Chapter 7

Traffic and ITS Design

The following are changes, additions or deletions to the January 2016, Topic #625-000-007, Plans Preparation Manual (PPM), for use on Turnpike projects only.

7.1 General

Add the following paragraphs

Florida’s Turnpike Enterprise has developed Traffic Plans Guide Drawings to establish guidelines for traffic design and traffic engineering plan development. The Guide Drawings attempt to improve the quality of plans, provide system consistency, reduce plan development time and reduce plan review time. The Guide Drawings represent the compilation of engineering manuals, best practices and effective design experience on Florida’s Turnpike. The Guide Drawings show layouts and details of an example condition.

It is the responsibility of the Design Engineer of Record using these Guide Drawings to exercise proper engineering judgment and prepare a safe and effective design that fits the specific conditions of a project. The inappropriate use of and adherence to these Guide Drawings does not exempt the engineer from the professional responsibility of developing an appropriate design. Design engineers and consultants are encouraged to become familiar with the information contained in the Guide Drawings and to discuss specific design details with Florida’s Turnpike design staff.

The Traffic Plans Guide Drawings are available as .dgn and .pdf at the following link:

http://design.floridasturnpike.com/prod_design/traffic/trafficguidedrawings.html

7.2 Signing

7.2.1 Design Criteria

Add the following to paragraph 1

The placement of signs must prevent subjecting motorists to too much information, not interfere with other traffic control devices, not impair the visibility of other signs and not violate minimum spacing distances listed in Table 1, Minimum Spacing Distances for Signs in Florida Administrative Code 14-51.014. Table 1 provides the minimum spacing requirements and the design should maximize the sign spreading concept in MUTCD 2E.11 when possible. In addition, the minimum sign spacing between a Dynamic Message Sign (DMS) and guide signs/directional signs should be 1000 feet.

Add the following to paragraph 2
The designer must consider the physical placement of sign supports as well as the visibility of the sign panel. The placement of sign supports must not occur in the bottom of ditches. Clearing and grubbing should be included if the visibility of the sign panel is blocked. Refer to the Traffic Plans Guide Drawings for guidance.

The design for sign location must consider the cross section as to the placement of the sign structure foundation outside the clear zone. Signs located behind guardrail must be located at the minimum setback required from the face of guardrail. This applies to the foundations on overhead signs and for the sign panel for ground mounted signs.

Add the following paragraphs

All advance guide signs should use the physical gore as the point of reference for distance messages. The only time this should not be done is if the physical gore and theoretical gore are separated by more than 500 feet.

Destination guide signs on ramps must include destinations that repeat advance guide sign and supplemental guide sign information and provides route guidance to the driver.

Follow Typical Off Ramp Signing Diagrams, located on Turnpike Design Internet, for Advisory Speed Warning Signing at all Turnpike exit ramps.

For all post-interchange distance signs on the Turnpike, the maximum letter height used must be 10” E or 10” EM.

For size of signs, lettering and plaques, Florida’s Turnpike facilities must follow the Freeway Classification in MUTCD Tables 2B-1, 2C-2, 2E-4 and 2E-5. The minimum sizes for regulatory and warning signs on exit or entrance ramps to/from Turnpike facilities must be Freeway Classification as well.

7.2.2 Overhead Signs on Freeways and Expressways

Replace item 3 under paragraph 2 as follows

Mount advance guide signs and exit direction signs on overhead structures when the number of travel lanes in one direction is three or more. Supplemental guide signs must remain ground mounted under sections of three or more travel lanes.

Add the following paragraph

Overhead sign installations must meet the vertical clearance requirements of TPPPH Section 2.10, Table 2.10.2.
7.2.4 External Lighting of Overhead Signs

Add the following item

4. If a sign panel on an existing structure is being replaced, all signs on the structure should be consistent. For example, if a structure has three existing signs with lights, one panel is being replaced, the plans should call for either A) lights on the new panel or B) the other two panels replaced with Type XI sheeting and removal of the lights.

7.2.5 Signs on Median Barriers and Traffic Railings

Modify the list in paragraph 1

4. Add “Do Not Stop” (TPK-7) to the list of permanent signs critical to safety.

7.2.8 Delineators, Object Markers and Express Lane Markers

Add the following to paragraph

On Turnpike facilities, Express Lanes will be either barrier separated or buffer separated with express lane markers. Standard specifications for the express lane markers used in this application have not yet been developed. Therefore, a Modified Special Provision is required and must be included in the contract to define requirements for color, height, retroreflectivity, spacing, and mounting technique. The Turnpike Traffic Engineer must be consulted on this item.

Modification for Non-Conventional Projects:

Delete the last sentence of the above paragraph and see RFP for delineator requirements on Turnpike Express Lane projects.

Add the following section

7.2.11 Toll Route Markers

The Florida’s Turnpike mainline must use the Turnpike Route Marker sign panel shown in the most current Guide Drawings.

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

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

The width of the attached cardinal direction sign, directional arrow auxiliary sign, or other auxiliary sign must match the width of the parent route marker sign.

On the side streets, leading to the Turnpike Mainline, use the Toll Auxiliary Sign (M4-15) in combination with the Turnpike route marker. On numbered routes, such as Toll Route 869, use the
Add the following section

7.2.12 Truck Lane Restrictions

The design engineer must include truck lane restriction signs on corridors that have three or more lanes in each direction of travel.

Sample panel designs for the restriction are included in the Guide Drawings. The design engineer should implement the signs similar to a post-interchange sign so that drivers entering the system are informed at each entry point. If installation of the truck lane restriction sign is not possible on the mainline due to sign clutter, the truck lane restriction sign can be implemented on the entrance ramp after the toll plaza, when necessary, to maintain proper sign spacing.

