includes circuit ordering and equipment installation by the Telco. To be included only if leased lines are used.
18	**District TMC to FTE Tolls Data Center Communications Media (for sending toll amount data)**	This item is associated with the protocol for communicating tolls amount data from the District to the Turnpike. It not associated with the physical communications media, but the rather the protocol. The Turnpike owns the ICD. Communications media will be either fiber communications or leased line.	District & Turnpike	District & Turnpike	District & Turnpike	District & Turnpike	NA	District & Turnpike	District & Turnpike	NA	
19	**Tolls WAN Monitoring**	Includes monitoring of all of the Toll's WAN electronics (within FTE and District network) and leased line connectivity.	Turnpike	Turnpike	NA	NA	NA	Turnpike	Turnpike	Turnpike	Turnpike will monitor WAN switch for connectivity. Wide Area Communication requires a response as soon as practical. Performance metrics should be established for response and repair time.
20	**ITS Roadside Equipment**	Includes all of the ITS roadside equipment (not including the signs - covered elsewhere in matrix) and system required to identify traffic conditions and monitor vehicle speeds and volumes through the corridor.	District	District	District	District	District	District	District	District	
21	**ITS Roadside Communication**	Includes the equipment required to connect the roadside equipment with the ITS building/cabinet equipment.	District	District	District	District	District	District	District	District	
22	**ITS Traffic Management Software**	Includes the software required for traffic management as well as calculate the toll amounts.	District	District	District	District	District	District	District	NA	District will test pricing system. The Turnpike and District will jointly perform End to End testing.
23	**ITS Power Service**	Includes power services required for equipment use.	District	District	District	District	District	District	District	NA	ITS power **shall not** be combined or shared with the toll equipment building power service.
24	**ITS Cabinet/ Building**	Includes the site infrastructure and building or cabinet required to house the ITS equipment and/or ancillary equipment.	District	District	District & Turnpike (R)	District	District	District	District	District	For Turnpike involvement in submittal review - Should Toll's wide area network (WAN) regeneration be required, then the District ITS cabinet/building shall accommodate the Tolls WAN equipment and electronics.
25	**Toll Site**	Locating of tolling site and all the civil/site infrastructure in, around, and below the gantry, building, maintenance access area, utility constraints, drainage, etc.	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike	District	District	District	Turnpike (R) includes the review of site components for GTR conformance.
26	**Toll Gantry**	Includes the structure and all associated elements included with the structure required for installing, operating, and testing toll equipment. Includes all ancillary items such as grating, fall protection systems, gear operators, electrical equipment, man lifts, access gates, etc. Excludes toll equipment and associated cables provided by the toll equipment contractor.	District	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike (R)	District & Turnpike	District	District	District	Turnpike (R) includes the review of gantry components for GTR conformance. Turnpike to provide guidance on the appropriate use of accessible gantries. District to notify Turnpike when performing Toll Gantry Structure Inspections.

Project No.:	**Date:**
Project Name:	**Project Contacts**
Project Location:	**FDOT District:**
	Turnpike:

District Tolling Procedures (Not For Concession Type Projects)

Express Lanes: FDOT District (non-Turnpike)

District and Turnpike Express Lanes Responsibility Matrix TEMPLATE

LEGEND:

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GTR: The State's General Tolling Requirements

