



Ministry of  
Transportation  
and Infrastructure

ELECTRICAL AND TRAFFIC ENGINEERING MANUAL

## **Section 300**

### **Lighting Design**

Electrical and ITS Engineering

**January 2019**

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### APPENDICES

#### 300.1 Glossary

**Electronic versions of this manual and appendices available at:**

**[http://www.th.gov.bc.ca/publications/eng\\_publications/electrical/electrical\\_and\\_traffic\\_eng/Electrical\\_Signing\\_Design\\_Manual/tableofcontents.htm](http://www.th.gov.bc.ca/publications/eng_publications/electrical/electrical_and_traffic_eng/Electrical_Signing_Design_Manual/tableofcontents.htm)**

## **301 INTRODUCTION TO LIGHTING DESIGN**

### **301.1 ABOUT SECTION 300**

- .1 Section 300 outlines the standard engineering practices for roadway and area lighting system design within the jurisdiction of the BC Ministry of Transportation and Infrastructure. Lighting installations include roadways and off-roadway facilities such as parking lots, rest areas, and pedestrian facilities.
- .2 Section 300 also provides basic details of the standard design, equipment and construction standards used for lighting installations. Approved equipment is listed on the ministry *Recognized Products List*, detailed material specifications for lighting equipment can be found in the ministry Electrical and Signing Materials Standards and construction standards can be found in Section 635 of the ministry Standard Specifications for Highway Construction.
- .3 This manual presents recommended standard practices and design guidelines for roadway and related lighting systems. Good engineering practices and sound engineering judgment shall be used in determining the required solutions for lighting designs. Variations to these standard practices may be considered provided they are supported by proper engineering principles and sound engineering judgment. These variations must be submitted to ministry Electrical and ITS Engineering for evaluation and approval.

### **301.2 PURPOSE FOR ROADWAY LIGHTING**

- .1 The primary purpose of roadway lighting is to produce accurate and comfortable vision along roadways at night. Roadway lighting serves different functions depending on the roadway type that is being illuminated. In general, lighting for freeways and expressways assists motorists by improving visibility beyond the range of vehicle headlights while lighting for major, collector, and local roads assists motorist to identify obstacles and provide adequate visibility for cyclists and pedestrians.
- .2 The ministry generally limits their responsibility for lighting to motorist and pedestrian safety. Other lighting such as lighting used for promotion of commercial areas, is normally the responsibly of the local municipal jurisdiction.

### **301.3 ENGINEERING AND REFERENCE DOCUMENTS**

- .1 These lighting design guidelines have been developed in accordance with generally accepted engineering practices for roadway lighting and associated lighting systems. These guidelines reference engineering standard practice documents, which in part, form the requirements of lighting design for highways in British Columbia.

**301.3.1 Primary Reference Documents**

- .1 The following documents and manuals form the technical requirements for lighting design on highways in British Columbia. Lighting designers should reference the latest editions of these manuals and documents published by the organizations listed below.
  - .1 Illuminating Engineering Society of North America (IESNA)
    - .1 IESNA-HB *The IESNA Lighting Handbook*
    - .2 IESNA RP-8 *American National Standard Practice for Roadway Lighting*
    - .3 IESNA RP-20 *Lighting for Parking Facilities*
    - .4 IESNA RP-22 *Recommended Practice for Tunnel Lighting*
    - .5 IESNA RP-33 *Lighting for Exterior Environments*
    - .6 IESNA DG-19 *Design Guide for Roundabout Lighting*
  - .2 Transportation Association of Canada (TAC):
    - .1 *Illumination of Isolated Rural Intersections*
    - .2 *Guide for the Design of Roadway Lighting - Volume 1 and Volume 2 Fundamentals*
  - .3 Transport Canada (TC)
    - .1 *Grade Crossing Standards*

**301.3.2 Auxiliary Reference Documents**

- .1 The following documents and manuals may be referred to for additional reference information pertaining to lighting systems. Lighting designers should reference the latest editions of these manuals and documents.
  - .1 IESNA DG-4 *Design Guide for Roadway Lighting Maintenance*
  - .2 IESNA G-1 *Guideline for Security Lighting for People, Property and Public Places*
  - .3 IESNA LM-50 *Photometric Measurements of Roadway Lighting Installations*
  - .4 IESNA LM-52 *Photometric Measurements of Roadway Sign Installations*
  - .5 IESNA LM-71 *Photometric Measurement of Tunnel Lighting Installations*
  - .6 IESNA LM-79 *Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.*
  - .7 IESNA LM-80 *Approved Method: Measuring Lumen Maintenance of LED Light Sources*
  - .8 IESNA TM-21 *Projecting Long Term Lumen Maintenance of LED Light Sources*



- .9 TC TP-312E *Aerodrome Standards and Recommended Practices*
- .10 TC Standard 621 *Obstruction Marking and Lighting*
- .11 Transport Canada *Navigable Waters Bridges Regulations*
- .12 IESNA RP-37 *Recommended Practice for Outdoor Lighting for Airport Environments*
- .13 IESNA LM-50 *Photometric Measurements of Roadway Lighting Installations.*

### **301.3.3 Conflicting Recommendations**

- .1 Requirements and recommendations provided in the reference documents listed may vary and, in some cases, may be in conflict. Where there are discrepancies, contact ministry Electrical and ITS Engineering for clarification.

### **301.4 BEFORE YOU BEGIN**

- .1 This manual assumes the designer has a sound knowledge of lighting design. Refer to the latest edition of the IESNA Lighting Handbook, as well as the documents listed in Clause 301.3 for information on lighting theory, design concepts, and terminology.
- .2 Specific lighting design information, such as classification definitions and design criteria, is not included in this manual. This information is included in the appropriate IESNA Recommended Practice (RP), Design Guide (DG), Guide (G), Technical Memorandum (TM) or Lighting Measurement (LM) documents.
- .3 Designers shall note that there are two methods for calculating lighting levels for roadway lighting design: the Luminance Method and the Illuminance Method. The two design methods are explained in the IESNA RP-8, American National Standard Practice for Roadway Lighting. The appropriate application of the different design methods is outlined in the current revision of IESNA RP-8.
- .4 Designers shall refer to the applicable manuals and documents listed noted in Chapter 104 of this manual.