7.3 Lighting

Florida’s Turnpike Enterprise has developed Lighting Guide Drawings to establish guidelines for lighting design and plan development. The Lighting Guide Drawings are available as .dgn and .pdf at the following link:

http://www.floridasturnpike.com/design/prod_design/lighting/lightingguidedrawings.html

Projects including lighting design must comply with applicable standards. In addition to the Department's Standard Specifications, the following standards should be consulted:

Roadway Lighting Design Guide, AASHTO - This is the basic guide for highway lighting. It includes information on warranting conditions and design criteria.

Design Standards - These indices are composed of a number of standard drawings or indexes which address specific situations that occur on a large majority of construction projects.

Recommended Practice for Roadway Lighting IES RP-8-00 (R2005), ANSI/IESNA.

American National Standard Practice for Tunnel Lighting IES RP-22-11, ANSI/IESNA.

The IESNA Lighting Handbook Reference & Application, IESNA.

Federal Aviation Regulation, Part 77, Safe, Efficient Use, and Preservation of the 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, FAA. This advisory circular contains the FAA specification for obstruction lighting equipment.


7.3.1 Design Criteria

Add the following paragraphs

Lighting pole layout and design must employ practices, where possible, to reduce the risk of light poles in high crash and high risk locations. Some of these design considerations are, but not limited to: lane drop and intersection locations, sections of roadway where the paved shoulder narrows, and curve/vehicle departure directions. All design considerations must be documented in the Lighting Design Analysis Report (LDAR).

Conventional lighting should be used for all Florida Turnpike roads.

| Modification for Non-Conventional Projects: |
| Conventional lighting must be used unless directed otherwise in the RFP. |

Conventional lighting must be shoulder mounted. Median mounted poles are not allowed. If a geometric or safety concern exists related to shoulder mounting, median mounted poles will be considered. In these cases, approval is required by the Turnpike Project Manager, Turnpike Electrical Engineer, and Turnpike Maintenance. Median mounted poles must be limited to the area of geometric or safety concern.

| Modification for Non-Conventional Projects: |
| Shoulder mounted poles must be used unless directed otherwise in the RFP. |

High mast lighting may be considered where conventional lighting is proven not feasible and the surrounding area is not residential or environmentally sensitive. The consultant must obtain approval from the Turnpike Electrical Engineer, Turnpike Structures Maintenance, and Project Manager before considering high mast lighting.

| Modification for Non-Conventional Projects: |
| High mast lighting must not be used unless directed otherwise in the RFP. |

High mast lighting must not be located in the following locations and must meet horizontal clearance requirements specified in PPM, Vol. 1 Chapter 2:

a. Steep Embankments
b. Steep Slopes in Slope Pavement
c. Adjacent to Slope Embankment Cut-Outs
d. With Buried Pole Bases
e. In areas not accessible to a crane for aerial basket work.
Underdeck lighting must be mounted to pier caps, end bents, or walls. If pendant hung fixtures are required to meet criteria, special attention should be given to locate fixtures over shoulders, gore areas, other separations from traffic. If pendant hung fixtures are required over live traffic lanes, the fixture locations must be coordinated with the Turnpike Electrical Engineer and Turnpike Maintenance. Additional coordination with the Department’s central office will be required where use of pendant lighting is recommended prior to final design submittal and must be coordinated with the Turnpike Project Manager. All pendant hung fixtures must have a redundant method of support, designed, signed and sealed by a Structural Engineer.

Where there is continuous roadway lighting, roadways under bridges structures must be lighted to the same level (or criteria) of the adjacent roadway. If the adjacent roadway is not lighted, lighting under bridges structures is still required where there is frequent nighttime pedestrian traffic; or where unusual or critical roadway geometry occurs adjacent to or under the bridge structure. Tunnel or daytime lighting may be required when the bridge structure limits natural sunlight penetration and limits a driver’s visibility under the structure. Other factors to consider in evaluating the need for tunnel or daytime lighting include, but may not be limited to: specific roadway geometry and conditions, pedestrian and vehicular activity, bridge/underpass orientation and length to height ratio, safe site stopping distance, and traffic speed. Evaluation of proposed roadway design regarding the need for Tunnel or Daytime lighting must be included in the Lighting Design Analysis Report. These requirements include not only Turnpike facilities, but any roadway crossing under a Turnpike facility.

Projects with conventional lighting along the roadside must be designed for an average initial illumination as indicated in Table 7.3.1. Projects with high mast lighting must be designed for an average initial illumination as indicated in Table 7.3.2 Rest areas and Service Plazas must be designed for an average initial illumination as indicated in Table 7.3.5. This includes the ramps to and from the Service Plazas.

If the adjoining mainline roads are not illuminated, then the lighting design must 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 must extend beyond the project lighting limits by approximately four-to six-pole spacing. The mainline transition illumination levels must be 1.0 foot candles average initial intensity (horizontal foot candles) with the same uniformity ratios specified in Table 7.3.1.

If the length of the mainline between any two lighted areas (roadway sections, interchanges, service plazas, and/ or tolls plaza) is 0.5 mile or less, then that section of the mainline must be lighted regardless of what the Lighting Justification Report indicates.