(NA): Not Applicable

No.	Element	Description	Ownership	Design Delivery	Submittal Reviews		Construction/ Implementation / Testing	Maintenance		RCI/BMS/ Asset Mgmt	Notes
					Design Plans	Shop Drawings		Funding District	Perform		
27	**Toll Equipment Building**	Includes the toll equipment building, and foundation.	District	District & Turnpike	District & Turnpike	District & Turnpike	District & Turnpike	District	Turnpike	District	Turnpike (R) includes the review of toll equipment building components for GTR conformance. The Turnpike will perform maintenance on the Toll Equipment Building. Electrical components within the building will be maintained by Turnpike, but the Power Distribution to the Building will be maintained by the District. Replacement of building from damage beyond repair or end of service life is the District's responsibility. The District does not have to program the maintenance costs for this element, as they are deducted from the toll revenue that the District receives. District is responsible for obtaining/determining the Building #. Florida's Turnpike will have the building added to the Turnpike's commercial insurance policy and the District's/Project's portion of the insurance premium is deducted from the toll revenue distribution by Central Office.
28	**Toll Equipment Building (Facility Systems)**	Includes the systems required for operation of the toll equipment building. These systems include stand-by generator, automatic transfer switch (ATS), diesel fuel tank, HVAC, lighting, electrical power up to the UPS, equipment connections to the SCADA system, and other required systems	District	District & Turnpike	District & Turnpike	District & Turnpike	District & Turnpike	District	Turnpike	District	Turnpike (R) includes the review of the facility systems for GTR conformance. This does not include gantry or rack mounted toll equipment provided and installed by the toll equipment contractor, which is covered under "Toll Equipment" in this matrix. District is responsible for purchasing all fuel for generators. Replacement of all toll equipment building facility systems due to damage beyond repair and end of service life is the Districts' responsibility. The District does not have to program the maintenance costs for this element, as they are deducted from the toll revenue that the District receives. Fire supression systems in toll equipment buildings shall be installed by others under a separate contract by the Turnpike.
29	**Toll Equipment Building (Tolling Systems)**	Includes the systems required by the GTR for card access control, communications switch, and CCTV.	District	Turnpike	Turnpike	Turnpike	Turnpike	District	Turnpike	District	This does not include gantry or rack mounted toll equipment provided and installed by the toll equipment contractor, which is covered under "Toll Equipment" in this matrix. Turnpike will coordinate with the District on Toll Systems installation. The District does not have to program the maintenance costs for this element, as they are deducted from the toll revenue that the District receives.
30	**Toll Equipment Building (Power Service)**	Includes power services required by the toll facility.	District	District & Turnpike	District & Turnpike	District & Turnpike	District & Turnpike	District	District	District	Turnpike (R) includes the review of the facility power systems for GTR conformance. The toll equipment building power service shall be dedicated and not shared. Roadway lighting and ITS power shall not be combined or shared with the toll equipment building power service.
31	**Toll Loops**	Includes the loop system installed in the tolling area pavement, 50 feet on both sides of the gantry centerline in the express lanes, inside shoulder and adjacent general purpose lane as required by the toll equipment contractor.	District	District & Turnpike	District & Turnpike	NA	District & Turnpike	District	Turnpike	District	The toll equipment contractor shall install these loops in the tolling pavement area in conjunction with the gantry and building mounted toll equipment. The loops are part of the tolling system. The Turnpike will perform an annual inspection of the toll pavement. District will program and pay for maintenance performed by the Turnpike. Turnpike will provide estimates for District programming.

Project No.:	**Date:**
Project Name:	**Project Contacts**
Project Location:	**FDOT District:**
	Turnpike:

District Tolling Procedures (Not For Concession Type Projects)

Express Lanes: FDOT District (non-Turnpike)

District and Turnpike Express Lanes Responsibility Matrix TEMPLATE

LEGEND:

