REQUEST FOR PREQUALIFICATION OF LED LIGHT FIXTURES

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Sections in RED on this Table of Contents have been revised

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1.1 GENERAL

1.1.1 Introduction and Administrative Information

LED lighting technology has advanced greatly in recent years. Applications previously focused on LED "luminance" installations and now with the advances of the white LED, there is a growing application for LED products to provide "illuminance" for indoor and outdoor applications. The New Jersey Turnpike Authority is aware of this growing industry and sees advantages in providing both energy savings and the benefits of replacing their existing HID lighting installations with "white light." As such, this solicitation is intended to invite manufacturers to submit their products for installation, evaluation and testing for any or all of the listed applications as follows (there are no "listed applications above"), in accordance with the guidelines and criteria defined herein.

This Request for Qualification ("RFQ") is intended to provide interested manufacturers of LED Light Fixtures with the opportunity to obtain prequalification of their products in order to be eligible for use for new highway construction projects, or as part of a retrofitting of existing HID lighting installations. The prequalification process will be accomplished in two steps.

1. The first step will require the submittal of technical documentation as outlined in this Request for Prequalification. After the Authority has completed its review of the technical documentation the Authority will notify the manufacturer as to whether the technical documentation has been approved and if it has not been approved, details will be provided regarding the deficiencies determined to exist.
2. Once the technical documentation has been approved by the Authority, the second step in the process will require that the manufacturer submit product samples for field testing by the Authority on Authority roadways and facilities. **Quantity of fixtures required are shown in the Table under Exhibit 1-2.**

The Authority intends to establish a prequalified list of LED Light Fixtures in the following eight (8) categories in accordance with the guidelines and criteria defined herein.

- Roadway Mainline and Interchange Lighting
- Ramp Lighting
- Underbridge Lighting
- Tunnel Lighting
- Sign Lighting
- Parking Lot/Storage Yard Lighting
- Toll Plaza Approach Lighting
- Toll Plaza Lane (under canopy) Lighting

The purpose of this process is only to prequalify manufacturers to supply their products in response to an Invitation to Bid, and approval shall not entitle any manufacturer to a contract for the supply of any goods or services. The Authority reserves the right to cancel, abandon or modify this prequalification process if it determines it would be in its best interest to do so. Once the Authority has completed its evaluation of the technical documentation and light fixtures, manufacturers will be notified as to whether its products have been accepted. The Authority reserves the right to deny prequalification to any manufacturer that, in the Authority's sole discretion, lacks sufficient financial, operational or manufacturing resources sufficient to meet the Authority's needs.

It is understood that not all manufacturers have products which will meet all of the applications suggested in this solicitation, and any manufacturer may submit any number of products for any number or combination of categories. For reasons of administrative convenience and open competition, the Authority reserves the right to place reasonable limitations on the number of products that may be submitted by a given manufacturer, or to otherwise conduct the prequalification process in phases. When submitting technical documentation or fixtures for consideration it will be important for the manufacturer to clearly define which application the submittal pertains to and the criteria it meets.

Any manufacturer desiring to attain prequalification for a product shall be required to provide technical documentation followed by a specified quantity of LED Lighting Fixtures to the Authority, together with any other required supporting documentation, at no cost to the Authority. The quantity of required fixtures is dependent upon the specific application and is defined below in this RFQ. The typical quantity required is less than 6 for each application. The manufacturer will not be required to install the product samples; however, instructions for installation and any required adapters or accessories to make the installation possible on existing Authority equipment must be provided. Any sample LED Lighting Fixtures shall become the sole property of the Authority as the Authority cannot guarantee the return of samples at the conclusion of the evaluation period, the term of which may be indefinite. It is anticipated that the initial evaluation period will be approximately **8 months.**

1.1.2 Basis For Grant of Prequalification

Set forth below are certain extractions of the Authority's current design manual for lighting system design. The intent in setting forth this information is not to provide a design handbook, but, rather, to establish the conditions and specifications within which proposed LED Lighting Fixtures will be put to use. LED Lighting Fixtures that are deployed for demonstration testing will be required to prove acceptable for usage, to the satisfaction of the Authority, in accordance with the Authority's established lighting system design specifications.

In addition, LED Lighting Fixtures will be evaluated based on the following specific parameters:

  - Dimensions and weight
  - Adaptability to an existing light pole or mounting bracket or plate
  - Integrity to environmental elements, including weather and vibration
  - Operating voltage range and power demand
  - Effectiveness of heat dissipation
  - Serviceability and maintenance life cycle (LED and engine life)
- IES Type distribution and optics
- Ability to meet application illumination requirements as defined herein

It should be noted that this is not a competition for the selection of one manufacturer's fixture over another. Fixtures which meet or exceed all of the requirements will be placed on the Authority's "approved luminaires" list, which would allow the fixture to be submitted for use by contractors in lighting installations pertaining to its usage classification as defined in Exhibit 1-1 of this solicitation. Any manufacturer can qualify if the requirements are met at the end of the evaluation period. There is no single start date for the evaluation trial. Start date will commence from the date the fixture is received by the Authority. The manufacturer will be notified at the end of the trial period as to whether or not the submitted fixture is approved.

Throughout this solicitation, reference is made to Standard Drawings. A complete listing of standard drawings can be found at http://www.state.nj.us/turnpike/NJTA-Standard-Drawings.htm and each drawing may be downloaded as needed.

All fixture installations will be performed by the Authority. The manufacturer may be present during installation of the product to provide guidance if necessary; however, there will be no reimbursement for such participation.

1.1.3 Reference Publications

The following publications have been referenced in developing this Section for Lighting and Power Distribution Systems, and shall serve as a reference to design information that is not specifically included in this manual.

An Informational Guide for Roadway Lighting. American Association of State Highway and Transportation Officials (AASHTO).

American National Standard Practice for Tunnel Lighting. Illuminating Engineering Society of North America (IESNA). Publication Number RP-22-96.

American National Standard Practice for Roadway Lighting. Illuminating Engineering Society of North America (IESNA). Publication Number RP-8-00.

Roadway Lighting Design Guide. American Association of State Highway and Transportation Officials (AASHTO). Publication Number GL-6.

Roadway Lighting Handbook. Federal Highway Administration (FHWA).

Standard NJTA Design Manual. New Jersey Turnpike Authority, latest version.

Standard Specifications. New Jersey Turnpike Authority, latest version.

Standard Electrical Drawings. New Jersey Turnpike Authority, latest version.

National Electric Code. National Fire Protection Association (NFPA). Publication Number NFPA 70.

Lighting Handbook. Illumination Engineering Society (IES).

NJDOT Design Manual. New Jersey Department of Transportation.

National Electric Safety Code. Institute of Electrical and Electronics Engineers, Inc. Publication C2.