All widening and resurfacing projects must be reviewed for compliance with current lighting criteria. Project begin and end limits must define project lighting scope to be considered, regardless of the limits of resurfacing unless otherwise noted. All deficiencies within the project scope must be addressed and corrected. Deficiencies outside the project scope must be brought to the attention of the Turnpike Project Manager and Electrical Engineer.
Projects with highway speed tolling gantries are not required to have roadside lighting unless dictated by another section of the TPPPH and/or a Lighting Justification Report. Where roadside lighting exists, the roadway lighting must remain and must be reviewed for compliance with current lighting criteria. All deficiencies within the project scope must be addressed and corrected. Deficiencies outside the project scope must be brought to the attention of the Turnpike Project Manager and Electrical Engineer.

Where new poles and luminaires are being proposed, all poles, luminaires, foundations, and infrastructure within the project scope must be new.

**Modification for Non-Conventional Project:**

All poles, luminaries, foundations and infrastructure must be new unless directed otherwise in the RFP.

### Table 7.3.1 Conventional Lighting – Roadways and Signalized Intersections

**Replace the following table**

<table>
<thead>
<tr>
<th>ROADWAY CLASSIFICATIONS</th>
<th>ILLUMINATION LEVEL AVERAGE INITIAL (H.F.C)</th>
<th>UNIFORMITY RATIOS</th>
<th>VEILING LUMINANCE RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERSTATE, EXPRESSWAY, FREEWAY, MAJOR ARTERIALS &amp; HIGHWAY SPEED TOLLING GANTRIES</td>
<td>1.7</td>
<td>4:1 or Less</td>
<td>10:1 or Less</td>
</tr>
<tr>
<td>ALL OTHER ROADWAYS</td>
<td>1.0</td>
<td>4:1 or Less</td>
<td>10:1 or Less</td>
</tr>
<tr>
<td>*PEDESTRIAN WAYS AND BICYCLE LANES</td>
<td>2.5</td>
<td>4:1 or Less</td>
<td>10:1 or Less</td>
</tr>
</tbody>
</table>

**Note:** These average illumination values should be considered standard, but should be increased if necessary to maintain an acceptable uniformity ratio. The maximum illumination level average initial horizontal foot-candle value must be 2.25 FC for Interstate, Expressway, Freeway, Major Arterials, and Highway Speed Tolling Gentries. The maximum illumination level average initial horizontal foot-candle values must be one and one-half values for All Other Roadways, Pedestrian Ways, and Bicycle Lanes.

* This assumes a separate facility. Facilities adjacent to a vehicular roadway should use the levels for that roadway.
Table 7.3.2 Highmast Lighting – Roadways

<table>
<thead>
<tr>
<th>ROADWAY CLASSIFICATIONS</th>
<th>ILLUMINATION LEVEL AVERAGE INITIAL ( \text{(H.F.C)} )</th>
<th>UNIFORMITY RATIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AVG/MIN</td>
<td>MAX/MIN</td>
</tr>
<tr>
<td>Interstate, Expressway, Freeway, Major Arterials &amp; Highway Speed Tolling Gantry</td>
<td>1.0</td>
<td>3:1 or Less</td>
</tr>
<tr>
<td>All Other Roadways</td>
<td>1.0</td>
<td>3:1 or Less</td>
</tr>
</tbody>
</table>

Note: These average illumination values should be considered standard, but should be increased if necessary to maintain an acceptable uniformity ratio. The maximum illumination level average initial horizontal foot-candle values must be one and one-half values for Interstate, Expressway, Freeway, Major Arterials, Highway Speed Tolling Gantries, and All Other Roadways.

Table 7.3.5 Sign Lighting

<table>
<thead>
<tr>
<th>AMBIENT LUMINANCE*</th>
<th>ILLUMINATION LEVEL AVERAGE INITIAL ( \text{(H.F.C)} )</th>
<th>UNIFORMITY RATIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAX/MIN</td>
<td></td>
</tr>
<tr>
<td><strong>LOW</strong></td>
<td>5.0 to 10.0</td>
<td>6:1</td>
</tr>
<tr>
<td><strong>MEDIUM</strong></td>
<td>10.0 to 20.0</td>
<td>6:1</td>
</tr>
<tr>
<td><strong>HIGH</strong></td>
<td>20.0 to 40.0</td>
<td>6:1</td>
</tr>
</tbody>
</table>

* Ambient luminance classifications are defined in Section 10.3 of the AASHTO Roadway Lighting Design Guide (2005). Refer to the Traffic Plans Guide Drawings for information on sign panel sheeting used on Turnpike projects.
Table 7.3.7 Rest Area and Service Plaza Lighting

<table>
<thead>
<tr>
<th>AREA ILLUMINATED</th>
<th>ILLUMINATION LEVEL AVERAGE INITIAL (H.F.C)</th>
<th>UNIFORMITY RATIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRANCE AND EXIT</td>
<td>1.7</td>
<td>4:1 or Less</td>
</tr>
<tr>
<td>INTERIOR ROADWAYS</td>
<td>1.5</td>
<td>4:1 or Less</td>
</tr>
<tr>
<td>PARKING AREAS</td>
<td>1.5</td>
<td>4:1 or Less</td>
</tr>
</tbody>
</table>

Note: These average illumination values should be considered standard, but should be increased if necessary to maintain an acceptable uniformity ratio. The maximum illumination level average initial horizontal foot-candle values must be one and one-half values.

Add the following section

7.3.1.1 Box Girder Maintenance Lighting and Power

No welding or burning of the structure will be allowed. All fasteners must be approved mechanical devices. The electrical work associated with the box girders involves working in confined space areas. All precautions and rules according to "confined spaces" of the Code of Federal Regulations, 29 CFR 1910.146 must apply. Emergency lighting must be provided within each box girder per NFPA 101.