Turnpike (R): Limited Design and Shop Drawing Review by Turnpike

GTR: The State's General Tolling Requirements

(NA): Not Applicable

No.	Element	Description	Ownership	Design Delivery	Submittal Reviews		Construction/ Implementation / Testing	Maintenance		RCI/BMS/ Asset Mgmt	Notes
					Design Plans	Shop Drawings		Funding District	Perform		
32	**Toll Equipment**	Includes the gantry/ground/building mounted equipment provided and installed by the toll equipment contractor. Includes the gear boxes on accessible gantries.	District	NA	NA	NA	Turnpike	District	Turnpike	District	Turnpike will test the tolling system. The Turnpike and District will jointly perform End to End testing. Toll equipment installation as-builts are provided by the toll equipment contractor. District will program and pay for maintenance performed by the Turnpike. Turnpike will provide estimates for District programming.
33	**FCC License**	This includes the coordination and acquisition of the license for the AVI subsystem RF License from the Federal Communications Commission.	Turnpike	NA	NA	NA	Turnpike	NA	NA	NA	Time line as required by FCC, requires Northing and Easting, Lat/Long and physical building address for application.
34	**Toll Amount Pricing**	District will provide toll amount/rates through coordination with their TMC and provide them to Turnpike Toll's back office.	District	NA	NA	NA	NA	NA	NA	NA	The District is responsible for the dynamic pricing of express lanes based on traffic conditions. (The Turnpike establishes toll rates through the Rule Making Process.)
35	**Toll Transaction Processing Software**	Includes the software required to manage and operate the toll facility including, transaction creation, trip building, account management, and violations processing.	Turnpike	Turnpike	NA	NA	Turnpike	Turnpike	Turnpike	NA	Turnpike performs these services. The District is charged for the related toll operating costs.
36	**Incident Management**	Includes funding for Road Ranger Services and other incident management services.	District	NA	NA	NA	District	District	District	NA	
37	**Toll Enforcement (Back Office)**	Includes programs used to enforce tolls within the system.	Turnpike	NA	NA	NA	Turnpike	Turnpike	Turnpike	NA	Includes Back Office processing for toll violations in accordance with violation business rules for express lanes. Turnpike performs these services. The District is charged for the related toll operating costs.
38	**Traffic Enforcement (Roadside)**	Coordination of speed enforcement, illegal access/egress, and unauthorized vehicles with FHP or other enforcement agencies.	District	NA	NA	NA	NA	NA	NA	NA	
39	**Toll Transaction Processing**	Back office processing of express lanes toll transactions in accordance with express lane Toll Processing Business Rules. This element is associated with the transaction processing activity.	Turnpike	Turnpike	NA	NA	Turnpike	Turnpike	Turnpike	NA	Turnpike performs these services. The District is charged for the related toll operating costs.
40	**Public Information (PIO)**	Coordination of all project related information on the express lanes project.	District & Turnpike	District & Turnpike	NA	NA	NA	NA	NA	NA	District PIO provides operational information and statistics (average toll, traffic information, incident management). Turnpike addresses express lanes tolling methodology and processes.

F. Examples of Dynamic and Time of a Day Toll Setting Parameters Memorandums

Florida Department of Transportation
RON DESANTIS
GOVERNOR
605 Suwannee Street
Tallahassee, FL 32399-0450
KEVIN J. THIBAULT, P.E.
SECRETARY

MEMORANDUM

DATE:

TO: John Easterling, P.E., PTOE FTE Traffic Operations Engineer
Trey Tillander, P.E., Director, Traffic Engineering and Operations

FROM: District Traffic Operations Engineer

COPIES: District Secretary
District Director of Transportation Operations

SUBJECT: **Initial Toll Setting Parameters**

FDOT District Two has reviewed the traffic data supplied from the Traffic and Revenue (T&R) study and the Systems Interchange Modification Report (SIMR) and is recommending the initial toll setting parameters for I-295 West Express Phase I from the Buckman Bridge to I-95 [213345-7-52] as indicated below.

I-295 West Express Phase I will operate in time of day mode with a maximum toll amount of $0.50 Monday through Friday from 6:00 am to 10:00 am and from 3:00 pm to 7:00 pm. There will be zero toll Saturday and Sunday. These toll parameters consist of a configured minimum and maximum segment toll and Time of Day table. **Table 1** shows the initial Time of Day table proposed for use on this project.

Table 1: Initial Time of Day Table for I-295 West Express Phase I

Weekday Time- Monday through Friday	Segment Toll	
	Minimum	Maximum
6:00 am – 10:00 am	$0.50	$0.50
10:01 am – 2:59 pm	$0.00	$0.00
3:00 pm – 7:00 pm	$0.50	$0.50
7:00 pm – 5:59 am	$0.00	$0.00
Weekend Time- Saturday and Sunday	**Segment Toll**	
	Minimum	**Maximum**
7:01 pm Friday – 5:59 am Monday	$0.00	$0.00

Utilizing a combination of the projected hourly volumes from both the T&R and the SIMR, the LOS was estimated for each hour based on thresholds derived from the Highway Capacity Manual Version 6. The express lane configuration is a two-lane facility for the majority of the corridor but is one-express lane for

approximately 1,500 feet at the Southbound ingress. The Northbound ingress is unique in that it has two single lane ingress points, one for traffic entering the express lanes from I-295 northbound and a second point for traffic coming from I-95. The Northbound section is one-lane for approximately 1-mile prior to the additional ingress point past the I-95 entrance ramp, where the express lanes become two-lanes. The express lane limits are approximately 3.2 miles in the Southbound direction and 4.2 miles in the Northbound direction. For the purposes of this analysis, the single-lane threshold was used since this portion of the express lanes is the critical segment along the system.