1.2 TECHNICAL REQUIREMENTS

1.2.1 Lighting Design Criteria

The Authority utilizes an Illuminance method for the design of all lighting systems, except as required by the IESNA publications for Roadway Tunnels. Illuminance levels shall be in accordance with the following criteria, shown below in Exhibit 1-1:

EXHIBIT 1 - 1
TABLE OF ILLUMINATION AND UNIFORMITY REQUIREMENTS

Usage Classification	Minimum Average Maintained Illuminance (foot-candles)	Maximum Average Maintained Illuminance (foot-candles)	Minimum Point Illuminance (foot-candles)	Maximum Uniformity Ratio (Avg./Min.)[1]
Mainline Roadways and Ramps	0.70	0.85	0.20	4.0:1
Gore Areas (Mainline Roadways and Ramps)	0.70	0.85	0.20	4.0:1
Toll Plaza Merge Area	2.30	2.50	0.60	4.0:1
Toll Plaza Lanes (Area below Canopy)	15.00	20.00	10.00	1.5:1
Major Long Bridges	0.70	0.85	0.20	4.0:1
Service Areas/Parking Areas	1.75	2.25	0.50	4.0:1

Roadway Tunnels	See the *IESNA Recommended Practice for Tunnel Lighting*			
Sign Lighting	26.00	35.00	2.00	See former Std Dwg E-21
Other Areas	See the IES *Lighting Handbook*			
Footnotes: [1] Higher uniformity values will be acceptable for elevated ramps near highmast poles, when approved in advance by the Authority				

Light levels for the Toll Plaza Merge Area shall be as listed in Exhibit 1-1 above, and traditionally are designed to transition gradually to the light levels of the adjacent roadways near the limits of the merge area.

Toll plaza lanes shall be illuminated on all plazas to the requirements shown. The calculation zone shall be coincident with the projection of the toll plaza canopy onto the roadway surface.

EXHIBIT 1 - 2
NUMBER OF REQUIRED FIXTURES FOR EVALUATION

Usage Classification	Number of Required Fixtures
Mainline Roadways and Ramps	5
Gore Areas (Mainline Roadways and Ramps)	5
Toll Plaza Merge Area	8
Toll Plaza Lanes (Area below Canopy)	8
Major Long Bridges	5
Service Areas/Parking Areas	5
Roadway Tunnels	10
Sign Lighting	3

Light Loss Factor (LLF)

Traditionally, the Authority's requirements for all lighting calculations are performed utilizing a Combined Light Loss Factor (also referred to as Maintenance Factor) to account for degradation of light output due to bulb losses, equipment tolerances, and dirt accumulation. Existing Light Loss Factors (LLF) are as shown below in Exhibit 1-3. However, it is understood that LED technology has a different life depreciation curve and some manufacturers design the driver engine to account for depreciation, thus maintaining illumination. While aspects of lower depreciation from LED light output and vibration are minimized, dirt and soot accumulation remains the same. There are numerous factors as to why overall light output may diminish over time and some will be relevant to the nature of the fixture design itself. However, one factor shall remain constant as it is inherent to the Turnpike Authority's roadways and conditions; that is Light Dirt Depreciation (LDD). The extent of LDD depends on these conditions and

also how often the fixtures will be cleaned. This factor may be identified by the fixture type's maintenance category (I through VI) in ascending order of imperviousness to dirt and dust intrusion (see the IESNA Lighting Handbook for more information). For the purpose of the Authority's roadways, an LDD of 0.6 shall be applied. The manufacturer shall submit the total LLF breakdown for their fixture including this applied LDD with other fixture specific light loss factors.

EXHIBIT 1 - 3
TABLE OF LIGHT LOSS FACTORS

Facility	Light Loss Factor
Garden State Parkway Roadways and Facilities	0.75
New Jersey Turnpike Roadways and Facilities	0.68
Other Authority Facilities	0.75
Other Authority Facilities Considered Dirty[1]	0.68
Local, County, and State (NJDOT) Roadways	Per NJDOT requirements
Other Areas outside NJTA jurisdiction	Per property owner

[1] Area shall be considered "dirty" if environmental factors (i.e. soot, exhaust, dirt, etc.) are expected to accelerate depreciation of lamp lumen output relative to an average installation.

1.2.1.1 Roadway Lighting

Pole-Top Cutoff Systems shall be considered the preferred Roadway Lighting System on the Parkway and Turnpike roadways. Pole-Top Cutoff Systems have been installed on roadways and toll plazas as wide as 10 lanes with optimal results, and are considered for all installations. Pole top fixtures must be adaptable to the Authority's standard light poles and the fixtures shall be "cutoff" type exhibiting no glare to the motorists.

1. The Pole-Top Cutoff Lighting System utilizes full-cutoff Type P2, P3 or P4 luminaires (in accordance with the Authority's standards) that are designed to be mounted on poles without the traditional bracket arms. Nominal mounting heights are either 26 or 40 feet, and shall be determined based on the criteria listed in the Authority Design Manual Subsection 7.3.1. Special tenon adapters are installed on the top of each pole, and the luminaire is installed and attached.

   The Type P luminaire is preferred by the Authority because maintenance can be performed without the need to shut lanes, as long as the lighting design places luminaires above full-width accessible shoulders. It is preferred to mount luminaires at zero (0) degrees tilt, but some luminaire tilts will be accepted as described in the Authority's Design Manual

Subsection 7.3.2 or where approved by the Authority's Engineering Department.

Pole-Top Cutoff luminaire photometric requirements for Type P2, P3 and P4 luminaires shall be in accordance with Standard Drawing E-28 (provided with this solicitation). Use of the luminaires shall be as follows:

- Type P2 – Mongoose with Flat Glass and Narrow reflector (IES Type I/II) optics
- Type P3 – Mongoose with Flat Glass and Wide roadway reflector (IES Type III) optics
- Type P4 – Mongoose with Flat Glass and Forward Throw reflector (IES Type IV) optics

2. Conventional Lighting System – The Conventional Lighting System utilizes traditional full-cutoff Type A, B, C and D cobrahead luminaires, mounted on either 8- or 15-foot bracket arms. Nominal mounting heights are either 26 or 40 feet for new installations (30 or 40 feet for retrofit installations on the Turnpike, see the Authority's Design Manual Subsection 7.3.1).

3. Offset (Expressway) Lighting System – The Offset Lighting system utilizes non-cutoff Type E fixtures mounted without arms to poles, and oriented such that the luminaires are at an angle to the roadway to maximize the light thrown to the roadway.

   The Offset lighting system is ideal for lighting very large areas of roadway; however, it does so at the cost of high glare and spill light. For this reason, the Offset Lighting System shall always be the last system considered for any roadway lighting application.

   In general, lighting standards with 26/30 foot mounting height shall be used for ramp roadway illumination, and lighting standards with 40 foot mounting height shall be used for mainline roadway illumination. However, 26/30 foot lighting standards may be used for roadways up to 36 feet wide, where existing 26/30-foot lighting systems are required to be modified.

   The following chart in Exhibit 1-4 summarizes the photometrics that shall be used for designs on both the Parkway and Turnpike, and gives recommendations where and how each type of luminaire should be used. Because of the variety of project geometrics, it is expected that these recommendations may have to be adapted for some projects. The manufacturer shall stipulate intended "usage classification" based on this table for Type P luminaries.