The minimum conductor size must be No. 10 AWG. A green insulated conductor must be installed in each conduit run. The minimum conduit size must be 1 inch.

The six-hour timers must control the lighting contactors. Timers must be provided at each hatch entrance and mid span.

The light fixtures must be connected to branch circuit breakers separate from the receptacle branch circuit breakers.

The service voltage for the box girders must be 240/480 volts, single-phase, three-wires and then step down to the 120/240 volts through the mini power centers. A main disconnect switch must be provided immediately adjacent to the hatch door of each girder. The 240/480 volt-feeder must terminate in a distribution panelboard. The distribution panelboard must provide 480 volt power to each mini power center.

The number of mini power centers within each box girder must be determined based on the number of lights and receptacles. The maximum number of lights and receptacles within a mini power center must be as indicated on Structural Index No. 21240.
Add the following section

7.3.1.2 Photometric Analysis

A point-by-point, computerized photometric analysis must be performed for all roadway areas being illuminated throughout the project. A 5 foot by 5 foot maximum point spacing must be used for the point by point photometric analysis on the mainline, and major arterials, ramps and all other roadways. Alternatively, the photometric grid may consist of longitudinal points spaced up to 16 feet apart with two transverse points per lane at each longitudinal point spaced ¼ of the lane width from the edges of the lane. Photometric data points must be legible. A copy of the results of this analysis must be included in the LDAR and submitted to the Turnpike Electrical Engineer for review. The photometric analysis must identify and evaluate each roadway classification and area of illumination, as defined by the section 7.3.1, within the project scope. The analysis must also identify distinct area/sections of roadway within the project scope. Some of these distinct areas may include: Mainline, Ramps, and Roadway Directions. Results must indicate foot-candle values displayed on plan view on 11’ x 17’ pages with 1/100th accuracy (0.XX foot-candles). Where solid objects, such as bridges, block light fixture contributions, a 3D graphic representation must be included to ascertain that solids were accounted for. Typical section photometric analysis are not considered a complete or through photometric analysis.

A point-by-point, computerized photometric analysis must be performed for all signs being illuminated throughout the project. A 1 foot by 1 foot maximum point spacing must be used for the point by point photometric for the entire area of the sign panel(s). A copy of the results of this analysis must be included in the LDAR and submitted to the Turnpike Electrical Engineer for review. Results must indicate foot-candle values displayed on each sign panel with 1/100th accuracy (0.XX foot-candles).

A photometric analysis is required for projects where the relocation of light poles is included in the scope of work.

Provide an angle convention detail, if any tilting is required, to clearly depict fixture tilt orientation. A detail is required for each type of fixture being used (fixture on pole, sign luminaire, etc.). The detail(s) must be provided in the LDAR and the plan sheets.

Add the following section

7.3.1.3 Lighting Load Center and Wiring Criteria

The standard service voltage for the roadway lighting load centers must be 240/480 volts, single-phase, three-wires.

Roadway lighting load centers must be coordinated with utility provider prior to Phase III Plan Submittal. Utility transformers must be sized for connected and spare loads. Consideration must be given for utility standard transformer sizes and limitations. Where a lighting load exceeds
typical utility transformer sizes, the lighting load must be split and multiple load centers provided to serve the load unless approved otherwise by Turnpike Electrical Engineer.

FDOT Design Standard Index No. 17504 (Service Point Details) and Turnpike Lighting Guide Drawings must be coordinated with the utility provider’s requirements for electrical service (or electrical service standards). The electrical service point must designed to and meet all utility provider’s requirements.

Load centers must not be connected to or located within any facilities buildings unless there is a requirement for the load center to have emergency power from the toll plaza’s generator.

The load center location and surrounding area must have a minimum of 1’-0” between the load center and the designer’s high water elevation.

Load center enclosure minimum dimensions must be as shown in the Turnpike Lighting Guide Drawings.

Where a load center is being replaced and existing poles, equipment, etc. are being re-fed, all equipment and identification labels must be replaced to include the new load center designation and circuit. Coordination with Turnpike Maintenance Engineer must be conducted as needed to properly update identification of equipment.

The voltage for the roadway luminaires must be 480 volts, single-phase, two-wires.

Roadway lighting circuit conductors must not be larger than #1 AWG. Circuits requiring conductors larger than #1 AWG must be coordinated with the Turnpike Electrical Engineer and Turnpike Maintenance.

Where existing conductors within a circuit are being replaced, the size of the new conductors must not be smaller than the existing conductors.

Dedicated circuits must be provided for daytime supplemental underdeck lighting. Daytime dedicated circuits must be in separate conduits from roadway lighting circuits. Where conduits are run in the same trench with roadway lighting conduits, the conduits must be separated in the pull boxes. Dedicated daytime lighting circuit conduits must be wrapped with electrical hazard tape in the pull boxes. Dedicated daytime lighting circuit conductors to be identified with an additional tag that states the conductors are live 24 hours a day, seven days a week.

Underdeck light fixture mounting details must be provided. Light fixtures/associated conduit may be field routed. Attachment of lighting equipment/associated conduit to MSE wall panels is not allowed. Attachment of lighting equipment/associated conduit to MSE copings is acceptable. Attachment to other bridge elements must conform to the Structures Design Guidelines Appendix 1A.

Roadway lighting must be connected to alternate circuits to prevent a total blackout of any section of the highway in the event a circuit is out of service. Minor replacements must be evaluated on a case by case basis.
**Modification for Non-Conventional Projects:**

Roadway lighting must be connected to alternate circuits unless directed otherwise in the RFP.