## 302 LIGHTING AND OTHER JURISDICTIONS

- .1 This section is intended to assist the designer in cases where a cost sharing agreement has been made between the ministry and another jurisdiction. Additional communications may be required between the designer, the jurisdiction, and the ministry. The following information is provided to ensure that all parties are aware of, and in agreement with, their immediate responsibilities and long-term obligations.

### 302.1 RESPONSIBILITY

- .1 For purposes of this manual, the term jurisdiction refers to municipalities, cities, regional districts, fire protection districts, unincorporated towns, or any other local governing body.
- .2 Lighting projects can cross jurisdictional boundaries. Responsibility for the lighting system can be both legal and financial. The financial responsibility and legal liability may not follow jurisdictional boundaries; under certain circumstances a jurisdiction may be required to assume financial responsibility even though the lighting system exists within the ministry's jurisdiction.
- .3 The ministry owns and operates lighting on all provincial highways (numbered and unnumbered), even if the highway runs through another jurisdiction. Also, the ministry presides over all roads in unincorporated areas of the province.
- .4 A jurisdiction presides over the roads that are within its incorporated boundaries except those controlled by the ministry.

Jurisdictional boundaries within a project are not always obvious, particularly with respect to the roadway lighting. The designer must obtain clear direction from ministry Electrical and ITS Engineering or District Office and it may be necessary to consult with the jurisdiction to ensure that all parties are aware of the exact location of jurisdictional boundaries.

### 302.2 FINANCIAL RESPONSIBILITY

#### 302.2.1 Shared with Jurisdictions - Warranted

- .1 The ministry has no formal policy for cost sharing the installation, operation, or maintenance of lighting systems. Cost sharing may be considered, but each situation will be evaluated individually and subject to available funding.
- .2 Enquiries and applications for cost sharing should be directed to the appropriate District Office of the ministry.
- .3 In cases where the ministry agrees to cost share, lighting warrants must be satisfied and the design approved by the ministry.

- .4 The ministry has control of the design on Major Highways but may agree to include features requested and paid for by a jurisdiction.
- .5 The Project Manager shall determine and document the financial responsibilities of the ministry and jurisdiction for all lighting designs. Estimated capital costs shall be determined early in the design process to allow the ministry to obtain written confirmation from a jurisdiction to proceed with the installation.
- .6 The financial responsibility for power and maintenance shall be documented and included as part of the Electrical Design Folder.
- .7 The project manager, Development Approvals Technician, or Manager, Electrical Services shall contact the jurisdiction and provide the estimated capital and operational costs.
- .8 The jurisdiction will be invoiced for their share of capital costs at the completion of construction.
- .9 The jurisdiction will be invoiced for their share of power and maintenance costs quarterly, in arrears.

### **302.2.2 Shared with Jurisdictions – Not Warranted**

- .1 If a jurisdiction requests lighting where ministry lighting warrants are not met, the jurisdiction is responsible for 100 percent of the design, construction, operation, and maintenance costs, except in certain cases for intersection lighting, as outlined below.
- .2 It is the District's responsibility to ensure that the jurisdiction is aware of the capital, operating, and maintenance costs associated with the unwarranted lighting.
- .3 The ministry will not share in any costs associated with the design, installation, and operating costs of unwarranted roadway lighting between intersections.

### **302.2.3 Maintenance**

- .1 The ministry Electrical Maintenance Contractor shall perform all maintenance on electrical equipment within the ministry right-of-way except for lease lighting which shall be maintained by the electrical utility. Exceptions must be from the ministry, in writing.

## **302.3 DESIGN REQUIREMENTS FOR UNWARRANTED LIGHTING**

- .1 To ensure lighting design standards are followed for unwarranted lighting, one of the following options must be employed:

- .1 Jurisdiction Designs and Installs Standard Roadway Lighting - The jurisdiction designs and installs the lighting at its own cost. The ministry owns, operates, and maintains the lighting and invoices the jurisdiction quarterly for 100 percent of the operational costs (power and maintenance). The lighting must be designed to ministry standards, use ministry approved materials, and be accepted by Electrical and ITS Engineering.
- .2 Power Utility Leased Roadway Lighting - The jurisdiction arranges with the local power utility company for leased lighting on utility poles as noted in Clause 307.6.4 . Leased lighting shall be owned, operated, and maintained by the appropriate power authority. The jurisdiction shall pay the power utility company directly for all costs associated with leasing. The ministry may agree to assist with the operational and maintenance costs of unwarranted intersection lighting. Each case will be evaluated individually and be subject to available financing. In order for ministry to assist with costs, the following must be undertaken:
  - .1 The cost sharing party shall complete and submit form H-0380 - Application for Cost Sharing of Intersection Lighting when applying for cost sharing on power utility company leased lighting. Appendix 300.2 contains a blank form H-0380 for reference. New leased lighting is acceptable to the ministry for cost sharing, provided the following criteria are met:
    - .1 The luminaire and mast arm brackets are oriented perpendicular to the highway. Other orientations will not be accepted.
    - .2 The cross street is a designated public access and is not a private driveway.
    - .3 The luminaire offset is no more than 15 m from the cross-street shoulder.
    - .4 The luminaire is approved by the ministry.
  - .2 A cost sharing agreement specific to the project is produced by the ministry and signed by both parties.
- .3 Decorative or Ornamental Lighting - The Municipality may install decorative and ornamental lighting that is not to ministry material standards provided that it meets the following technical requirements:
  - .1 All lighting design criteria listed in this document.
  - .2 Luminaire poles are structurally designed for use in traffic locations.
  - .3 The lighting source is approved by ministry Electrical and ITS Engineering.

- .4 Pole locations are compatible with other facilities within the project area.
- .5 Poles shall have frangible or breakaway bases where required and meet the general requirements of Clause 504.3 Frangible and Breakaway Bases.
- .6 The lighting design is approved by ministry Electrical and ITS Engineering.
- .7 The Municipality owns, operates, and maintains the lighting and is 100 percent responsible for the cost of design, installation, operation and maintenance.