EXHIBIT 1-4
TYPE P LUMINAIRE INSTALLATION GUIDELINES

TYPE	LAMP WATTS[2]	IES DIST. TYPE	OPTICS TYPE	NOMINAL MOUNTING HEIGHT	RECOMMENDED USE
P2	100	I	Narrow Roadway	26'	Ramps and Bridges < 30' in width[4]
P2	150	I	Narrow Roadway	26' / 40'	Design Areas < 48' in width
P2	250	II	Narrow Roadway	40'	Design Areas < 48' in width
P2	400	II	Narrow Roadway	-	Not approved
P3	150	III	Wide Roadway	-	Not approved
P3	250	III	Wide Roadway	40'	Special geometry[1]
P3	400	III	Wide Roadway	40'	Toll plazas and special geometry[1]
P4	150	IV	Forward Throw	26' / 40'	Special geometry[1]
P4	250	IV	Forward Throw	40'	Design Areas > 60' in width
P4	400	IV	Forward Throw	40'	Toll plazas, double & triple installations[3]

Footnotes:

* All luminaires are Flat Glass, Full Cutoff.
[1] Luminaire to be used in areas of non-standard geometry, varying widths, or transitions between light levels, and only when other approved fixtures do not work.
[2] Lamp wattage (in Watts) based on traditional HID light fixtures. Does not include ballast losses.
[3] A tilt of no more than 5 degrees shall be allowed for all luminaires. A tilt of up to 18 degrees shall be allowed for Type P4 luminaires where required if no full-cutoff (5 degree tilt max) solution can be made to work.

1.2.1.2 Underbridge Lighting

Underbridge Lighting shall be provided only where roadway lighting is required by other warrants in this Section, but proper lighting levels and uniformity cannot be achieved with ground-mounted lighting standards. This is often due to project-specific geometric considerations such as length of overpass, or orientation of structures relative to various roadways.

The intention of underbridge lighting is not to accent the roadways beneath structures, but rather to provide adequate illumination and to achieve continuity of lighting throughout the roadway. Therefore, underbridge lighting shall only be required where, due to structural limitations such as the width, skew and minimum clearance, adequate illumination cannot be accomplished by means of ground-mounted lighting standards.

Underbridge lighting luminaires shall be installed on bridge piers or abutments (Type-W) or supported by structural members (Type-S), as required.

1. Mounting height shall be as required for proper illumination of the roadway, and as follows:

Type-W Luminaires:	15 ft. minimum
Type-S Luminaires:	Bottom of luminaire in line with bottom of adjacent stringer flange.

2. Luminaire setback (light center to pavement edge distance) shall be as per the following minimum requirements:

Type-W Luminaires:	Face of pier or abutment to pavement edge.
Type-S Luminaires:	3 ft. beyond pavement edge over shoulder.

3. Existing Underbridge Luminaire wattages employed are typically 150 Watt HPS.

1.2.1.3 Sign Lighting

Garden State Parkway

Sign Lighting is generally no longer provided for any new signs on the Garden State Parkway or New Jersey Turnpike due to new reflective sign material requirements, except where warranted on ramps at interchanges where geometrically, headlight reflectivity may not be feasible. Where existing lighted signs are encountered within project limits, the signs are now replaced with new retroreflective panels, and the sign lighting system shall be removed. However, there may be special cases where new signs are required to be illuminated, or existing sign light fixture installations replaced without replacing the signs themselves. For this reason, the Authority is requesting the evaluation of LED sign light fixtures.

Special circumstances where sign lighting may be required are:

a. Tangent sight distance is less than 1200 feet due to horizontal or vertical curve or other sight obstruction
b. Sign panels do not meet optimal reflectivity requirements due to older construction methods (button copy, painted signs). This warrant shall not be applicable to new signs, which are constructed with retroreflective sheeting.
c. “High importance” Guide Signs (i.e. Lane Drops, Changeable Message Signs, or Diagrammatic signs)
d. Areas with high occurrence of frost or fog
e. Where directed by the Authority’s Engineering Department
f. Project specific considerations

Current sign lighting luminaries typically utilize 250 watt mercury vapor with a metal halide ballast. Luminaire arrangements for each sign panel, based the tabulation included in former Standard Drawing E-21 (no longer issued as a

standard drawing), shall be considered with the required listed “maximum” values for uniformity ratio as shown on the drawing.

1.2.1.4 Roadway Tunnel Lighting

Tunnel lighting is required to be evaluated in accordance with the *IESNA Recommended Practice for Tunnel Lighting*, Illuminating Engineering Society of North America Publication RP-22-05. In general, “a tunnel is defined as any structure over a roadway which restricts the normal daytime illumination of a roadway section such that the driver’s visibility is substantially diminished”. Additional daytime tunnel lighting is typically not required for tunnels of length less than 80 feet.

Where tunnel lighting is warranted, supplemented daytime lighting shall be required as directed in RP-22-05. Nighttime light levels in the tunnel shall conform to Authority design criteria, and shall transition appropriately with the roadways on either side of the tunnel.

Owing to the specialized nature of tunnel lighting, non-standard luminaires and installation methods are acceptable. The desire is for continuous (linear type) LED tunnel lighting.

1.2.1.5 Parking Lot Lighting

Parking Lot Lighting shall be in accordance with the required values as defined in Exhibit 1-1. LED fixtures may shoe-box style or other architectural configuration and need not be in similar appearance to an LED roadway light fixture.

1.2.1.6 Storage Facilities and Maintenance Yards Lighting

Storage Facility and Maintenance Yard Lighting shall be constructed of either the Conventional or Pole-Top Cutoff Lighting System. And shall be in accordance with the required values as defined in Exhibit 1-1.

1.2.1.7 Navigation and Aviation Obstruction Lighting

Navigation Lighting, including channel and fender lights shall be provided on bridge structures with navigable channels as required by the United States Coast Guard or other Federal or Local Regulations. Aviation Obstruction Lighting, including aviation obstruction beacons shall be installed as required by the Federal Aviation Administration.

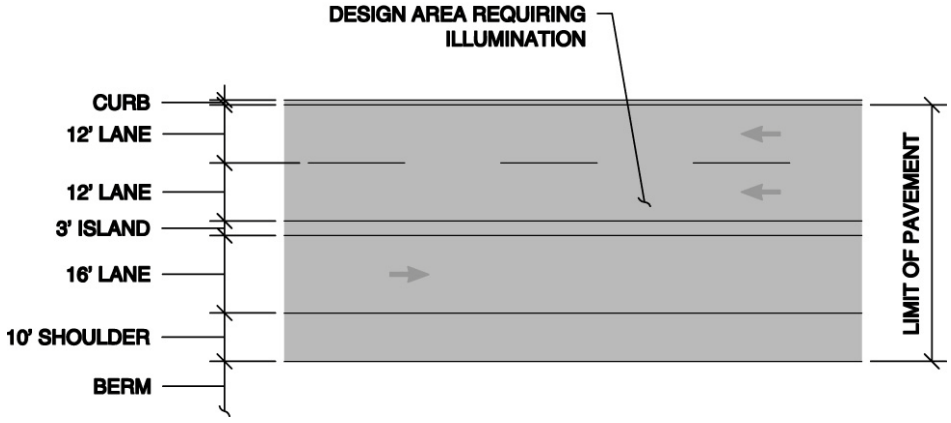
It should be noted that certain Authority facilities are within airport glide slopes, and may require special treatment to ensure that fixed lighting equipment does not project into restricted air space.

