

## Chapter 7

### Traffic and ITS Design

The following are changes, additions or deletions to the January 2007, Topic #625-000-007, Plans Preparation Manual (PPM) - English, for use on Turnpike projects only:

#### 7.2.1 Design Criteria

*Add the following to paragraph 1*

It is the direction of the Turnpike to mount all Advanced Exit Signs (excluding Supplemental Signs) on overhead (OH) sign structures when the number of travel lanes in one direction is 3 or more. In addition, ALL signs shall use Diamond Grade VIP sign sheeting (see section 7.2.9.6).

*Add the following to paragraph 1*

When locating and designing these multi-post signs, consideration should be given as to the physical placement of the posts as well as to the visibility of the sign panel. The placement of the sign posts shall not occur in a ditch bottom. In addition, clearing & grubbing should be included if the visibility of the sign panel is blocked. Refer to the latest Guide Drawings for guidance on both of these criteria.

*Add the following to paragraph 2*

When locating these structures, consideration shall be given, and noted on the signing cross sections, as to the placement of the sign structure foundation outside of the clear zone, as well. Signs located behind guardrail shall be located at a minimum of 4 feet from the face of the guardrail. This applies to the uprights on overhead signs and for the sign face (panel) for ground mounted signs. In addition, all overhead signs shall be designed with a roadway to luminaire vertical clearance of 18' – 0" minimum. This additional height allows for future panel revisions as well as possible maintenance friendly luminaire devices.

*Add the following paragraphs*

Signs of dissimilar shape shall not be mounted back to back. For example, a "STOP" sign shall not be mounted back to back on the same post behind a "Do Not Enter" sign.

All Advance Exit signs should use the physical gore as the point of reference for mileage designations. The only time this should not be done is if the physical gore and theoretical gore are separated by more than 500 feet.

Guide signs on ramps shall include destination signing that repeats the exit guide sign information and provides route guidance to the driver. A horizontal line shall separate destinations in different directions clearly to associate the destinations with their respective directions.

Exit Warning Speed (W13-2) and Ramp Warning Speed (W13-3) signs are to be used on exit ramps, except when the ramp has the same or greater design speed than the mainline.

The Florida's Turnpike mainline shall use the sign panel shown in the latest Guide Drawings. The panel sizes shall meet the following standards:

- To identify the Turnpike from a cross road or for trailblazing – 30" x 36"
- For all guide sign uses along a freeway and for Post Interchange signs – 40" x 48"
- For "special" applications – 50" x 60"

For all other Turnpike operated facilities the Toll Route Marker shall be used as shown in the Traffic Engineering Manual, Section 2.23. The size of this panel shall meet the standards in the TEM with the following exception:

- For identification along the mainline (i.e., Post Interchange Sign) – 36" x 48"

## 7.2.9 Toll Plazas

*Add the following sections*

All Toll Plaza signing shall conform to the latest standards and guidelines set forth by the Turnpike. These guidelines and standards are either specified or shown in this manual or can be obtained from the Turnpike Traffic Plans Engineer.

### 7.2.9.1 Approach Signing for Mainline Toll Plazas

The sequence of the advance signs to a standard mainline toll plaza should include as a minimum "Toll Plaza, 1 Mile, Cars \$X/XX", "Prepaid Tolls Only, SunPass (logo), (directional message)", "Toll Plaza, ½ Mile, Reduce Speed", "Exact Coins, Cars Only"/"Change Provided"/"Prepaid Tolls Only, SunPass (logo)" lane assignment signs, "Wide Lane Keep Right/Left" and the "Toll Schedule". There are other approach signs that may be used such as a "Toll Plaza, 2 Miles, Cars \$X.XX" sign or various speed reduction signs. The use of these signs should be coordinated with the Turnpike prior to design. Signs should not include the toll amount for plazas located within the Ticket System of the Turnpike Mainline.

All of the standard mainline approach signing mentioned above has been designed by the Turnpike and is shown in the latest Guide Drawings. These signs should be placed along the mainline according to the distances shown in the Guide Drawings. Any deviation from this placement should be clearly justified by the Engineer.