## 303 LIGHTING WARRANTS

### 303.1 GENERAL

- .1 Designers shall review all roadways and pedestrian/cyclist pathways in a project and determine their lighting warrant status. The lighting warrant shall be reviewed and approved by ministry Electrical and ITS Engineering prior to commencing the detailed design of any lighting systems.
- .2 Situations may occur where lighting is warranted but is not economically feasible, such as when power is not available. The ministry will continue to monitor the location and install lighting when power becomes available.

### 303.2 DEFINITIONS

- .1 *Continuous Lighting* refers to lighting that runs uninterrupted along a section of highway.
- .2 *Full Lighting* refers to lighting applied to intersections or interchanges in a uniform manner over the entire traveled portion of the roadway.
- .3 *Partial Lighting* refers to the lighting of key decision areas, potential conflict points, on and off ramp, merge and diverge areas, and/or hazards.
- .4 *Delineation Lighting* is a special case of partial lighting used to illuminate vehicles on a cross street or median crossing, or lighting that marks an intersection location for approaching traffic.

### 303.3 WARRANTS

#### 303.3.1 Warranted Lighting

- .1 Sub-clauses 303.3.2 to 303.3.20 describe situations where the ministry considers lighting to be warranted.
- .2 Lighting in all other situations shall be considered unwarranted.

#### 303.3.2 Continuous Roadway Lighting

- .1 Continuous lighting of urban highways shall be determined in consultation with ministry Electrical and ITS Engineering.
- .2 Continuous lighting is required between intersections in the following situations:
  - .1 Areas where the nighttime collision rate is above the critical rate, as determined by the ministry Traffic Engineer.

- .2 Sections of road with four seconds or less travel time between illuminated areas, provided that these areas are warranted for full lighting as outlined above.

### **303.3.3 Intersections**

- .1 For the purposes of this section of the manual, intersections are defined as rural, urban, or signalized. Roundabouts are also classified as intersections.
- .2 For warrant purposes:
  - .1 Rural Intersections are intersections at which two or more non-continuously lighted roadways join or cross at the same level. Rural intersections are characterized by the absence of sidewalks, parking lanes, and nearby residential or commercial development. They are usually characterized by the absence of significant pedestrian activity, particularly at night. However, there are exceptions such as when the intersection is used as a transportation assembly point (such as a school bus pickup/drop-off point).
  - .2 Urban Intersections are intersections within an area of a city or municipality with dense commercial development such as restaurants, shopping centers, malls, movie theaters, bars, etc. Downtown central business districts are included in this category.
  - .3 Signalized Intersections are intersections with electrical signals controlling traffic flow.
  - .4 Roundabouts are a form of intersection that accommodates traffic flow in one direction around a central island, operates with yield control at the entry points and gives priority to the vehicles within the roundabout. Roundabouts may be in rural, suburban or urban areas.
- .3 Intersection lighting is warranted as outlined below:
  - .1 Rural intersection lighting is based on a warrant analysis in accordance with the document TAC Illumination of Isolated Rural Intersections.
  - .2 Urban intersections require full lighting.
  - .3 Signalized intersections require full lighting.
  - .4 Roundabouts require full lighting.

### **303.3.4 Crosswalks**

- .1 Crosswalk lighting shall be warranted as recommended by IESNA RP-8.

### **303.3.5 Interchanges**

- .1 Urban interchanges require full illumination.

- .2 Rural interchanges shall have partial illumination at on/off ramp, merge, and diverge areas as defined in Figures 14 and 15 Typical Off and On-Ramp - Partial Lighting.

### **303.3.6 Bridges**

- .1 Roadway Lighting on bridges.
  - .1 Bridge lighting is warranted when roadways approaching the bridge are illuminated.
  - .2 Roadway lighting may be considered, at the discretion of ministry Electrical and ITS Engineering where one or more of the following situations exist:
    - .1 Sag or crest vertical curves exist where the roadway cannot be illuminated by vehicle headlights for at least one safe stopping sight distance (SSSD).
    - .2 Shoulder widths are less than 2.5m.
- .2 Marine Navigation Lights or Hazard Lights on Bridges.
  - .1 The warrant for marine navigation lights or hazard lights on bridges over a waterway is defined in the Transport Canada Navigable Waters Bridges Regulations.
  - .2 The designer shall confirm the need and requirements for marine navigation lighting or hazard lights on bridges over navigable waterways with the ministry Rail, Navigable Waters Coordinator, Bridge Engineering, Victoria.
- .3 Bridge Piers in Navigable Waters
  - .1 Bridge pier floodlighting or marker lighting may be required on some bridges for safety reasons such as heavy marine traffic or for aesthetic and architectural reasons.
  - .2 The designer shall confirm the need for floodlighting or marker lighting on bridge piers with the ministry Rail, Navigable Waters Coordinator, Bridge Engineering, Victoria.
- .4 Aircraft Obstruction Lights on Bridges
  - .1 The purpose of aircraft obstruction lighting is to indicate the presence of a hazard to aircraft.
  - .2 The requirements for aircraft obstruction lights on bridges are defined in the Canadian Aviation Regulations, Standard 621 – Obstruction Marking and Lighting.
  - .3 The designer shall confirm the need and requirements for aircraft obstruction lights on bridges with tall towers with the ministry Rail, Navigable Waters Coordinator, Bridge Engineering, Victoria.



**303.3.7 Tunnels**

- .1 The purpose of tunnel lighting is to:
  - .1 Provide a transition from ambient light levels to tunnel light levels at the tunnel entrance and exit.
  - .2 Provide appropriate lighting levels internal to the tunnel and tunnel approaches as stated by IESNA RP-22.
- .2 Warrants for daytime and nighttime tunnel lighting shall be determined by the application of IESNA RP-22. It should be noted that the lighting requirements of RP-22 may indicate that no lighting is required for certain tunnels, particularly short tunnels with good wall reflectance or good daylight penetration. It should also be noted that a tunnel that does not warrant daytime lighting may require nighttime lighting if the roadway is warranted for continuous lighting.
- .3 Lighting is warranted in walkway and bikeway tunnels, provided power is available. The lighting warrant shall be confirmed with ministry Electrical and ITS Engineering.