1.2.2 Required Areas of Illumination

1.2.2.1 Continuous Lighting on Roadways

Continuous lighting on roadways, freeways, ramps, and direct connections, are provided from pavement edge to pavement edge. The Design Area shall include all shoulders, medians, curbs, and islands as shown for a typical roadway section in Exhibit 1-5 below:

EXHIBIT 1-5
REQUIRED DESIGN AREA FOR TYPICAL RAMP



Where lighting is required only on certain portions of the roadway, such as the case of acceleration or deceleration lanes, the other requirements of this Subsection shall apply.

1.2.2.2 Deceleration Lanes

Deceleration Lane lighting, where warranted, shall be installed in advance of the striped gore for the predetermined distance as listed in Exhibit 1-8, and continued to a point 30 feet beyond the physical gore. The Design Area shall include the deceleration lane(s) and shoulder, as well as the two adjacent mainline lanes. Lighting shall be provided for a distance of 30 feet beyond the physical gore. Deceleration lane lighting may be extended in certain cases to accommodate project-specific consideration. Deceleration Lane lighting is shown in Exhibit 1-6 and Exhibit 1-7 below:

EXHIBIT 1-6
REQUIRED DESIGN AREA FOR DECELERATION LANE

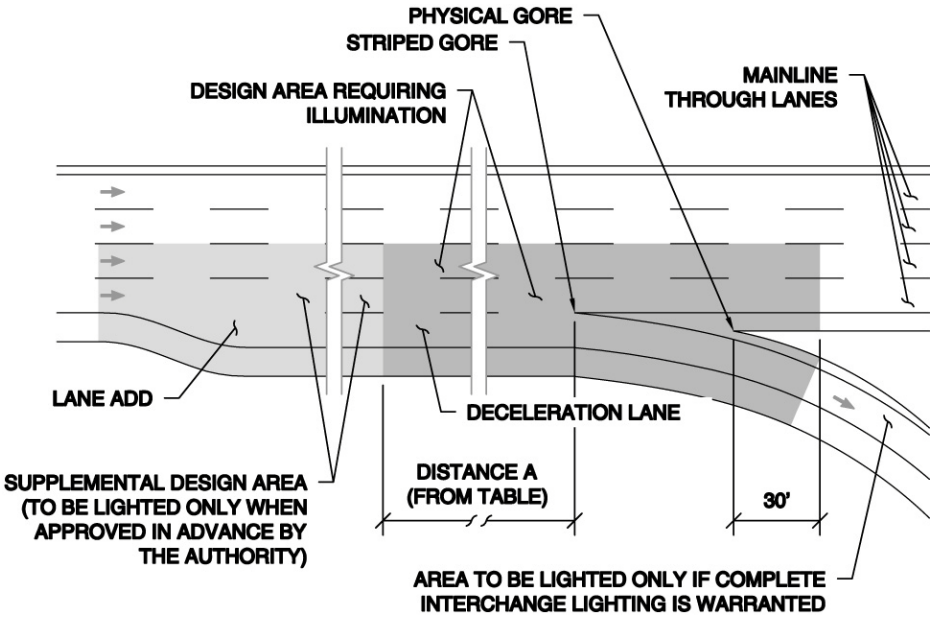
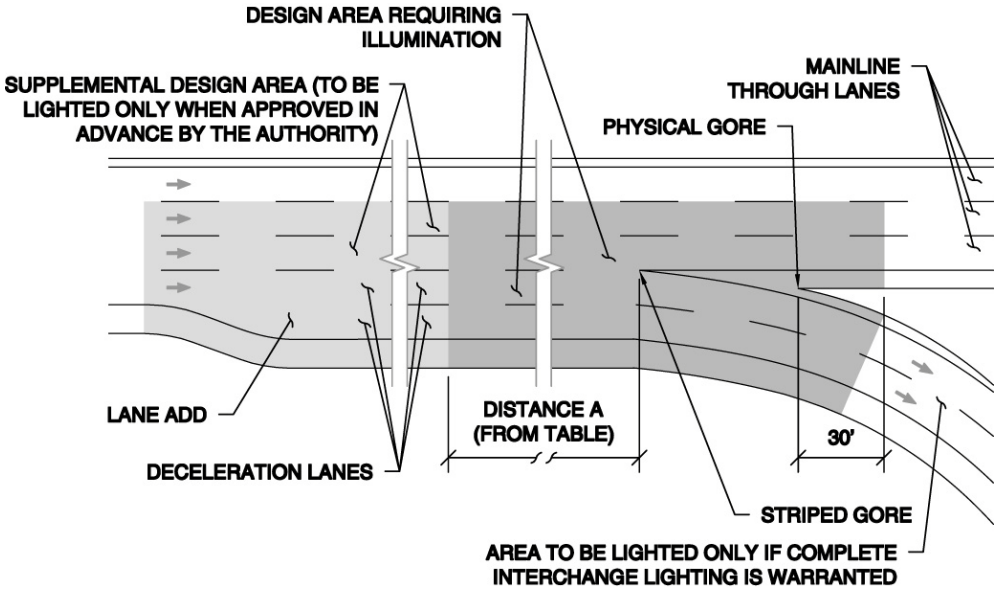


EXHIBIT 1-7
REQUIRED DESIGN AREA FOR MULTIPLE DECELERATION LANES



The minimum distance that requires lighting, as measured from the physical gore, is listed below in Exhibit 1-8:

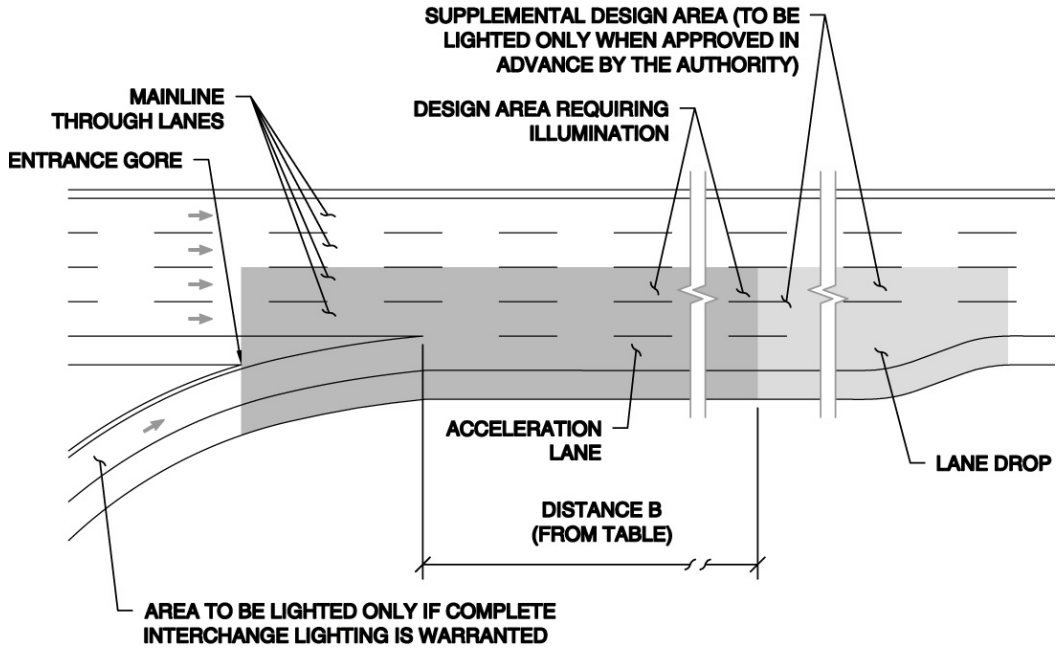
EXHIBIT 1-8
TABLE OF DISTANCES FOR DECELERATION LANE LIGHTING

Design Speed Limit	Distance A (Safe Stopping Distance)
35 MPH	250 Feet
40 MPH	325 Feet
45 MPH	400 Feet
50 MPH	475 Feet
55 MPH	550 Feet
60 MPH	640 Feet
65 MPH	735 Feet
70 MPH	835 Feet