### 7.2.9.2 Approach Signing for Ramp Toll Plazas

The sequence of the advance signs to a ramp plaza should include as a minimum "Toll Plaza Ahead, Cars \$X.XX", "Prepaid Tolls Only, SunPass (logo), (directional message)", "Toll Violations", "Wide Lane Keep Right/Left" and the "Toll Schedule". There are other approach signs that may be used such as various speed reduction signs. The used of these signs should be coordinated with the Turnpike prior to design. Signs should not include the toll amount for

plazas located within the Ticket System of the Turnpike mainline. Advance directional signing should only be provided at locations where geometry will not permit adequate directional signing on the departure side of the plaza.

All of the standard ramp approach signing mentioned above has been designed by the Turnpike and are shown in the latest Guide Drawings. These signs should be placed along the ramps while maintaining the typical 100 ft. spacing necessary for sign legibility. When geometry on the ramp plaza does not allow enough room for sufficient sign spacing, the Designer should look to remove the “Prepaid Tolls Only, SunPass (logo), (directional message)” sign and/or locate signs opposite each other along the ramp. When the distance from an intersecting roadway to the toll plaza is less than 400 ft., the “Prepaid Tolls Only, SunPass (logo), (directional message)” sign should be removed from the signing scheme.

### **7.2.9.3 Canopy Signing**

All canopy-mounted signs shall be included in the plans as shown in the latest Guide Drawings. These panels shall be included as standard sized panels. The designer shall begin the design with the largest panels first and proceed smaller only if an existing canopy cannot accommodate the larger panel. All canopy signs should be the same height when placed along the same approach fascia for a Toll Plaza. When a Changeable Message Sign (CMS) is used on a canopy, all static signs on that same fascia shall be 5 ft. in height to match the display height of the CMS panel.

Associated with all canopy-mounted signs should be a Lane Use Control Signal. Information about this signal is mentioned in Section 7.4.1.1, Lane Use Signals.

### **7.2.9.4 Pavement Markings**

All pavement marking details and descriptions are shown in the latest Guide Drawings. The designer should refer to these Drawings as a guide for striping design. Deviation from these Drawings may be necessary at times and should be coordinated with the Turnpike Traffic Plans Engineer.

Mainline plaza approach striping shall be designed and placed in a way that directs the driver to a segment of the plaza from the mainline travel lanes. This is accomplished by segregating the plaza into sections based upon the number of toll lanes and the number of mainline travel lanes. This typed of design is used to try and eliminate high-speed weaving and last minute lane changes. A detail showing this is included in the latest Guide Drawings.

### **7.2.9.5 SunPass**

*Add the following sections*

#### **7.2.9.5.1 Signing**

Island signing for SunPass shall consist of the following as a minimum:

1. A 25 mph speed limit sign with a 45 degree arrow (M6-2) shall be added to the left of the dedicated lane to provide liability protection and speed enforcement.
2. A toll collector warning sign shall be added on the island on each side of the dedicated lane. This sign is installed curbside near the sidewalk between the administration building and the first lane of a mainline plaza. At locations with dedicated lanes on the outside of the plaza, the toll collector warning sign shall also be placed on the shoulder. Layouts for these signs and others are shown in the latest Guide Drawings.

### 7.2.9.5.2 Pavement Markings

All SunPass equipped lanes shall have toll attendant/collector warning symbols placed in any walkway across adjacent islands, in the doorways of booths on the adjacent islands, and on the sidewalk between the administration building and the first lane on the plaza. A note shall be added to the plans as follows: “The Attendant Pavement Warning Symbols shall be 3M Sidewalk Graphic Image as distributed by Ad Graphics, Inc., of Pompano, Florida, or an approved equal.” These symbols are intended to warn toll attendants of the danger in crossing the SunPass lanes, since vehicles are not required to stop as part of a dedicated SunPass lane electronic toll transaction. Dedicated SunPass lanes shall have approach and departure channelization with pavement messages as shown in the latest Guide Drawings. The dedicated SunPass markings shall be supplemented with RPMs and flexible delineators as shown in these Guide Drawings. For dedicated SunPass lanes that are 12 feet wide or greater, the lane shall be narrowed to 10 feet through the plaza area. Details for the toll attendant signs and marking symbols are shown in the latest Guide Drawings.

### 7.2.9.6 Sign Sheeting

*Add the following section*

To help increase the visibility of Turnpike signs, all projects with a letting date of January 1, 2007 or later are required to have Diamond Grade VIP sign sheeting on all new signs. Projects letting prior to this date will be evaluated on a case by case basis for the ability to incorporate Diamond Grade VIP sign sheeting.