The maximum distance between pull boxes and/or splice boxes in long conduit runs must be 300 feet.

A special power distribution design is required when new poles and luminaires are being proposed behind Noise Barriers (Sound Walls). Conduit, junction boxes, and pull boxes must not be installed behind Noise Barriers (Sound Walls). Provide conduit, junction boxes, and pull boxes in front of Noise Barriers (Sound Walls) on the roadside.

There must be no more than three circuits in a single conduit. Provide multiple conduits as needed in the plans.

All roadway crossings must be provided with a spare conduit and provided with a dedicated pull box at each end of the crossing road. Use of light pole pull boxes is not allowed, where space is sufficient for providing dedicated pull boxes.

All pull boxes and splice boxes must be H-20 or HS-20 load rated.

**Add the following section**

### 7.3.1.4 Temporary Lighting Criteria

The design of temporary lighting must meet the criteria shown in section 7.3.1. If this criteria cannot be met based on various factors of construction, the Design Engineer of Record must submit a safe and effective design, using proper engineering judgment to the Turnpike Project Manager and Turnpike Electrical Engineer for review and approval.

### 7.3.2 Pole Design Criteria

#### 7.3.2.1 General

It is desirable not to locate any light poles on highway bridges. Spacing must be adjusted, if possible, to keep light poles off bridge structures including the approach slabs. If light poles are required on bridges, their location must be closely coordinated with the Bridge Structural Designer. Bridge-mounted poles must have pull box as specified in FDOT Standard Index No. 21210.

Nominal mounting heights for conventional poles must be 40 and 50 feet as specified in FDOT Standard Index No. 17515. Nominal mounting heights for highmast poles must be between 80 and 120 feet as specified in FDOT Standard Index No. 17502. In cases where lower or higher mounting heights are required to meet minimum lighting design criteria, the designer must contact the Turnpike Electrical Engineer for approval and coordination. Technical special provisions and
details must be provided in those cases where special designs are required. Technical special provisions must be signed and sealed by a Professional Engineer, licensed in the State of Florida. Vibration dampers and pads must be provided for all shoulder-mounted poles with pole-top mounted luminaires having mounting heights over 40 feet. All conventional light poles must be provided with breakaway transformer-type bases except when mounted on bridge traffic railing barriers or on barrier walls. Conventional light poles in parking lots must not be provided with frangible bases.

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

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

A combination pole and pull box concrete slab is not required where the grade is 1:2 or greater and protected by guardrail.

All foundations and pull boxes must be coordinated with current and future grading to ensure that the top of the foundations and the pull boxes are not below grade. In addition, foundations, boxes (pull, splice, junction or similar), and lighting equipment must not be located within the limits of any drainage systems or other locations where water and debris may accumulate.

### 7.3.4 Lighting Project Coordination

Replace the last paragraph with the following

Per PPM, Vol. 1, 2.10.4 and PPM, Vol. 1, 13.5.1, all projects must be reviewed and coordinated with the FDOT Aviation Office to determine if notification and/or permitting are required to the Federal Aviation Administration (FAA), Florida Department of Transportation (FDOT), and any local jurisdictions.

The Turnpike preferred method of determining FAA notification requirements must be the FAA’s Online Notice Criteria Tool at the following link:


The Turnpike Project Manager and Turnpike Electrical Engineer must be provided copies of all notifications and permits for review in the Lighting Design Analysis Report. If none are required, written notification must be given to that effect in the Lighting Design Analysis Report.

The airport manager of any possibly affected airport and/or heliport must be contacted and provided project scope, drawings, etc. and be met with to fully coordinate the airspace aspects of the project.
Add the following paragraph

Turnpike ITS and Tolls – When the locations of light poles are established, they should be checked with the ITS layout and the Toll Equipment layout for any conflicts with the light poles, the light pole pull boxes, and the roadway lighting circuits.

**Modification for Non-Conventional Project:**
The Roadway Lighting Engineer of Record is responsible for all necessary coordination.

7.3.5 Voltage Drop Criteria

Replace with the following paragraph

When determining conductor sizes for lighting branch circuits, the maximum allowable voltage drop must be 6 percent. It must 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 section

7.3.5.1 Pole Cable Distribution System

All components of the pole cable distribution system must be listed by a Nationally Recognized Testing Laboratory.

The pole cable distribution system must 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 its installation inside the pull box impractical, and only after obtaining the approval of the Turnpike Electrical Engineer.

For poles that are median barrier mounted or pedestal mounted, the light poles must not be provided with frangible bases, strain relief fittings, or breakaway fuseholders.

For poles with (2) luminaires, a single TC cable must be run from the adjacent pull box to the pole's handhole. From the pole's handhole, a pole cable distribution system is required for each luminaire.

7.4 Traffic Signals

7.4.1 Design Criteria

Add the following paragraph

The Designer must 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 must be reported to the Turnpike’s project manager before proceeding with design.

**7.4.2 Certification and Specialty Items**

*Replace the 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.

**7.4.11 Traffic Signal Project Coordination**

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

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

**Signal Systems** - At the request of 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 must match that already in place.

**Legal Authorization and Maintenance Agreements** - Maintenance Agreements with local maintaining agencies are handled by each FDOT district. New traffic signal locations need to be discussed with Traffic Operations personnel located in the district where they are being installed so that new traffic signals can be included in the overall list they are maintaining.

**7.5 Intelligent Transportation System (ITS) Components**

**7.5.1 Design Criteria**

*Add the following paragraphs*

All pull boxes and splice boxes must be H-20 or HS-20 load rated.