1.2.2.3 Acceleration Lanes

Acceleration Lane lighting is typically installed beginning at the physical gore and continuing for a predetermined distance from the striped gore as listed in Exhibit 1-10. The Design Area shall include the acceleration lane(s) and shoulder, as well as the two adjacent mainline lanes. Acceleration lane lighting may be extended in certain circumstances to accommodate project-specific needs. Acceleration Lane lighting is shown in Exhibit 1-9 below:

EXHIBIT 1-9
REQUIRED DESIGN AREA FOR ACCELERATION LANE



The minimum distance that requires lighting, as measured from the convergence of the acceleration lane and mainline lanes, is listed below in Exhibit 1-10:

EXHIBIT 1-10
TABLE OF DISTANCES FOR ACCELERATION LANE LIGHTING

Design Speed Limit	Distance B (Safe Stopping Distance)
35 MPH	250 Feet
40 MPH	325 Feet
45 MPH	400 Feet
50 MPH	475 Feet
55 MPH	550 Feet
60 MPH	640 Feet
65 MPH	735 Feet
70 MPH	835 Feet

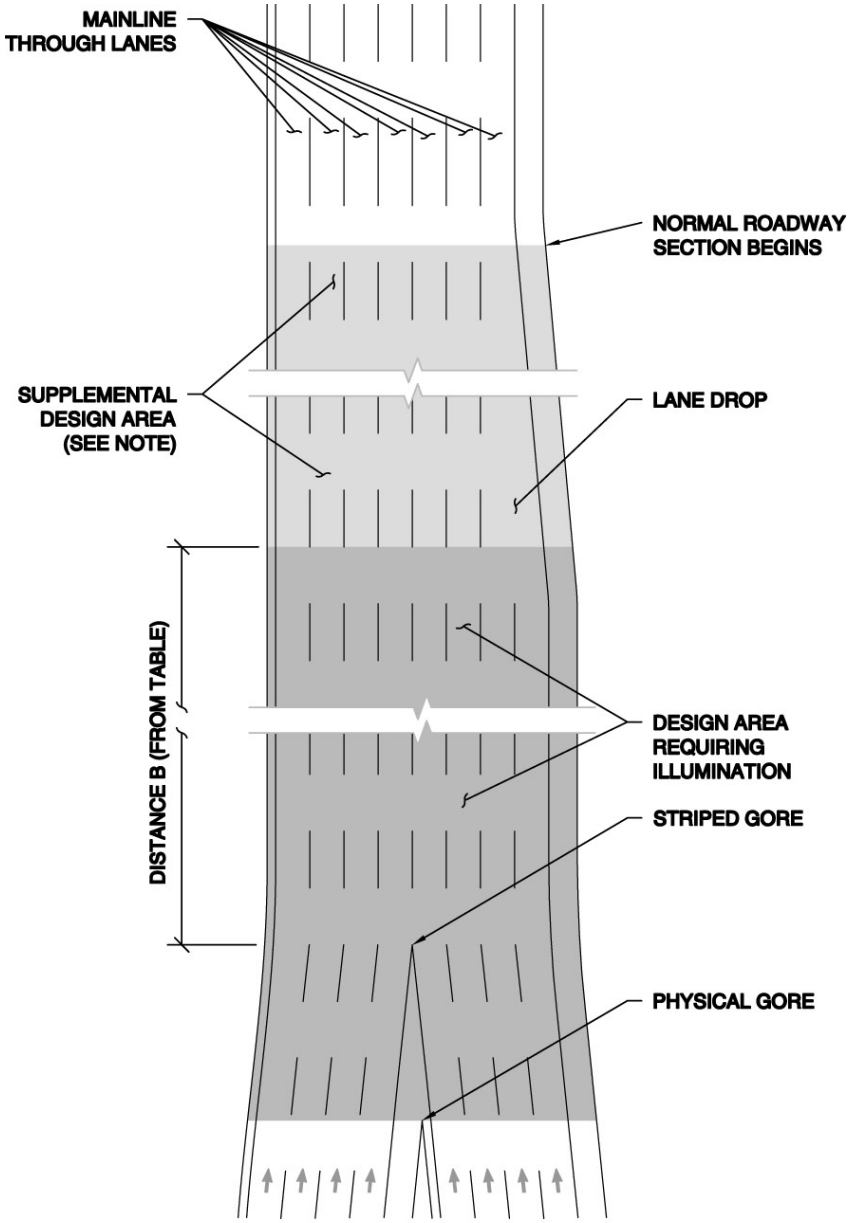
1.2.2.4 Merge, Weaving, and Diverge Areas

Design Areas for merge, diverge, and weaving areas are typically as shown below in Exhibit 1-11 and Exhibit 1-12.

The Design Area for merge and weaving areas shall include all paved area starting from the point of the physical gore, to the striped gore, and continuing for a predetermined distance B (determined from the table in Exhibit 1-10). If lane drops occur beyond the minimum merge area, the Design Area may be extended to the location where all lane drops have occurred.

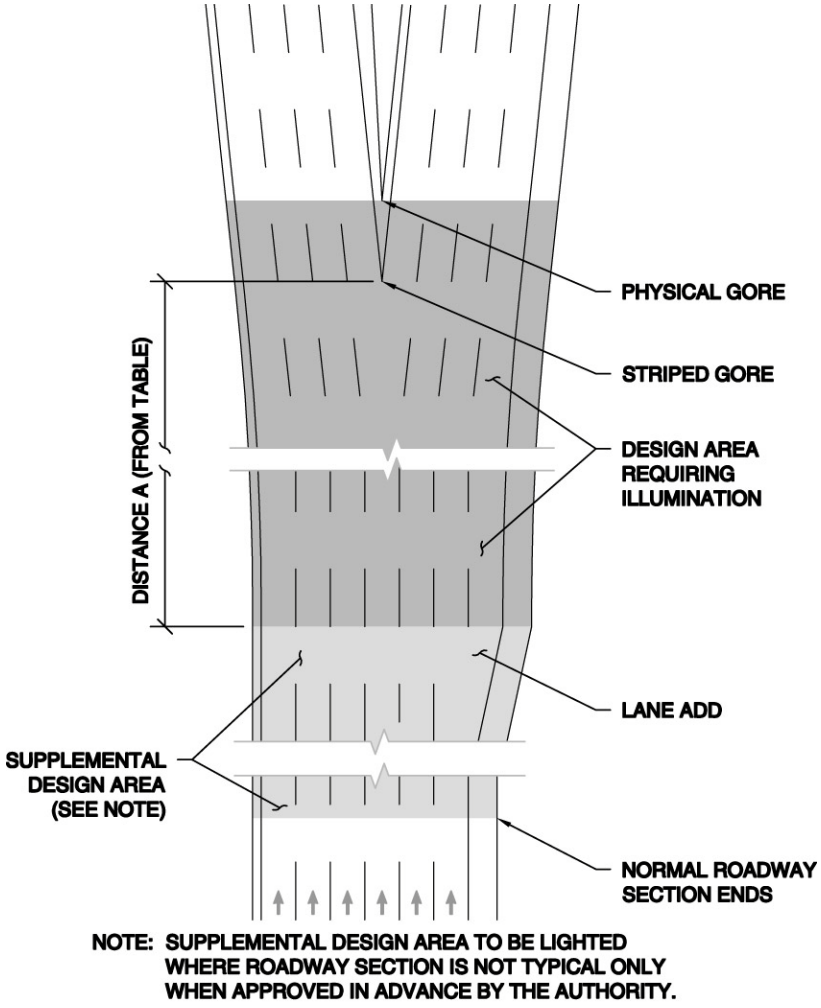
The Design Area for diverge areas typically includes all paved area starting from a point located a distance A (determined from the table in Exhibit 1-8) from the striped gore, and continuing to the location of the physical gore. If lanes are added in advance of the minimum diverge area for purposes of allowing proper weaving distance prior to the decision point, the Design Area may be extended in certain circumstances to a location where the first lane is added.