**303.3.8 Underpasses and Overpasses**

- .1 When a highway passes under a crossroad it is called an underpass; when a highway passes over a crossroad it is called an overpass.
- .2 Structures considered to be underpasses/overpasses are those where the length and physical configuration do not significantly reduce the driver's ability to see objects within the structure. Normally, supplemental daytime lighting is not required in underpasses less than 25m in length.
- .3 Warrants for lighting of underpasses and overpasses are based upon the recommendations stated in IESNA RP-8.
- .4 Where underpasses and overpasses meet the IESNA definition of a tunnel, warrants shall be based upon recommendations stated in IESNA RP-22.

**303.3.9 Pedestrian Walkways and Bikeways**

- .1 Lighting specifically installed for pedestrian walkways and bikeways (i.e., separate from the roadway lighting and with no potential for vehicle/pedestrian conflicts) is warranted in the following circumstances:
  - .1 Pedestrian overpasses and ramps to pedestrian overpasses. In cases where roadway luminaires in proximity of the overpass or ramp provide sufficient illumination, additional luminaires for the pedestrian overpass or ramp are not required.
  - .2 Multi-use pathways in urban areas.
  - .3 Stairways of more than 2 risers or other similar obstacles.

- .4 Walkways in known high security areas as determined by the ministry District Transportation Manager.

### **303.3.10 Signs**

- .1 New signs have high reflective sheeting (ASTM Type 9 or higher) eliminating the need for a sign luminaire. If an illuminated sign is to be moved or modified it shall be replaced with one with high reflective sheeting and the luminaire(s) removed.
- .2 A sign luminaire may be used if approved by ministry Traffic & Safety Engineering.

### **303.3.11 Rest Areas**

- .1 Rest areas have both vehicle and pedestrian traffic and therefore require lighting to ensure safety and security.
- .2 Lighting is warranted in all rest areas that are part of major highways, provided power is available.
- .3 Lighting will be installed in rest areas along minor highways if requested by the District Transportation Manager, provided power is available.

### **303.3.12 Weigh Scales**

- .1 Weigh scales have both vehicle and pedestrian traffic and therefore require lighting to ensure safety and security. Also, there are personnel operating the weigh scale and performing outdoor tasks, such as vehicle inspections. To increase pedestrian and worker safety, full area lighting is required at weigh scales that are operational at night.
- .2 For weigh scales that do not operate at night, only basic security area lighting is required as stated in IESNA G-1 Guidelines for Security Lighting for People, Property and Public Places.
- .3 Where security cameras are used lighting must meet the requirements of the camera system.

### **303.3.13 Surveillance Video Camera Lighting**

- .1 Roadways with video surveillance require full lighting. These include facilities such as reversible lane control systems, swing bridges, and other ITS Systems.

### **303.3.14 Webcam Video Lighting**

- .1 Partial lighting may be required for web cameras in remote areas. The lighting shall extend for the field of view of the camera, including multiple fields of view for pan-tilt-zoom cameras.

- .2 Infrared illuminators should be considered where roadway lighting is not effective or suitable. Generally, roadway lighting should only be installed where a motorist would expect it, such as a pull-out or cross street.

### **303.3.15 Brake Check Areas and Chain-up/off Pull-outs**

- .1 For the purposes of this manual, brake check areas and chain-up pullouts are classified as either formal or informal.
  - .1 Formal brake check areas and chain-up pullouts are facilities that are designed as an integral part of the highway system and are typically located along major highways. They are generally identified by the presence of acceleration and deceleration lanes and the presence of roadside barrier.
  - .2 Informal brake check areas are facilities that are simple, non-protected pullouts on the side of roadways and are typically located along minor highways. They do not have acceleration and deceleration lanes or roadside barrier.
- .2 Brake check areas and chain-up pullouts have both vehicle and pedestrian traffic and require lighting ensure safety and security.
- .3 Lighting is required at all formal brake check areas and chain-up pullouts provided power is available.
- .4 Lighting is required at informal brake check areas and chain-up pullouts if requested by the District Transportation Manager provided power is available.

### **303.3.16 Inland Ferry Terminals**

- .1 Road and Area Lighting
  - .1 Ferry terminals have both vehicle and pedestrian traffic and therefore require lighting to ensure safety and security. Additionally, there are personnel operating the ferry terminal and performing various visual tasks. To increase pedestrian and worker safety, full area lighting is required at ferry terminals that are operational at night.
  - .2 Ferry terminals that do not operate at night require basic security area lighting as stated in IESNA DG-1.
- .2 Marine Navigation Lights
  - .1 The designer shall confirm the need and requirements for marine navigation lighting at ferry terminals with the ministry Rail, Navigable Waters Coordinator, Bridge Engineering, Victoria.
- .3 Piers in Navigable Waters
  - .1 Terminal pier floodlighting or hazard marker lighting may be required at some ferry terminals for safety reasons, such as heavy marine traffic, or for aesthetic

and architectural reasons. Pier floodlighting or hazard marker lighting is generally required for all terminal piers located within or near a navigable waterway.

- .2 The designer shall confirm the need for floodlighting and/or hazard marker lighting of ferry terminal piers with the ministry Rail, Navigable Waters Coordinator, Bridge Engineering, Victoria.

### **303.3.17 Tolling Gantry's**

- .1 Roadways beneath tolling gantries shall be illuminated to the levels and requirements of the automated tolling equipment.

### **303.3.18 Parking Facilities**

- .1 Most surface parking facilities are owned and operated by jurisdictions other than the ministry. However, there are circumstances where the parking facility may fall under the ministry's jurisdiction.
- .2 Lighting is required for urban parking facilities under the ministry's jurisdiction when used during nighttime hours.
- .3 Lighting is required for rural parking facilities when requested by the District Transportation Manager responsible for the area.
- .4 Lighting requirements shall be as stated in IESNA RP-20 Lighting for Parking Facilities.

### **303.3.19 Construction Detours and Work Zones**

- .1 Lighting is required at all temporary construction detours where roadway lighting existed before the detour was constructed.
- .2 Lighting is required at detours when any one of the following conditions exists:
  - .1 The road geometry is complex
  - .2 There is a medium to high level of nighttime pedestrian traffic
  - .3 Vehicle or pedestrian safety is a concern
- .3 Lighting is only required at detours that will be in use during nighttime hours.
- .4 The above conditions apply to lighting for vehicle and pedestrian traffic only and do not include task lighting that may be required for nighttime construction work. Lighting for construction work is the contractor's responsibility and is regulated by WorkSafeBC.