By using this sheeting, the Turnpike will be able to reduce power consumption on externally lit signs by using a lower wattage light and increasing the reflectivity of the sign.

## 7.3 Lighting

*Add the following references*

**Roadway Lighting Handbook**, USDOT/FHWA (Implementation Package 78-15) - This Handbook provides additional information on roadway lighting design and also provides a warranting condition to be used for arterial roads.

**Federal Aviation Regulation, Part 77, Objects Affecting Navigable Airspace**, USDOT/FAA - This regulation sets the requirements to follow on projects near airports.

***Federal Aviation Administration Advisory Circular AC 70/7460-1, Obstruction Marking and Lighting***, FAA. This advisory circular defines the requirements to follow to identify objects that require special lighting near airports.

***Federal Aviation Administration Advisory Circular AC 150/5345-43, Specification for Obstruction Lighting Equipment***. This advisory circular contains the FAA specification for obstruction lighting equipment.

***Manual on Uniform Traffic Studies (January 2000) Chapter 15 Highway Lighting Justification Procedure***, FDOT ***Recommended Practice for Roadway Lighting IES RP- 8***, ANSI/IESNA

### 7.3.1 Design Criteria

*Add the following paragraphs*

Projects with conventional lighting along the roadside shall be designed for an average initial illumination of 1.7 to 1.8 foot candles. For Toll Plaza approaches an average initial illumination of 2 footcandles with uniformity ratios of 4:1 or less (average-to-minimum) and 10:1 or less (maximum-to-minimum). Projects with high mast lighting shall be designed for an average initial illumination of 1.0 to 1.2 footcandle, and uniformity ratios of 3:1 or less (Average/Min) and 10:1 or less (Max/Min). Lighting Criteria for Service Plazas should follow Table 7.3.4. This includes the ramps to and from the Service Plazas.

If the adjoining mainline roads are not illuminated, then the lighting design shall include mainline transition lighting to allow a driver a reasonable reduction in lighting levels from a lighted roadway to an unlit road. The mainline transition lighting shall extend beyond the project lighting limits by approximately four-to six- pole spacing.

If the length of the mainline between lighted interchanges is 0.5 mile or less, then that section of the mainline shall be lighted regardless of what the Lighting Justification Report says.

High mast lighting at interchanges may be used provided that the surrounding area is not an urban residential area. Lighting designers shall investigate future development plans of the area and obtain approval from the Turnpike Electrical Engineer and Project Manager before considering high mast lighting.

**Table 7.3.1 Conventional Lighting - Roadways**

ROADWAY CLASSIFICATIONS	ILLUMINATION LEVEL AVERAGE INITIAL (H.F.C)	UNIFORMITY RATIOS	
		AVG/MIN	MAX/MIN
INTERSTAE,EXPRESSWAY, FREEWAY & MAJOR ARTERIALS	1.7 to 1.8	4:1 or Less	10:1 or Less
ALL OTHER ROADWAYS	1.0 to 1.2	4:1 or Less	10:1 or Less
*PEDESTRIAN WAYS AND BICYCLE LANES	2.5	4:1 or Less	10:1 or Less
TOLL PLAZA APPROACH AND DEPARTURE AREAS	2.0	4:1 or Less	10:1 or Less

Table 7.3.2 Highmast Lighting – Roadways

ROADWAY CLASSIFICATIONS	ILLUMINATION LEVEL AVERAGE INITIAL (H.F.C)	UNIFORMITY RATIOS	
		AVG/MIN	MAX/MIN
INTERSTAE,EXPRESSWAY, FREEWAY & MAJOR ARTERIALS	1.0 to 1.2	4:1 or Less	10:1 or Less
ALL OTHER ROADWAYS	1.0 to 1.2	4:1 or Less	10:1 or Less
TOLL PLAZA APPROACH AND DEPARTURE AREAS	2.0	4:1 or Less	10:1 or Less

Table 7.3.4 Rest Area and Service Plaza Lighting

AREA ILLUMINATED	ILLUMINATION LEVEL AVERAGE INITIAL (H.F.C)	UNIFORMITY RATIOS	
		AVG/MIN	MAX/MIN
ENTRANCE AND EXIT	1.5	4:1 or Less	10:1 or Less
INTERIOR ROADWAYS	1.5	4:1 or Less	10:1 or Less
PARKING AREAS	1.5	4:1 or Less	10:1 or Less