EXHIBIT 1-11
REQUIRED DESIGN AREA FOR MERGE/WEAVING AREA



NOTE: SUPPLEMENTAL DESIGN AREA TO BE LIGHTED WHERE ROADWAY SECTION IS NOT TYPICAL ONLY WHEN APPROVED IN ADVANCE BY THE AUTHORITY.

EXHIBIT 1-12
REQUIRED DESIGN AREA FOR DIVERGE AREA



1.2.2.5 Ramp Termini

Ramp terminus lighting is typically installed where the ramps connect with local roads, intersections, or other freeways. Because of the diversity of the geometries of the various ramp terminals across the Parkway and Turnpike, the Engineer shall use judgment to determine the necessary Design Area. Any transition lighting necessary to visually connect the Authority's lighting system with the lighting system of another jurisdiction shall be included in the Design Area.

Examples of typical ramp terminus treatments are shown below in Exhibit 1-13 and Exhibit 1-14 for reference:

EXHIBIT 1-13
REQUIRED DESIGN AREA FOR TYPICAL RAMP TERMINUS

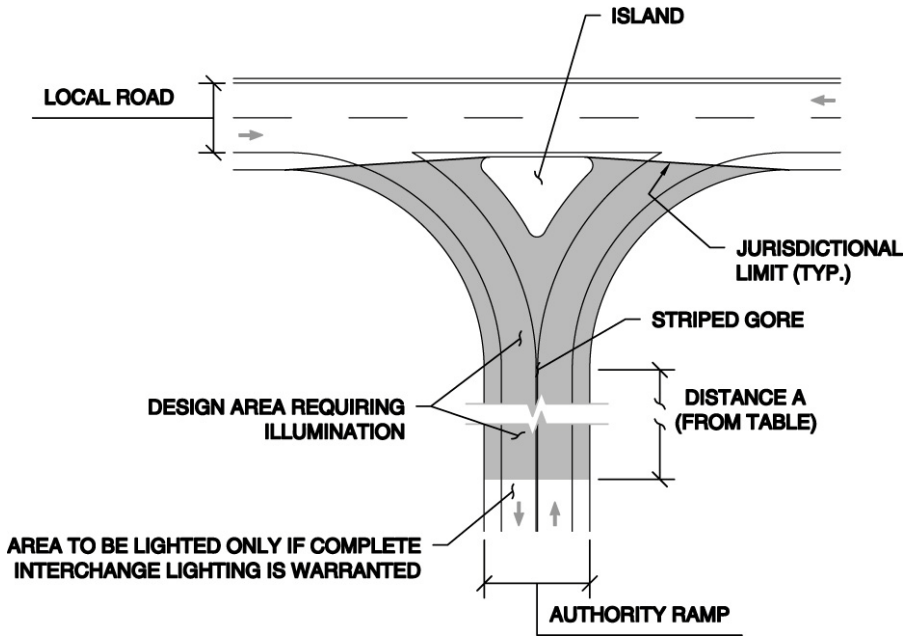
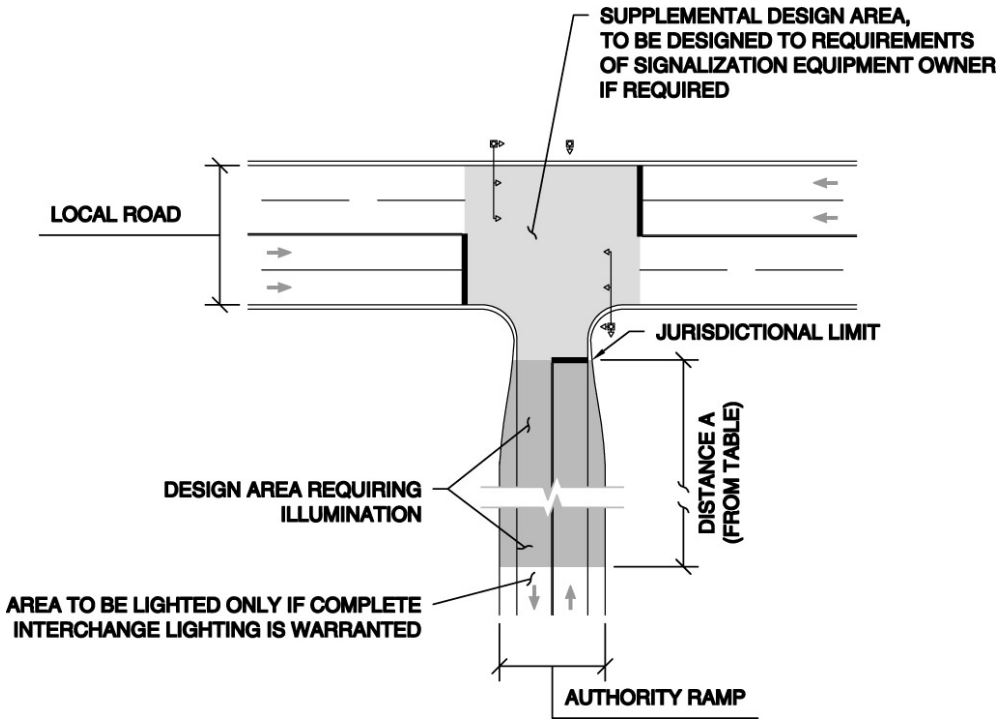