### **303.3.20 Other Situations Requiring Lighting**

- .1 There may be situations not described above where lighting is warranted due to the unique requirements of the situation. The designer is encouraged to review IESNA RP-8 Annex D, which describes such situations. The designer shall review the entire project to determine if any such special situations exist, and confirm the need for lighting with ministry Electrical and ITS Engineering.
- .2 Special lighting systems may be required in areas with nighttime collision rates above the critical rates as determined by the ministry Senior Traffic Operations Engineer or by the project Traffic Engineer.

## **304 LIGHTING DESIGN**

### **304.1 DESIGN REQUIREMENTS**

- .1 All lighting, warranted by the ministry, must meet the design criteria and the design requirements of the appropriate IESNA Recommended Practice (RP), Design Guide (DG), Guideline (G), Technical Memorandum (TM) or Lighting Measurement (LM) documents.

### **304.2 DEFINITIONS**

#### **304.2.1 Roadway Classifications**

- .1 Roadway classifications describing the general conditions of vehicle traffic interactions are detailed in IESNA RP-8.
- .2 Land use classifications, such as urban, suburban, and rural are used in the application of lighting warrants.
- .3 It should be noted that these classifications are the industry standard used by lighting designers and are not necessarily the same as those used by traffic engineers and municipal planners, even though the classification names may be similar. The lighting designer shall classify all roads within a project using the IESNA classifications.

#### **304.2.2 Pedestrian Walkway and Bikeway Classifications**

- .1 Pedestrian Walkway and Bikeway classifications are detailed in IESNA RP-8.
- .2 Pedestrian Conflict Area Classifications which describe vehicle/pedestrian interaction as high, medium or low are defined in IESNA RP-8

#### **304.2.3 Pavement Classifications**

- .1 Pavement Classifications are based on the pavement reflection characteristics detailed in IESNA RP-8.
- .2 As most ministry roads are asphalt surfaced, roadway lighting calculations for ministry projects generally use pavement reflectance values for the R2/R3 pavement classification. The designer should take special note that in some cases (bridges, tunnels, snow sheds, etc.) the road surface may be Portland cement concrete, in which case the road surface classification is R1.

### **304.3 DESIGN CRITERIA**

- .1 Design criteria for highway lighting systems are based on the appropriate IESNA Recommended Practice (RP), Design Guide (DG), Technical Memorandum (TM) or Lighting Measurement (LM) documents.

- .2 All design criteria as recommended by the appropriate documents shall be met for a lighting system, including but not limited to:
  - .1 Lighting levels (using the illuminance or luminance method).
  - .2 Uniformity ratios.
  - .3 Veiling luminance (glare).
  - .4 Obtrusive light (sky glow, spill light and light trespass) criteria as set out in Chapter 305 - Obtrusive Light and Light Pollution.
- .3 The designer shall confirm the design criteria with ministry Electrical and ITS Engineering before proceeding with the lighting design.
- .4 Specific design criteria and design requirements are referenced in the sub-clauses 304.3.6 through 304.3.21.
- .5 All new lighting designs shall use LED as the light source. Except as noted below, new designs shall use LED fixtures listed on the ministry *Recognized Products List*. Exceptions to this are large new lighting projects where installation costs, lighting quality, and energy efficiency can be improved by using an alternate fixture. The alternate fixture must be listed on one of the supplier lists available from the Province of British Columbia Procurement Services Corporate Supply Arrangement (CSA). See Section 306.1 for details regarding LED roadway lighting and procurement.

#### **304.3.1 Continuous Roadway Lighting**

- .1 Recommended lighting design values for continuous roadway lighting are outlined in IESNA RP-8.

#### **304.3.2 Intersection Lighting**

- .1 Recommended lighting design values for intersection lighting are outlined in IESNA RP-8.

#### **304.3.3 Crosswalks**

- .1 Recommended design values for crosswalk lighting are outlined in IESNA RP-8.

#### **304.3.4 Roundabouts**

- .1 Recommended design values for roundabout lighting are outlined in IESNA DG-19.

#### **304.3.5 Interchange Lighting**

- .1 Recommended design values for interchange lighting are detailed in IESNA RP-8.

**304.3.6 Pedestrian Walkway and Bikeway Lighting.**

- .1 Recommended lighting design values for pedestrian walkways and bikeways are detailed in IESNA RP-8.

**304.3.7 Bridge Lighting**

- .1 No specific design criteria are provided for bridges. When bridge lighting is warranted, the lighting shall meet the recommended roadway design values detailed in IESNA RP-8.

**304.3.8 Tunnel Lighting**

- .1 Recommended design values for vehicle tunnels are detailed in IESNA RP-22.
- .2 Recommended design criteria for walkway and bikeway tunnels are detailed in IESNA RP-8.

**304.3.9 Underpass and Overpass Lighting**

- .1 Where daytime lighting is required it shall meet the design values for vehicle tunnels detailed in IESNA RP-22. Where no daytime lighting is required and only night-time lighting is required to maintain continuity of the approach roadway lighting system it shall meet the levels required for the roadway as detailed in IESNA RP-8.

**304.3.10 Parking Facility Lighting**

- .1 Recommended lighting design values for parking lot lighting are detailed in IESNA RP-20, Lighting for Parking Facilities.

**304.3.11 Rest Area Lighting**

- .1 Recommended lighting design values for rest areas are detailed in Table 1 below.
- .2 These design criteria are provided for the area lighting only and does not apply to building lighting which is typically managed by the facilities management department of the ministry.



AREA DESCRIPTION	LUX (AVG)	UNIFORMITY (AVG:MIN)	GLARE $L_{vmax}/L_{avg}$
Interior Roads (Ingress and Egress)	14	6:1	0.3
Parking Areas	18	6:1	0.3
Public Areas	22	6:1	0.3
On/Off Ramps	Refer to <i>IESNA RP-8</i> for design values		

Table 1. Maintained Horizontal Illuminance Levels for Rest Areas.