Figure 1 shows the projected LOS by hour. As shown, the facility is projected to exhibit traffic conditions of LOS A and LOS B for the majority of the day. The majority of toll rate adjustments will be seen during the AM peak period for Southbound traffic and the PM peak period for Northbound traffic. The volumes reach LOS D for two to three hours when the single lane maximum service volume thresholds are exceeded. However, in field operating conditions, the LOS will be derived using multiple vehicle detection sensors for both the two lane and single lane segments. It is expected that that the field calculated LOS will be lower than what is shown in Figure 1 during normal operating conditions. Therefore, the analysis concludes the proposed LOS table will stay within acceptable LOS targets while providing the minimum toll amounts for the majority of the day.

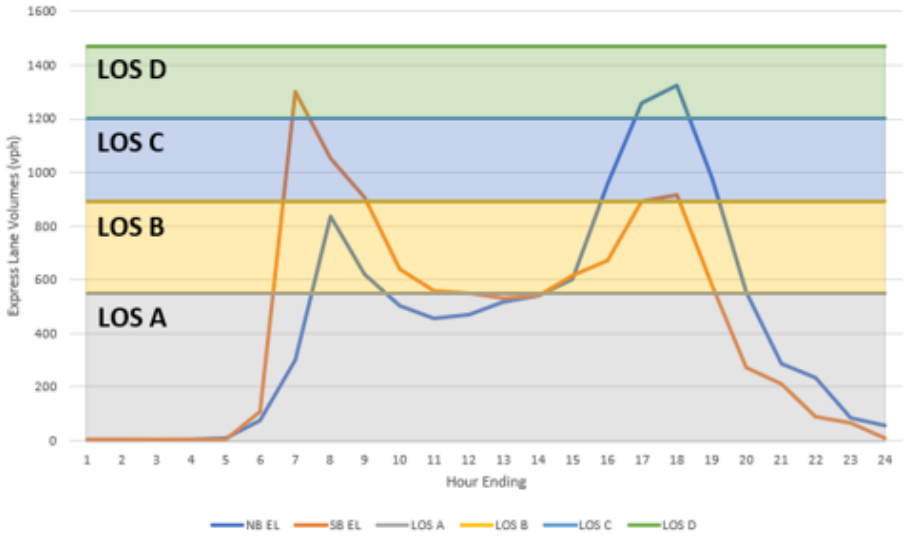

Figure 1: LOS Table with Projected Hourly Volumes

The facility will launch with a static $0.50 toll while the necessary testing and adjusting is made to the vehicle detectors. After that adjustment period, time of day tolling will be implemented. It will require initial close monitoring, and while no adjustments to these tables will be considered during the first few weeks, a thorough review will be performed to review the traffic conditions, tolls assessed, and other trends after the first month of operation. This first month review will determine if any adjustments should be required to best achieve reliability goals.

It is recommended to begin I-295 West Express Phase I with the initial Time of day table (Table 1).

Recommendation:

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Approval:

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Secretary
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G. Authority and References

Authority

Sections 20.23(3)(a) and 334.048(3), Florida Statutes (F.S.).