EXHIBIT 1-14
REQUIRED DESIGN AREA FOR RAMP TERMINUS AT SIGNALIZED INTERSECTION



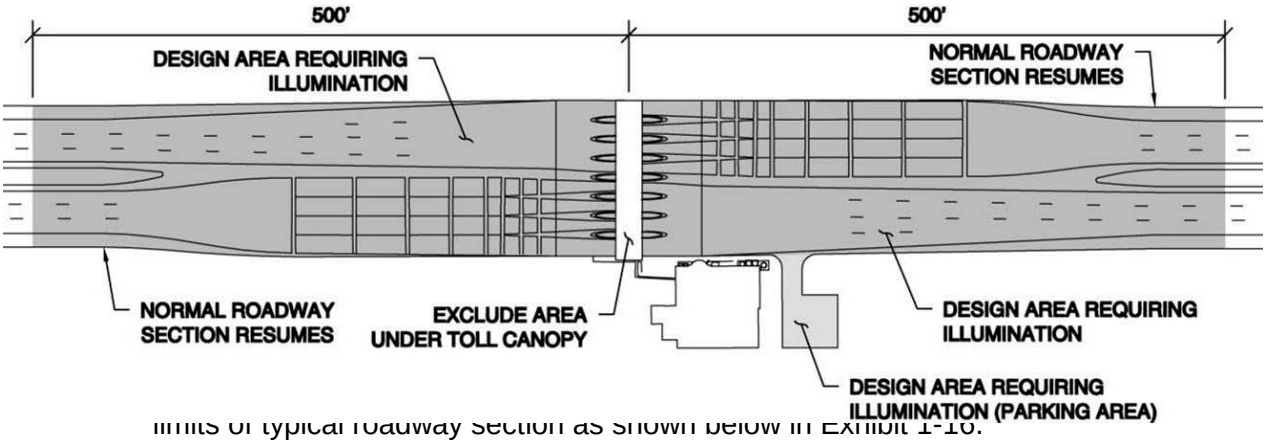
1.2.2.6 Toll Plaza Merge Areas

Toll Plaza Merge Areas (as defined below) is typically continuously lighted from pavement edge to pavement edge, including all shoulders, where required by the Lighting Warrant Analysis. The Design Area for Toll Plaza Merge Areas shall include all islands, dividers, and other obstructions, but does not include the area immediately below the Toll Plaza Canopy, which is typically analyzed separately.

The Toll Plaza Merge Area shall be defined as the greater of the two following areas:

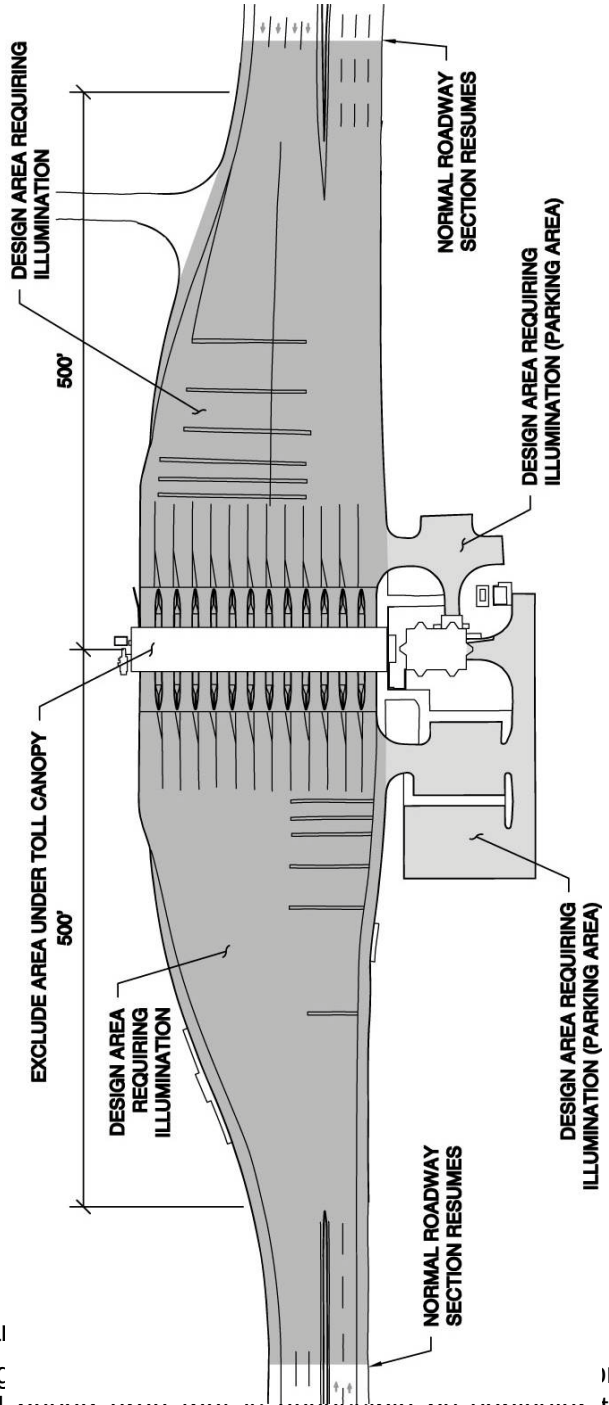
1. The paved area between points located 500 feet on either side of the Toll Plaza centerline as shown below in Exhibit 1-15, or

EXHIBIT 1-15
SMALL TOLL PLAZA DESIGN AREA



limits of typical roadway section as shown below in Exhibit 1-16.

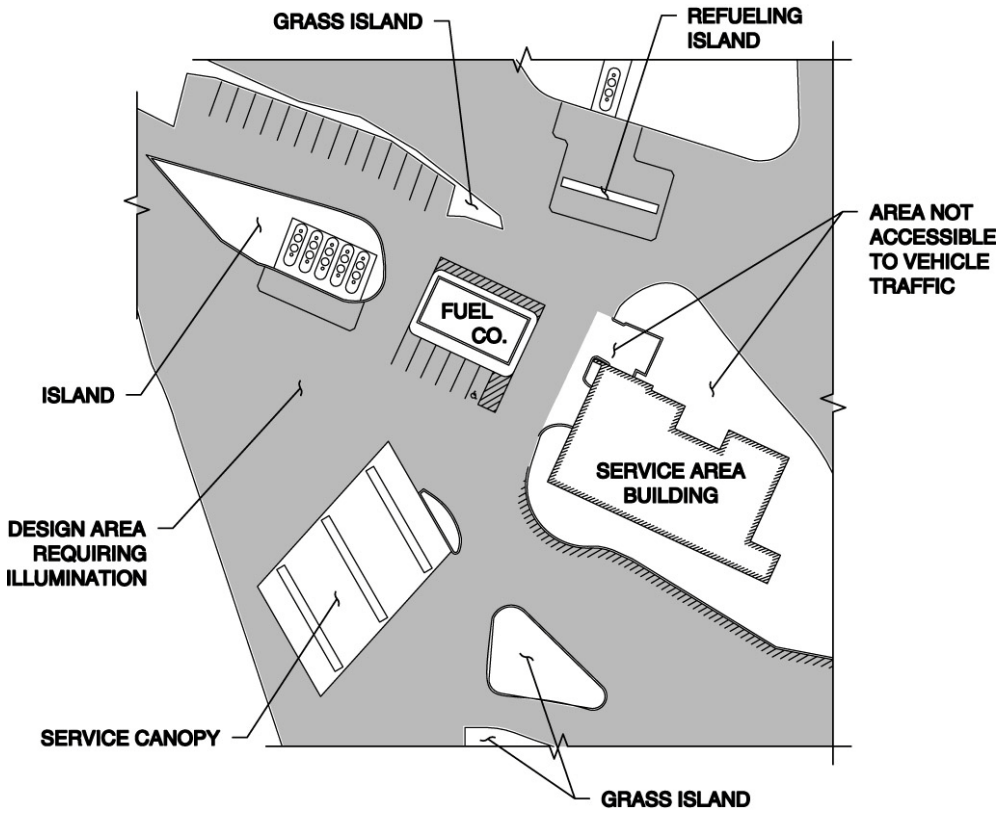
EXHIBIT 1-16
LARGE TOLL PLAZA DESIGN AREA