### 304.3.12 Brake Check Area and Chain-up Pull-out Lighting.

- .1 Recommended lighting design values for brake check and chain-up pull-out lighting are detailed in Table 2 below.
- .2 Lighting is provided at brake check areas and chain-up pullouts for vehicle and pedestrian safety; task lighting (for inspection or tire chain mounting and removal) is not provided.

### 304.3.13 Weigh Scale Lighting

- .1 The IESNA does not provide recommendations specifically for weigh scales. Recommendations for weigh scale lighting design criteria have been developed by the ministry using the design principles and recommendations outlined in IESNA RP-8 and IESNA RP-20 Lighting for Parking Facilities.
- .2 Recommended lighting design criteria for weigh scales are detailed in Table 2 below. This applies to operational hours only.

AREA DESCRIPTION	LUX (AVG)	UNIFORMITY (AVG:MIN)	GLARE $L_{vmax}/L_{avg}$
Interior Roads (Ingress and Egress) roads	14	3:1	0.3
Parking Areas	18	3:1	0.3
Inspection Area	30	3:1	0.3
Weigh scales	50	3:1	0.3
On/Off Ramps	Refer to <i>IESNA RP-8</i> for design values		

Table 2. Horizontal Illuminance Levels for Brake Check, Chain-up &amp; Weigh Scale.

- .3 Weigh scale areas that are closed or non-operational during nighttime hours shall have their area lighting levels reduced to basic security lighting design criteria as detailed in IESNA RP-20, Lighting for Parking Facilities.

- .4 The determined lighting levels for weigh scales shall be confirmed with ministry Electrical and ITS Engineering.

#### **304.3.14 Airport Road and Parking Area Lighting**

- .1 Roadway and parking area lighting in the vicinity of airports shall be designed in accordance with the recommendations and special requirements criteria detailed in IESNA RP-37 Outdoor Lighting for Airport Environments.
- .2 Lighting design for roadways in the vicinity of airports shall follow design practices recommended in IESNA RP-8. Standard ministry policy specifies the use of zero up-light (full cut-off) fixtures for roadway lighting.
- .3 Recommended lighting design criteria for parking areas can be found in IESNA RP-20.
- .4 The designer shall give particular consideration to the following special requirements as defined in IESNA RP-37 in the design of the lighting design:
  - .1 The amount of incident light and ambient light on control tower windows;
  - .2 The location of lighting equipment in relation to the control tower and the runway.
- .5 The designer shall ensure that the lighting design meets the requirements of TC TP-312E Aerodrome Standards and Recommended Practices. Special note is made of the requirement for specific minimum clearances and structure height restrictions in proximity of runways.
- .6 The designer shall contact the following prior to and during preparation of the lighting design:
  - .1 Transport Canada Pacific Region Safety Branch, Vancouver, BC at (604) 666-3518 to determine if TC has jurisdiction in the area of the proposed lighting, and for approval of the proposed lighting design. The Transport Canada Pacific Region website is located at:  
<https://www.tc.gc.ca/eng/pacific/menu.htm>
  - .2 The local airport operator or manager to determine factors that may affect luminaire pole location and height, and luminaire type and wattage.
  - .3 Ministry Electrical and ITS Engineering to confirm the scope of the lighting affected by the airport. This must be done prior to proceeding with a detailed design.
- .7 Additional information relating to the lighting in the vicinity of airports can be found via the Transport Canada website at <http://www.tc.gc.ca>

#### **304.3.15 Inland Ferry Terminal Lighting**

- .1 Ferry terminals have a mix of vehicle and pedestrian traffic. Lighting design should generally follow the recommendations IESNA RP-20, Lighting for Parking Facilities.
- .2 Lighting levels for the outdoor areas of ferry terminals shall be confirmed with the ministry Electrical Representative prior to proceeding with the detailed design.
- .3 Ferry terminals that do not operate during nighttime hours shall have their area lighting levels reduced to the basic security lighting design values as detailed in IESNA RP-20, Lighting for Parking Facilities.
- .4 These recommendations apply to area lighting for vehicle and pedestrian traffic only and do not apply to task lighting for ferry terminal workers. Task lighting for workers is regulated by WorkSafe BC.
- .5 These design criteria do not apply to building lighting, which is typically managed by the facilities management department of the ministry.

#### **304.3.16 Toll Gantry Lighting**

- .1 Generally, lighting levels for toll gantry areas should meet the requirements of the automated tolling equipment.
- .2 Lighting levels for toll gantry areas shall be confirmed with the ministry Electrical and ITS Engineering prior to proceeding with the detailed design.

#### **304.3.17 Surveillance Video Camera Lighting**

- .1 Where CCTV surveillance is required, the design criteria for continuous roadway lighting shall be used. Roadway lighting design values provide sufficient illumination for video surveillance.

#### **304.3.18 Webcam Video Lighting**

- .1 Generally, roadway lighting provides sufficient illumination for webcams.
- .2 Lighting may be added where there is no roadway lighting but careful consideration should be given to luminaire placement to ensure it is located where a motorist would normally expect it, such as a cross-road or pull-out. If there is no pull-out or cross-road, an infra-red illuminator should be considered.
- .3 When the camera is mounted on the same pole as the luminaire, directly beneath the luminaire, the near field-of view is normally illuminated sufficiently in all directions.
- .4 Where there are several luminaires, the camera should be located on one of the middle poles to take advantage of lighting for the far field-of-views.
- .5 Any lighting added shall be confirmed with ministry Electrical and ITS Engineering.

**304.3.19 Construction Detour & Work Zone Lighting**

- .1 To ensure safety, roadway lighting on temporary construction detours may require higher lighting levels than those noted in IESNA RP-8. Issues such as speed, road geometrics, number of detour stages, proximity of roadside hazards, volume of traffic, and driver safety will affect detour lighting levels. If lighting of temporary construction detours is required (as outlined in Sub-clause 303.3.20), the design values for the class of roadway in question shall be selected, and the required lighting level increased by 50%. This is based on the principle outlined in IESNA RP-8 Recommended Illuminance for Intersections, which recommends increasing roadway lighting levels by 50 percent for traffic conflict areas.
- .2 These special recommendations apply to lighting for vehicle and pedestrian traffic only. These are not recommendations for task lighting that may be required for nighttime construction work. The lighting for construction work is the contractor's responsibility and is regulated by WorkSafeBC. Refer to the current edition of the ministry Standard Specifications for Highway Construction, Chapter 194.