References

Florida Statutes and Florida Administrative Code

- 316.0741 (4)(5)(6), F.S. – *High-occupancy-vehicle lanes (HOV)* – This statute describes the type of vehicles to be driven in an HOV and the decal and registration certificate process that needs to be followed by the Department.
- 335.02(3), F.S. – *Authority to designate transportation facilities and rights-of-way and establish lanes; procedure for redesignation and relocation; application of local regulations* — Section (3) of this statute establishes the process the Department needs to follow when determining the number of lanes for any regional corridor or section of highway on the SHS.
- 338.22, F.S. – *Florida Turnpike Enterprise Law* — Sections 338.22-338.241 may be cited as the "Florida Turnpike Enterprise Law."
- 338.151, F.S. – *Authority of the department to establish tolls on the SHS* – This statute describes when the Department may establish tolls on new facilities on the SHS. In addition, an exception for HOV, express lanes, turnpike systems, and others authorized by law, is described when the Department may not establish tolls on limited access facilities.
- 338.155, F.S. – *Payment of toll facilities required: exemptions* – This statute provides a list of the exemptions when a person may use a toll facility without payment of tolls.
- 338.166, F.S. – *High-occupancy toll lanes or express* lanes – Allows the Department to issue bonds on High Occupancy Toll Lanes or Express Lanes owned by the Department.
- 338.221, F.S. – *Definitions* – This statute defines the terms as used in Chapter 338 from Statute 338.22 to 338.241.
- 14-100.003, Florida Administrative Code (FAC) – *Express Lane Tolling* – The purpose of this rule is to establish criteria for express lanes tolling by the FDOT. This rule describes toll criteria for variable tolling, authorized users, and display of toll criteria.
- 14-100.004, FAC – *95 Express Lane Tolling* – The provisions of this section apply to only express lanes on I-95 in Miami-Dade, Broward and Palm Beach Counties.
- 14-100.005, FAC – *Video Billing* – This rule establishes the process of video billing on the FTE System and other Department owned toll facilities, and on toll facilities owned by a public or private entity for which the Department collects tolls pursuant to an agreement between the Department and the private or public entity authorized by Section 338.161(5), F.S.
- 14-100.006, FAC – *Department Express Lane Toll Registration Exemption* – This rule establishes the criteria for toll exemptions on express lanes owned by FDOT, excluding FTE System.

United States Code

- U.S.C. Title 23, Section 129: *Toll Roads, Bridges, Tunnels, and Ferries* – Provides limitations on the use of toll revenues generated from FDOT-owned facilities that were funded (in whole or in part) by FHWA or any other federal entity.
- U.S.C. Title 23, Section 146: *Carpool and Vanpool Projects* – In order to conserve fuel, decrease traffic congestion during rush hours, improve air quality, and enhance the use of existing highways and parking facilities, the Secretary may approve federal financial assistance from funds apportioned under section 104(b)(2) of this title, projects designed to encourage the use of carpools and vanpools. Such a project may include, but is not limited to, such measures as providing carpooling opportunities to the elderly and handicapped, systems for locating potential riders and informing them of convenient carpool opportunities, acquiring vehicles appropriate for carpool use, designating existing highway lanes as preferential carpool highway lanes, providing related traffic control devices, and designating existing facilities for use as preferential parking for carpools.
- U.S.C. Title 23, Section 166: *HOV Facilities* – A public authority that has jurisdiction over the operation of an HOV facility shall establish the occupancy requirements of vehicles operating on the facility.
- U.S.C. Title 23, Section 167*: National Freight Program* – It is policy to improve the condition and performance of the National Highway Freight Network to ensure that the network provides the foundation for the United States to compete in the global economy and achieve the goals described below:
    1. to invest in infrastructure improvements and to implement operational improvements on the highways of the United States.
    2. to improve the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas.
    3. to improve the state of good repair of the National Highway Freight Network.
    4. to use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Highway Freight Network.
    5. to improve the efficiency and productivity of the National Highway Freight Network.
    6. to improve the flexibility of states to support multi-state corridor planning and the creation of multi-state organizations to increase the ability of states to address highway freight connectivity.
    7. to reduce the environmental impacts of freight movement on the National Highway Freight Network.

FDOT Policy and Procedures

- Topic 000-525-045: *Managed Lanes Policy* – This procedure provides guidance for employing managed lanes on appropriate facilities that experience significant congestion in existing or projected future conditions.
- Topic 525-030-120: *Project Traffic Forecasting* – This procedure provides instructions for using design traffic criteria to forecast corridor traffic and project traffic. The selection of the most appropriate analysis method(s) must be coordinated with FDOT before conducting the study. District planning offices will be responsible for carrying out the traffic forecasting process.
- Topic 525-030-160: *New or Modified Interchanges* — This procedure sets forth the state and federal requirements and processes to be used for determination of Safety, Operational and Engineering (SO&E) acceptability associated with adding or modifying interchange access to limited access facilities on Florida's SHS. Full compliance with the requirements and processes in this procedure is required for any Interchange Access Request (IAR).