The design and construction of all ITS electrical conductor splicing inside power pull boxes must comply with the requirements specified in the Highway Lighting Systems and Highway Lighting Materials sections of the FDOT Standard Specifications for Road and Bridge Construction.

**7.5.2 ITS Device Approval and Compatibility**

*Add the following paragraph*

Wireless and network equipment requirements must be coordinated at time of final RFP development or specification development with the Florida’s Turnpike Traffic Operations Unit to ensure the most appropriate manufactures and models at the time.
7.5.4 Motorist Information Systems

7.5.4.1 Dynamic Message Sign (DMS)

Add the following paragraphs

When general purpose mainline DMS are proposed, a travel time sensor compatible with the existing travel time system (TTS) must be installed at the site. Placement of mainline and arterial DMS must be in accordance with the PPM.

New walk-in DMS installed on the mainline must be capable of displaying 18” characters, 21 characters per line, three lines, full color, full matrix messages with 20mm pixel pitch (resolution). Half-span or Full Span supporting truss structure is the preferred mounting style.

Arterial DMS (also known as “ADMS” or “Front Access DMS”) must be capable of displaying 12” characters, 15 characters per line, three lines, full color and full matrix messages with 20mm pixel pitch (resolution). The ADMS are typically mounted on cantilevered structures.

Toll Plaza Approach DMS (TDMS) are typically mounted to cantilevered structures and must be full-color with 20mm pixel pitch (resolution). TDMS must be located 1-mile to 2-miles from the toll plaza being considered, and must be located to provide adequate perception-reaction distance for the approaching motorists.

Single-line DMS (S-DMS). The Express Lanes status DMS must be capable of displaying 18” characters, 18 characters per line, one line, full color and full matrix messages with 20mm pixel pitch (resolution). For S-DMS provided along arterials, the character height requirement may be reduced to 12”, depending on the arterial speed limit.

Toll Amount DMS (T-DMS). The Express Lanes toll mount DMS must be capable of displaying 18” characters, 7 characters per line, one line, full color and full matrix messages with 20mm pixel pitch (resolution). For T-DMS provided along arterials, the character height requirement may be reduced to 12”, depending on the arterial speed limit.

When general purpose mainline DMS are proposed, transfer switch, auxiliary power and generator connection must be installed. A generator may also be desired; check with Florida’s Turnpike Traffic Operations Unit to see if a separate generator is required. At DMS locations with separate generators (separate from the overall express lanes generator installations) a leveled concrete pad of minimum eight feet (8’) by ten feet (10’) and six-inch (6”) thickness must be installed to support the DMS controller cabinet and generator.

7.5.4.2 Highway Advisory Radio

Add the following paragraphs

Existing HAR Transmitter (HART) and HAR Beacon (HARB) locations impacted by project work must be relocated to maintain system effectiveness, in accordance with FCC licensing requirements.
A typical HAR deployment consists of one (1) HART and two (2) HARB signs. One HARB is installed in each direction approaching the HART. A frequency study should be performed prior to locating HARB and HART to ensure adequate signal strength and to limit potential interference of the radio signal between HARB and HART locations, however a practical spacing of 3 miles is recommended between the HART and HARB location to ensure adequate signal strength at the beacon locations.

Coordinate relocations with Central Office Telecommunications, who maintains FCC licensing information for each HART. The Radio Frequency (RF) output is power adjustable up to the FCC maximum of 10 watts, but must be in accordance with the requirements of the FCC License.

The existing and desired radio frequency is established at 1640 AM (1640 KHz), as licensed by the FCC on the Turnpike system.

### 7.5.5 Video Equipment

#### 7.5.5.1 Closed-circuit Television Systems

Provide IP-addressable CCTV cameras with, Power over Ethernet (PoE) and Built-in encoder utilizing H.264. Provide camera capable of providing 1080p resolution.

Provide CCTV Poles in accordance with Index 18113.

All new CCTV deployments must utilize a camera lowering device to facilitate maintenance for locations that are difficult to access or where pole heights greater than 45 feet.

#### 7.5.5.2 Video Display Systems

Video wall requirements must be coordinated at time of final RFP development or specification development with the Florida Turnpike Traffic Operations Unit to ensure the most appropriate manufactures and models at the time.

### 7.5.6 Network Devices

All device requirements must be coordinated at time of final RFP development or specification development with the Florida’s Turnpike Traffic Operations Unit to ensure the most appropriate manufactures and models at the time.
7.5.7 Fiber Optic Cable and Interconnect

7.5.7.1 Fiber Optic Cable

For new systems, the FOC backbone should utilize 144 single-mode fibers as a minimum (Minimum FOC 144 fibers mainline).

Lateral connections for ITS drops to the backbone must utilize 24 fibers as a minimum.

Label splice enclosure, exiting conduits, and FOC entering the boot with weatherproof laser printed tags (no sharpie or marker). Label patch panels inside of building installations. Use a permanent laser printed tag, waterproof labels, with a printout indicating the department, number of strands, stations upstream and downstream to the next hub. For example:

- Department: TP-ITS
- Strands: 144
- Install Date: 07/07/2013
- Project: 420735-1-A
- Current MP: 152.6
- Upstream MP: 153.4
- Downstream MP: 151.9

7.5.7.2 Fiber Optic Conduit

The fiber optic conduit system must consist of a minimum of four (4) 1-1/4” conduits. One (1) of the conduits must contain the fiber optic cable (FOC) backbone. One (1) of the conduits must contain tone wire and the other two (2) remaining conduits are spares. The conduits must utilize the following colors:
- Orange without stripes (fiber optic cable backbone);
- Orange with white stripes (tone wire);
- Orange with green stripes (spare); and
- Orange with black stripes (spare).