**304.3.20 Situations Requiring Special Consideration**

- .1 Where it is determined that lighting is required in situations where it is not otherwise warranted, the designer shall apply the general design principals outlined in IESNA RP-8.

**304.3.21 Non-Compliance**

- .1 In extreme cases where the required design criteria cannot be achieved due to circumstances beyond the designer's control, the designer shall obtain approval from the ministry Electrical and ITS Engineering to design to modified design criteria.

**304.4 CALCULATIONS****304.4.1 General**

- .1 Lighting design and calculations for roadways, walkways, tunnels, and open areas can be done using different methods as appropriate for the specific situation. The design and calculation methods appropriate for different situations are outlined in the IESNA documents listed in Clause 304.3 Design Criteria.

**304.4.2 Calculation Methods**

- .1 Lighting calculation methods shall follow those defined in IESNA RP-8.

**304.4.3 Computer Programs for Lighting Design**

- .1 Computer programs used for lighting design calculations shall be accepted industry standard software intended for roadway, tunnel, and area illumination such as AGI-32 or Visual.

#### **304.4.4 Calculation Area**

- .1 The calculation area shall be as specified in the applicable IESNA Recommended Practices document.

#### **304.4.5 Light Loss Factors**

- .1 The total Light Loss Factor (LLF) for LED fixtures shall be 0.81, except in areas with high concentrations of airborne dirt and dust.
- .2 Due to the uncertainty regarding lumen depreciation applicable to LED light sources, the ministry considers only Lamp Lumen Depreciation (LLD) and Luminaire Dirt Depreciation (LDD). Each of these is assigned a value of 0.9. Total Light Loss Factor (LLF) is calculated as:

$$\text{LLF} = \text{LLD} \times \text{LDD}$$

$$\text{LLF} = 0.9 \times 0.9$$

$$\text{LLF} = 0.81$$

- .3 Any other value of LLF shall be confirmed with ministry Electrical and ITS Engineering.

## 305 OBTRUSIVE LIGHT AND LIGHT POLLUTION

### 305.1 INTRODUCTION

- .1 Obtrusive light, or light pollution, is a concern to the general public and is monitored by organizations such as the International Dark-Sky Association. Obtrusive light can detract from the enjoyment of a nighttime setting and has also been shown to have negative effects on biological systems. Most obtrusive light is misdirected light that does not reach the intended target area and can therefore be considered a wasted energy. The reduction of obtrusive light will typically lead to superior lighting designs, increased energy efficiency, and eliminate a potential source of contention with the public.
- .2 Obtrusive Light can be classified into three categories:
  - .1 Light Trespass: This is light that strays from its intended target and becomes an annoyance, nuisance, and/or a detriment to visual performance.
  - .2 Sky Glow: This is the result of stray light being scattered into the atmosphere resulting in the glowing effect commonly seen above cities from a distance.
  - .3 Glare: Glare is an unwanted source luminance, and is defined by the IESNA as “the sensation produced by luminance in the visual field that is sufficiently greater than the luminance to which the eye has adapted to cause annoyance, discomfort, or loss of visual performance and visibility”.

### 305.2 DESIGN RECOMMENDATIONS

- .1 The light distribution for outdoor fixtures is classified by IESNA TM-15-11, Luminaire Classification System for Outdoor Luminaires (LCS) where the distribution of light is defined within three primary zones: up-light, backlight, and forward light. Each of these zones is further divided into angles and the percentage of lumen output for each zone is given for each angle. The fixture is assigned a Backlight-Up-light-Glare (B-U-G) rating that summarizes the lumen distribution and can be of assistance to the lighting designer. The LCS is summarized in IESNA RP-8-14, section 2.4.
- .2 Luminaires used by the ministry shall be capable of providing B-U-G ratings in any combination of B1/B2/B3-U0-G1/G2/G3.
- .3 The ministry has developed the following general recommendations that shall be applied to all ministry lighting design projects.
  - .1 Light trespass, or obtrusive light, shall be avoided. Designs shall ensure that light is directed to the intended area and not trespass to other areas.
  - .2 Sky glow (up-light) shall be avoided. Unless specified by the ministry Electrical Representative, fixtures shall produce zero up-light, as defined by the B-U-G rating of the LCS.
- .4 In certain circumstances obtrusive light may be an unavoidable requirement of the function and design of the lighting system, such as navigation lighting for watercraft

or aircraft. In these cases, as determined and identified by ministry Electrical and ITS Engineering, lighting systems shall be designed to minimize light pollution as outlined in IESNA RP-33 Lighting for Exterior Environments.

## 306 LIGHTING EQUIPMENT

### 306.1 STANDARD LIGHTING EQUIPMENT

- .1 The ministry uses LED lighting at all new and upgraded lighting installations. The materials specification for LED roadway luminaires can be found in the ministry *Electrical and Signing Material Standards* Section 504, LED Roadway Luminaires.
- .2 Fixtures approved for use on ministry roadways can be found on the ministry *Recognized Products List* under LED Roadway Luminaires – Direct Replacement.
- .3 Policy guidelines for the use of LED roadway lighting on ministry roadways are summarized in Technical Bulletin TE-2015-02 Transition to Roadway Lighting, which can be viewed on the ministry Engineering website at:

[https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-bulletins/traffic-and-electrical/tb-2015/te-2015-02\\_transition\\_to\\_led\\_roadway\\_lighting.pdf](https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-bulletins/traffic-and-electrical/tb-2015/te-2015-02_transition_to_led_roadway_lighting.pdf)

The policy guidelines are summarized as follows:

- .1 New lighting installations should use LED fixtures listed on the *Recognized Products List* under LED Roadway Luminaires - Direct Replacement. However, large new lighting projects that may realize significant design and energy efficiency may use fixtures from the Procurement Services Branch – Corporate Supply Arrangement. This can be viewed at:  
<http://www2.gov.bc.ca/gov/content/governments/services-for-government/bc-bid-resources/support-services/procurement-services>
- .2 Existing HPS fixtures may be replaced with LED fixtures having equal or better lumen output and same distribution type. These are listed on the *Recognized Products List* under LED Roadway Luminaires - Direct Replacement.
- .3 Efforts will be made to avoid mixing LED and HPS light sources in continuous lighting installations.
- .4 At intersections, light sources shall not be mixed.
- .4 Due to the rapid evolution of LED lighting, material suppliers and equipment specifications may change at any time. The designer shall reference the most current version of the ministry's *Recognized Products List* and Procurement Services Corporate Supply Arrangement to ensure that the latest equipment is used for new designs.