- Topic 525-030-260: *Strategic Intermodal System Highway Component Standards and Criteria* — This procedure addresses the responsibilities of the various offices within FDOT to develop and implement the Strategic Intermodal System (SIS). It also defines the requirements for coordination with the local government and Metropolitan Planning Organization (MPO) transportation planning process. Such coordination is needed to ensure IARs are consistent with the SIS Master Plan and Action Plan for the affected facilities.
- Topic 650-000-001: *Project Development and Environment (PD&E) Manual* — This manual describes in detail the process by which transportation projects are developed by the Department to fully meet the requirements of the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ), and other related federal and state laws, rules, and regulations. The manual aids project analysts and project managers in understanding all aspects of the project development process and its requirements, such as engineering and environmental analyses, public involvement, and documentation.
- Topic 625-000-002: *FDOT Design Manual (FDM)* – This manual sets geometric and other design criteria, as well as procedures, for FDOT projects. The information in the FDM applies to the preparation of contract plans for roadways and structures.
- Topic 750-000-005: *Traffic Engineering Manual (TEM)* – This manual provides traffic engineering standards and guidelines to be used on the SHS by the Department's District Traffic Operations Offices.
- Topic 750-040-003c: *FDOT Systems Engineering and Intelligent Transportations Systems Architecture Procedure* – This procedure concerns all entities associated with federally funded intelligent transportation systems (ITS) projects including local agencies, MPOs, and all applicable units of FDOT. This procedure contains information related to the methodology and maintenance of ITS architecture and the roles of agencies in ensuring this procedure is applied.

H. Resources

Managed Lanes Projects Database
https://managedlanes.wordpress.com/2021/01/05/projects-database/

Managed Lanes Chapter for the Freeway Management and Operations Handbook; Office of Operations, FHWA
https://ops.fhwa.dot.gov/freewaymgmt/publications/frwy_mgmt_handbook/revision/jan2011/mgdlaneschp8/sec8.htm

Congestion Pricing: A Primer; Publications, FHWA
https://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm

Toll Facilities in the United States; Office of Highway Policy Information, FHWA
https://www.fhwa.dot.gov/policyinformation/tollpage/2015/history.cfm

Guidance General Tolling Programs; MAP-21, FHWA
https://www.fhwa.dot.gov/map21/guidance/guidetoll.cfm

Traffic Engineering and Operations Office, Managed Lanes
https://www.fdot.gov/traffic/its/managedlanes.shtm

Traffic Engineering and Operations Office, Managed Lanes
https://www.fdot.gov/traffic/its/managedlanes.shtm

FDOT Project Traffic Forecasting Handbook
https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/systems/systems-management/document-repository/traffic-analysis/2019-project-traffic-forecasting-handbook.pdf?sfvrsn=e105e71d_2

FDOT Traffic Analysis Handbook
https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/systems/systems-management/document-repository/traffic-analysis/traffic-analysis-handbook_05-2021.pdf?sfvrsn=cecdd23b_2

FDOT Interchange Access Request User's Guide
https://www.fdot.gov/planning/systems/documents/sm/default.shtm

FDOT Project Development and Environment (PD&E) Manual
https://www.fdot.gov/environment/pubs/pdeman/pdeman-current

General Tolling Requirements
General Tolling Requirements – Florida's Turnpike (floridasturnpike.com)

NCHRP Research Report 835. National Academies of Sciences, Engineering, and Medicine 2016. *Guidelines for Implementing Managed Lanes*. Washington, DC: The National Academies Press. https://doi.org/10.17226/23660.

NCHRP Research Report 891: National Academies of Sciences, Engineering, and Medicine 2018. *Dedicating Lanes for Priority or Exclusive Use by Connected and Automated Vehicles*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25366.

NCHRP Report 649. National Academies of Sciences, Engineering, and Medicine 2010. *Separation of Vehicles CMV-Only Lanes*. Washington, DC: The National Academies Press. https://doi.org/10.17226/14389.

HCM 6th Edition Transportation Research Board. 2016. *Highway Capacity Manual 6th Edition: A Guide for Multimodal Mobility Analysis*. Washington, DC: The National Academies Press. https://doi.org/10.17226/24798.

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