The electrical conduit system must consist of a minimum of one (1) 2” conduit, and must utilize Red colored (without stripes) conduit.

Lateral fiber conduit requirements for ITS must include two (2), 1.25-inch conduits of which one is a spare. The lateral conduits must utilize the following colors:
- Orange without stripes (lateral); and
- Orange with white stripe (spare).
7.5.7.3 Fiber Optic Splices and Terminations

Add the following paragraphs

Terminate all fibers that enter a structure inside the rack.

Do not locate splice vaults outside of hub buildings; bring the trunk and laterals inside the hub building.

Do not use multimode fiber or copper in any underground backbone or lateral locations.

When the project work necessitates a break in the fiber cable, include provisions regarding allowable downtime. Temporary fusion splices may be used provisioned to temporarily reconnect any broken fibers. Mechanical splices are not permitted. After any temporary splices are added to the system and prior to final acceptance of the project permanent repair and subsequent testing of the ITS fiber optic cable must be completed in accordance with the FDOT Specifications.

Further, permanent repair for fiber optic cable must include replacement of the entire cable from the nearest existing termination point (butt end splice) to the next existing termination point (butt end splice) removing all temporary splices, unless otherwise directed by the Engineer. The butt end splice is defined as a color to color splice of all fibers of the cable. All temporary and permanent splicing must be performed in accordance with the provisions of FDOT Specifications.

Include requirements to submit an ITS repair plan to the Engineer at the pre-construction conference. The plan must outline the procedures, resources and points of contact for a step-by-step guideline in the event the Contractor damages or disrupts normal operation.

Provide detailed plans to the Engineer which show how damage to any ITS facility will be remedied. These details will become part of the as-built plans package. Remediation plans must follow the same guidelines for development and presentation of the as-built plans. In addition, the remediation plans must be approved by the Engineer before any remediation work proceeds.

7.5.7.4 Fiber Optic Cable Designating System

Add the following paragraphs

In addition to the Sunshine One Call number (800-432-4770) provided on each route marker, the following contact information must be shown:

1. Florida’s Turnpike Enterprise, Traffic Management Center (Orlando) 407-264-3363
2. Florida’s Turnpike Enterprise, Traffic Management Center (Pompano) 954-934-1370

The labeling on the Fiber Route Marker must be:

BEFORE DIGGING IN THIS AREA CALL
Florida’s Turnpike Enterprise
407-264-3363
7.5.7.5 Pull, Splice and Junction Boxes

Add the following paragraph

Provide requirements for splice vault wire management such as non-metallic cable supports to allow the slack cable to be positioned without resting on the ground. The railing system must provide at least 3 inches of separation from the cabling to the bottom of vault. Maintain manufacturers recommended bend radius during and after installation. Provide concrete apron as indicated in the standard index, ensuring appropriate compaction to reduce the possibility of washouts.

Pull, Splice and Junction Boxes must be located above the Design Water elevations, and must meet the minimum requirements of the FDOT Standard Specifications. In addition, foundations and pull boxes must not be located in ditch bottoms or other locations where water and debris may accumulate.

Pull Boxes and Splice Boxes for fiber optic cable must be labeled and include the words “TPK FIBER OPTIC” permanently cast into their top surface.

7.5.8 Infrastructure

Add the following paragraphs

Electrical pull boxes must be spaced at a maximum distance of 500 feet for the entire length of new projects.

Electrical Pull Box covers for ITS must include the words “TPK ITS Electric” permanently cast into their top surface.

All foundations, cabinets and pull boxes must be coordinated with current and future grading to ensure that the top of the foundations, cabinets and the pull boxes are not below grade. In addition, foundations, cabinets, boxes (pull, splice, junction or similar), and ITS equipment must not be located within the limits of any drainage systems or other locations where water and debris may accumulate.

FTE preference is the use of gel-cap splices. No wire nut or electrical tape splicing is acceptable.

Power conduits must have smooth walls and be sized adequately, as determined by the overall cable diameter and recommended percentage of fill of conduit area, per requirements in the latest NEC and FDOT standard specifications, or a minimum of two inches (2”) conduits, whichever is larger.
600V step-up electrical systems must not be allowed, without approval from Turnpike Electrical Engineer and Turnpike Maintenance.

### 7.5.8.2 CCTV Pole and Lowering Device

*Add the following to the first paragraph*

The CCTV camera must be mounted at a minimum of 45 feet above the road, and in some cases may need to be higher to maintain 100% coverage of the roadway.

*Add the following paragraph*

When prestressed concrete poles are specified for ITS Poles, the Design Consultant should provide design and details based on the proposed attachments. Symmetrically placed prestressing should be considered where applicable.

### 7.5.8.4 Equipment Shelter

*Add the following paragraph*

The design layout must include necessary master hub locations to minimize network traffic with an optimum spacing, however, must be supported by a network layout and analysis with appropriate design loss calculations to meet the intent and requirements of this section and all applicable FTE and FDOT standards.

### 7.5.9 Vehicle Detection and Data Collection

*Add the following paragraphs*

Except for vehicle detectors used to capture information in the Express Lanes, new vehicle detectors (Vehicle Detection Systems or Microwave Vehicle Detection Systems) must be installed every one-mile.

Express Lanes VDS must be installed at a spacing in accordance with the FDOT Express Lanes Handbook.

The VDS should be installed at CCTV Camera locations to minimize costs, where conflicts between the VDS and CCTV lower device can be avoided. The use of roadway lighting poles or sign structures for the installation of CCTV cameras and MVDS sites is not allowed.