## 7.3.2 Pole Design Criteria

### 7.3.2.1 General

*Add the following paragraphs*

It is desirable not to locate any light poles on highway bridges. Spacing shall be adjusted, if possible, to keep light poles off bridge structures. If light poles are required on bridges, their location shall be closely coordinated with the Bridge Structural Designer. Bridge-mounted poles shall be provided with vibration dampers inside the pole and with vibration pads at the base (this requirement applies for all bridges and fly-over ramps even if they are not over open bodies of water or on causeway sections). Bridge-mounted poles shall have the handhole 1.0 foot above the barrier wall and the handhole shall face the traffic lane.

Nominal mounting heights for conventional poles shall be 40 feet for mainlines and 35 feet for ramps, 40 or 35 feet for arterial roads and between 100 and 120 feet for high mast poles. In cases where higher mounting heights are required to meet minimum lighting design criteria, the designer shall contact the Turnpike Electrical Engineer for approval and coordination. Vibration dampers and pads shall be provided for all shoulder-mounted poles with pole-top mounted luminaires having mounting heights over 40 feet.

All conventional light poles shall be provided with frangible transformer-type bases except when mounted in bridge traffic railing barriers or in barrier walls. Conventional light poles in parking lots shall not be provided with frangible bases.

Conventional light poles shall be aluminum and shall not be painted. High mast light poles shall be galvanized steel only.

For lighting designs on or near coastal areas, consult with the Turnpike Electrical Engineer whether galvanized steel conventional poles should be used in lieu of aluminum poles due to the salt in the atmosphere. Also coordinate the type of material to use for the high mast poles.

The spacing of conventional light poles on curved ramps at interchanges shall be calculated by taking into account the curvature of the road in order to provide the illumination and uniformity ratios required by the Turnpike. A point-by-point, computerized photometric analysis shall be performed for all roadway areas being illuminated throughout the project. A copy of the results of this analysis shall be included in the lighting analysis report and submitted to the Turnpike Electrical Engineer for review.

### 7.3.3 Foundations Criteria

*Add the following paragraphs*

Screw type foundations may be used only when they are needed due to the complexity and location of underground utilities and only under the approval of the Turnpike Structural Engineer. The Roadway Lighting Design Documentation shall include the proper Technical Special Provisions since the Standard Specifications may not apply.

When conventional light poles are located on slopes steeper than 4:1, the standard concrete foundation detail shown on FDOT Design Standards, Index 17503 is not applicable. In this case, the Designer shall incorporate a special concrete foundation in its design. The applicable detail shall be shown on the lighting plans and the affected poles shall be properly identified on the

Pole Data sheet. Proper structural calculations shall be submitted for review to substantiate the size of the special foundations.

A concrete slab is not required in those instances when the poles are located behind sidewalks. The pull box shall be located flush with the sidewalk in front of the light pole, and is paid for as "roadside".

### **7.3.5 Lighting Project Coordination**

*Add the following paragraphs*

When a project is within 3 miles (5.0 kilometers) of an airport, flight path clearances need to be checked. The Lighting Designer shall coordinate with the Airport Manager on specific requirements. A proper airspace analysis shall be performed and submitted for review. The analysis shall be prepared following the Federal Aviation Administration (FAA), Federal Aviation Regulations Part 77 Objects Affecting Navigable Airspace requirements. FAA Form 7460-1 shall be prepared and submitted to the Turnpike Project Manager and Turnpike Electrical Engineer for proper transmittal to the FAA.

### **7.3.6 Voltage Drop Criteria**

*Replace with the following paragraph*

When determining conductor sizes for lighting branch circuits, the maximum allowable voltage drop shall be 6 percent. It shall include a combination of both feeder and branch circuit runs from the power company service point to the last luminaire within a circuit.

*Add the following paragraph*

Voltage drop calculations shall be submitted for each lighting branch circuit. Voltage drop calculations along with load center wiring schematic plan sheet shall be prepared, signed and sealed by a Professional Electrical Engineer licensed in the State of Florida.

#### **7.3.6.1 Load Analysis Criteria**

*Add this Section*

Load analysis calculations shall be submitted for each branch circuit breaker within a load center and for the entire load center to back-up the branch circuit breaker and main breaker ratings and the service feeder size. These calculations shall be prepared, signed and sealed by a Professional Electrical Engineer licensed in the State of Florida.