1.2.2.7 Pa

The Desig rage areas typically include all paved area that is accessible by vehicular traffic. Channelizing devices, buildings, islands, service canopies, maintenance buildings, etc. shall be excluded from the Design Area in order to reduce unnecessary light spill and improve overall system efficiency. Areas with any expected pedestrian traffic are also included in the design area to ensure maximum safety. A typical parking area is shown in Exhibit 1-17, below:

EXHIBIT 1-17
TYPICAL DESIGN AREA FOR PARKING FACILITY



1.2.2.8 Roadway Tunnels

The Design Areas for Roadway Tunnels, including Adaptation, Transition, and Interior Zones, shall be as defined and described in *IESNA Recommended Practice for Tunnel Lighting*, Illuminating Engineering Society of North America Publication RP-22-96.

1.2.3 Lighting Calculation Method

This Subsection lists the specific requirements which are required by designers when performing illuminance calculations for Authority projects. These methods are used for most roadway, site, sign, underpass, and other lighting systems. For details of the luminance calculation methods required for certain Tunnel Lighting installations, see the *American National Standard Practice for Tunnel Lighting* (Illuminating Engineering Society of North America)

Calculations are typically submitted for all areas where Roadway Lighting is warranted, including but not limited to Roadways, Tunnels, Underbridge, Signs, and where Aesthetic Lighting is required for each project.

1.2.3.1 Software and Setup

1. All illuminance calculations are performed using the Acuity Lighting Brands, Inc. lighting calculation software called Visual™ Professional Edition, latest version. This is the industry-standard program used for review of lighting calculations. The Engineer has the option of proposing use of an alternate lighting calculation program. However, before an alternate program is approved for use on a Project, the Engineer must ensure that any alternate program used shall be capable of calculating illuminance based on both direct and reflected components, shall be capable of three-dimensional analysis, and shall utilize a graphical user interface for data input and analysis.

   The Visual™ lighting software is not to be used for luminance calculations, as is required for such installations as Tunnel Lighting. There are program specific for calculating cd/m^2 such as AGI32 or equivalents.

2. All calculations shall be performed in U.S. Customary units (lumens, feet, foot-candles).

1.2.3.2 Calculation Zones

1. Calculations zones are defined to be coincident with the lighting Design Area. Calculation zones are constructed using the Polygon method, and shall closely match all curved geometry of the base drawing to ensure that no calculation points are unintentionally omitted. Each section or Design Area is analyzed using a separate calculation zone, and multiple calculation zones shall be allowed for each Design Area. Use of statistical zones is typically not permitted. Calculation zones are defined as large as possible given the above criteria for ease of design and review.

2. In order to facilitate review of the calculations, calculation zones are named to match the area being calculated, or roadway station points. Multiple colors are used to differentiate between zones. Minimum and maximum values are displayed in a different color than the main calculation zone points.

3. Calculation zone accuracy is required to be set to hundredths (double-digit decimal “0.00” accuracy). Point spacing for all calculation zones shall be 5 feet transversely and longitudinally.

4. Calculation zones are defined for all residential lots, and shall be named “Residential Area”. Lighting levels in these areas are kept to a maximum illuminance of 0.10 foot-candles. If more than one residential area exists, or if residential areas are separated such that they cannot be defined as one area, then each residential area is numbered logically following “Residential Area 1”, “Residential Area 2”, etc.

5. Masking or deletion of individual calculation points is not permitted. The only exception is that masks will be allowed for large parking areas – for

example, to exclude a gas station or building from the overall calculation zone.

1.2.3.3 Luminaires and Photometrics

1. Luminaire definitions shall be created using the approved .IES photometric files shown on the Standard Drawings, and as otherwise directed by the Authority's Engineering Department. For fixture comparisons, the manufacturer may obtain the most recent version of the photometric files and corresponding documentation which are available on the Authority's website for use in project designs.

2. IES photometric files used in calculations for existing and/or proposed non-Authority or non-standard equipment shall be as per the manufacturer's direction for the specific equipment.

3. Tilt values and optical rotations in the luminaire definition shall be set to zero degrees in the luminaire definition. All tilts shall be applied to the individual luminaires / light standards.

4. Mounting height of luminaires shall be the actual mounting height as shown in the Standard Drawings, rounded to the nearest foot to simplify data entry.

5. Symbols in the Luminaire Schedule shall be defined accurately and to scale. Arm lengths, where required for each Lighting Standard, shall be defined to match those shown on the Standard Drawings.

6. Luminaires / Lighting Standards shall be laid out in accordance with the details shown on the Standard Drawings and to match the design considerations listed in Design Manual Subsection 7.2.4.

7. All light sources within three (3) mounting heights of any calculation zone are considered to be included in the calculations. This includes all light sources, including utility, site, and other lighting that is not on Authority property. For example, if a utility light on a 30-foot pole is near Authority property, it shall be included in the design as a contributing light source if it lies within 3 x 30 = 90 feet of any calculation zone.

1.2.3.4 Verification of Lighting Design

After the LED fixtures have been installed by the Authority in the field, the Authority will perform a verification of the lighting installation to ensure that the illumination values are consistent with those calculated in a computerized lighting analysis and that the usage application requirements have been met.

The Authority will overlay a grid with a maximum point spacing of 50 feet on a site plan of all lighted areas, and shall take light readings at each point. A plan of actual light reading values shall be created and compared to the computerized calculations prepared for project design, using a Light Loss Factor of 1.00 (at initial installation, lighting has not yet depreciated).

1.3 SUBMISSION REQUIREMENTS

The following must be submitted in order to qualify for the evaluation:

- Shop drawings defining product materials, dimensions, weights, UL and/or CSA certifications, and electrical requirements
- IES Distribution Type
- IES Photometric file (software generated or lab tested acceptable)
- Recommended applicable Light Loss Factor (LLF)
- Installation instructions
- Maintenance instructions
- Intended usage classification(s) in accordance with Exhibit 1-1
- Manufacturer's fixture list price

After notification from the Authority that the above described documentation has been reviewed and found to be satisfactory, manufacturers shall provide sample light fixtures, fully assembled, in the quantity as defined in Exhibit 1-2.

Submittals must be addressed to:

Joseph Lentini
Assistant Director – Building Maintenance
New Jersey Turnpike Authority
Traffic Management and Technology Center
King Georges Post Road
Woodbridge, NJ 07095

It is important that when submitted, the manufacturer clearly state whether a fixture is intended for the following usage classifications: "new," "retrofit" or "both." This is essential, since a fixture may be approved on the basis for direct replacement of existing HID light fixtures, meeting illumination criteria without modification to existing pole spacing for existing roadway installations, which is preferred. However, a submitted fixture may not meet these criteria if the intended application is for new design installations only. If this is the intent, then the manufacturer shall be required to submit a Cost Benefit Analysis to reveal the long term savings associated with energy reduction and reduced maintenance costs versus increased pole and infrastructure installation costs. The Authority reserves the right to request additional data if necessary.