For travel time data collection, consideration should be given to Bluetooth technologies as an alternative to the toll tag reader technologies. Travel Time System (TTS) equipment must be installed at each DMS and every interchange, with a maximum spacing at approximately 3 to 5 miles for blue tooth based technology, 10 miles for transponder based technology, and in accordance with the manufacturer’s requirements. Where Bluetooth technology is deployed adjacent to a section which currently utilizes toll transponder tags, the alternating technologies must have at least one link which overlaps the existing technology at the corridor beginning and end points.
Regardless of the technology selection, the designer must provide a Travel Time Origin-Destination and link development submittal. This submittal must be coordinated with the Florida Turnpike Traffic Operations Unit, ensuring adequate link and site design/selection to provide adequate read and matches to provide a reliable travel time. This submittal will clearly identify each TTS location, message origin & destination, segment length, and anticipated DMS travel time message. In addition, this submittal will identify the links and messages for the FL 511 designation, which will be provided for critical segments from interchange to interchange.

7.6 Pavement Markings

Add the following reference

TPPPH Guide Drawings

Add the following sections

7.7 Electrical Systems Design and Analysis

The design of all electrical systems (Lighting, Traffic Signals, ITS, etc.) must comply with Florida Administrative Code (FAC) 61G15-33, Responsibility Rules of Professional Engineers Concerning the Design of Electrical Systems. These responsibilities are applicable for all new projects and any major modifications or renovations. The following analysis are required, yet not limited to: Voltage Drop Calculations, Load Analysis and Calculations, Arc Flash Hazard Analysis, and Short Circuit Analysis and Device Coordination. These designs and analyses must be prepared, reviewed, and signed and sealed by a Professional Engineer licensed in the State of Florida. The Professional Engineer must be competent in electrical engineering through training and/or experience. The design analyses must be submitted with each plan submittal as part of the Lighting Design Analysis Report (LDAR) for lighting projects and the Power Design Analysis Report (PDAR) for ITS projects.

Turnpike preference is for electrical system design analysis to be completed using accepted industry power system analysis software (i.e. ETAP, SKM, etc.). When calculations by hand are used, engineering judgement, assumptions and methods must be clearly explained in the report. All supplemental information used or referenced in the power design analysis must also be provided in the report.

7.7.1 Voltage Drop

Voltage drop calculations must be submitted for all branch circuits and service feeders. Voltage drop calculations must be limited to the percentages shown in the TPPPH and/or TPPPH Guide Drawings. If no criteria exist within the TPPPH and/or TPPPH Guide Drawings, the standards set forth in the FDOT PPM, FDOT Design Standards, and FDOT Standard Specifications for Road and Bridge Construction must be used. If no Turnpike or FDOT criteria exist, the consultant must use the guidelines set forth in the National Electric Code (NEC). Voltage drop calculations must be performed when additional loads are added to existing infrastructure to ensure the proposed
conductors are sized appropriately for the total voltage drop resulting from the addition of new loads further from the existing circuits. Formulas, description of variables, and any other supplemental information required to evaluate design results must be included in the report.

### 7.7.2 Load Analysis

A complete load analysis must be submitted. This analysis must include, but is not limited to: calculation of individual circuits, major distribution equipment, and service points. All calculations must verify all interrupting ratings and conductor sizing.

For any major modifications or renovations, calculations must consist of providing the existing load (prior to modification), the load being removed, the load being added, and new total load. A load analysis must be provided any time electrical load is added to existing infrastructure. All existing loads must be field verified by metering or calculated based on existing conditions.

New service points and major distribution equipment must be provided with a minimum of 20-percent spare capacity.

Manufacturer’s product data cut sheets containing equipment power requirements must be provided in the report. Generator sizing calculations, UPS sizing calculations, and any other calculations affected by power loads for the project must be provided in the report.

### 7.7.3 Arc Flash Hazard Analysis

Provide an Arc Flash Hazard Analysis for new electrical distribution equipment (panelboards, transformers, load centers, disconnects, etc.), per the latest version of the Standard for Electrical Safety in the Workplace, NFPA 70E. An arc flash hazard analysis must determine the Arc Flash Protection Boundary and the personal protective equipment (PPE) that personnel within the Arc Flash Boundary must use. The arc flash hazard analysis must be updated when a major modification or renovation takes place. Arc Flash and Shock Warning labels must be field installed on each piece of new electrical distribution equipment. The labels will indicate the flash hazard boundary, the flash hazard at 18 inches, the PPE level requirements, and the approach restrictions. All labels proposed for use on electrical equipment must be provided (in .pdf format) as part of the report and in the plans.

### 7.7.4 Short Circuit Analysis and Device Coordination

A short circuit analysis must determine maximum fault current on each piece of new electrical distribution equipment and proper fault current interrupting capacity. Provide documentation from the utility provider on the maximum available fault current at the utility transformer. This value must be used in the short circuit analysis. Software programs or hand methods used must be capable of calculating the maximum short circuits at all electrical equipment locations to ensure equipment ratings are adequate. The short circuit analysis must be updated when a major modification or renovation takes place or if electrical load is added to existing infrastructure. The AIC ratings for all equipment must be provided as part of the contract documents to meet or exceed the short circuit analysis results.
Electrical distribution equipment must be designed as fully rated and selectively coordinated systems. The protective features of the electrical distribution system must automatically and selectively isolate a faulted or overloaded circuit from the remainder of the electrical system. Only the closest protective device to the fault must operate to isolate the fault without affecting other parts of the system.