#### **7.3.6.2 Pole Cable Distribution System**

*Add this section*

The pole cable distribution system shall be installed in the pull box adjacent to each light pole. A pole cable distribution system that is installed inside the pole base may only be used when specific project conditions deem it's installation inside the pull box impractical, and only after obtaining the approval of the Turnpike Electrical Engineer.

### **7.3.9 Mainline Toll Plaza**

*Add this section*



Power for the mainline toll plaza approach roadway lighting shall come from the mainline plaza lighting panel and be backed up by the standby generator. This circuit(s) shall include a minimum of 6 conventional luminaires on each side of the plaza for each roadway direction and the conventional light poles on the express lanes. The roadway contractor shall terminate the branch circuit wiring in a pull box for extension into the lighting panel. The light poles are to be symmetrically placed. Conventional lighting shall be used for the mainline toll plaza approach and departure areas.

Lighting branch circuit conduits interconnecting light poles through the mainline toll plaza building shall be installed in such a manner as to avoid the tunnel located at the toll plaza centerline and to avoid the plaza concrete apron. The roadway lighting plans shall show the proper lighting branch circuit conduits and the associated mainline roadway conduit crossings and pull boxes on either side of the toll plaza Administration Building. The wiring of the luminaires to be fed from the plaza generator shall be terminated in a pull box near the mainline toll plaza Administration Building by the roadway contractor for completion of roadway lighting wiring to the plaza lighting panel by the toll plaza contractor. Close coordination between the Toll Plaza Designer and the Roadway Designer is necessary. Separate conduits, wiring and pull boxes are required for those luminaires fed from the plaza generator.

A note shall be provided in the roadway lighting plans for the roadway contractor to provide the necessary equipment to test the luminaires fed from the plaza generator.

If the limits of the roadway contract fall within the limits of the toll plaza roadway lighting, adjacent section Designers shall coordinate new limits for the lighting portion of the contracts.

## **7.4 Traffic Signals**

### **7.4.1 Design Criteria**

*Add the following paragraph*

The Designer shall make every reasonable effort to incorporate the design preferences of the local maintaining agency. These preferences may include but are not limited to pole types, detector loop strategies, conduit routing, specific equipment, signal timing methods, etc. It is the responsibility of the design consultant to meet with the maintaining agency to ascertain their preferences and obtain all other pertinent information. The findings of the design consultant shall be reported to the Turnpike's project manager before proceeding with design.

#### **7.4.1.1 Lane Use Control Signals**

*Add the following section*

The Designer should include Lane Use Control Signals as part of any Toll Plaza Canopy revision or design. These signals shall display either a red "X" or a green "double arrow" as specified in the MUTCD. The type of signal display should be a Lighting Emitting Diode (LED) or an approved equal. Sizes of these displays will vary depending upon the lanes that they are placed above. Coordination should be done prior to design with the Turnpike Project Manager to ensure proper size and placement.

## 7.4.2 Certification and Specialty Items

*Replace the last paragraph with the following*

The design of traffic signals compatible with local signal systems may require the use of materials for which there are no Department approved Standard Specifications or Supplemental Specifications. In those cases, the design consultant will be required to develop project specific Technical Special Provisions (TSPs) for inclusion in the contract document. The design consultant is encouraged to get samples of similar TSPs from the local and maintaining agency. The Turnpike Traffic Operations and plans review staff are available to assist or guide this endeavor. All traffic control products for signals shall be on the Qualified Products List (QPL) as maintained by the FDOT Specification Department.

### 7.4.13 Traffic Signal Project Coordination

*Add the following as paragraphs 7, 8 & 9*

In general, the Turnpike will actively work with the local and local maintaining agencies for coordination of design and maintenance issues.

**Signal Systems** - At the request of the local or the local maintaining agency any signals designed by the Turnpike will include features and equipment typically used for their signals and signal systems. This will include time base, closed loop, UTCS or other technologies. The communications medium shall match that already in place.

**Legal Authorization and Maintenance Agreements** - The Turnpike must secure legal authorization and execute a maintenance agreement with the local maintaining agency. This will be accomplished through the assistance of the local Traffic Engineer. It is in the Turnpike's interest to make an effort to cooperate with the local and maintaining agency to expedite this process.