#### 306.1.1 LED Roadway Lighting Procurement

- .1 The ministry has entered into a Corporate Supply Arrangement (CSA) with Province of British Columbia Procurement Services. This CSA lists suppliers that are qualified to supply LED roadway lighting fixtures to the ministry and provides



details about specific fixture models, pricing, and warranty. All LED roadway lighting fixtures must be purchased through this CSA from the listed suppliers. For current listing of suppliers and fixture models, see the Procurement Services – Province of British Columbia website and search: “LED Street Light Luminaires”.

- .2 Due to the time and effort required to negotiate the benefits of the CSA (such as extended warranty and volume pricing) access to the CSA is restricted. Only ministry Electrical Maintenance Contractors (EMC’s) or ministry personnel are permitted to purchase LED roadway luminaires through the CSA.
- .3 For further information on LED roadway lighting procurement see Technical Bulletin TE-2017-01 LED Roadway Lighting Fixture Procurement on the ministry Engineering Branch Publications website.

### **306.2 HIGHMAST LIGHTING EQUIPMENT**

- .1 Refer to the ministry *Electrical and Signing Material Standards* manual for highmast lighting equipment specifications. Standard highmast lighting equipment generally consists of the following:
  - .1 Multisided or round galvanized steel poles 30m to 45m in height. The designer may consider custom mounting heights.
  - .2 LED light source.
  - .3 Luminaires mounted on a lowering ring.
  - .4 A power distribution panel is located inside the hand-hole of each pole.

### **306.3 SPECIALTY LIGHTING EQUIPMENT**

- .1 Specialty lighting equipment shall be selected to suit the project requirements. Specialty materials are not covered by the ministry pre-approval process and must be approved for use by ministry Electrical and ITS Engineering on a project-by-project basis. This equipment typically includes, but is not limited to, the following:
  - .1 Highmast luminaires
  - .2 Vehicle tunnel luminaires
  - .3 Floodlights
- .2 If non-standard lighting equipment is specified, it shall be of the highest quality. Non-standard equipment must be readily available and easy to maintain. Similar products must be from a single manufacturer. In order to avoid future maintenance problems, custom products shall be avoided.

## **307 ROADWAY LIGHTING**

### **307.1 CONTINUOUS, FULL AND PARTIAL LIGHTING**

- .1 The ministry's general policy is to minimize lighting while maintaining IESNA recommended levels and uniformity. Prior to beginning a roadway lighting design, the extent of the required lighting must be determined by following the application procedures detailed in Chapter 303 - Lighting Warrants.

### **307.2 CONVENTIONAL DAVIT & HIGHMAST LIGHTING**

#### **307.2.1 Conventional Davit Lighting**

- .1 Roadways are illuminated with LED, zero up-light, cobra head luminaires mounted on davit luminaire poles.

#### **307.2.2 Highmast Lighting**

- .1 Large interchanges requiring full roadway and area lighting may be more effectively illuminated with highmast lighting. Smaller interchanges requiring only partial lighting are generally more economically illuminated with conventional davit lighting. However, highmast lighting may be used for partial lighting installations in certain cases if it is shown to be cost effective. The advantages and disadvantages of highmast lighting over conventional davit lighting are:
  - .1 Advantages:
    - .1 Reduced glare
    - .2 Improved uniformity
    - .3 May be installed at an early stage of construction and be used to provide required detour lighting
    - .4 Greater offset from traffic lanes, improving safety and reducing pole knockdowns
    - .5 Reduced maintenance costs.
  - .2 Disadvantages:
    - .1 Light may trespass on adjacent properties and emit excessive brightness when viewed against a dark sky.
    - .2 May obstruct daytime views of residential areas
    - .3 Require pullouts for maintenance vehicles and room to facilitate lowering and maintenance
  - .3 Highmast luminaire poles shall be located well clear of the roadway to reduce hazards and allow for easy maintenance. Clear zone requirements must be met. When locating highmast poles, ensure they will be easily accessible to maintenance vehicles. Pullouts and working areas for the maintenance vehicles may be required.

- .4 For projects where highmast lighting is being considered, the ministry may require that the designer prepare a cost/benefit analysis of highmast versus conventional davit lighting. The analysis should consider initial capital costs for materials and construction, as well as ongoing operational and maintenance costs over a 25-year period. The cost benefit analysis may include systems that are shared financially and functionally with others such as cellular providers.
- .5 Consideration must always be given to the aesthetic affect that the highmast poles and luminaires have on the night and daytime background scenery. The designer of a highmast lighting system must fully analyze the impact that the poles will have on views from strategic locations. This analysis must be formally documented and presented for review and discussion to the ministry Electrical and ITS Engineering.

### **307.3 ROADWAY LUMINAIRE LAYOUT**

- .1 Cobra head luminaires mounted on davit poles, or luminaire poles, and are generally configured as shown on Figure 1.
- .2 Davit luminaire pole layout shall be applied as follows:
  - .1 One side lighting is generally used on single lane roads.
  - .2 Staggered or opposite lighting is generally used on roads with two or more lanes.
  - .3 Opposite lighting is generally used on very wide roads.
  - .4 Median lighting is generally used on roads that have wide medians or median concrete barrier.
- .3 Designers should consider the possibility of future road widening. If road widening is planned for within a reasonable timeframe, then the lighting design should accommodate the planned roadway geometrics.
- .4 For one-sided designs where a concrete barrier is not used, davit luminaire poles shall be placed on the inside of curves as shown in Figure 2.
- .5 Refer to Figure 15 in Section 308 for typical davit luminaire pole location information around underpasses, overpasses, and tunnel structures. Positioning luminaires in optimum locations is critical in achieving proper lighting under the structures.

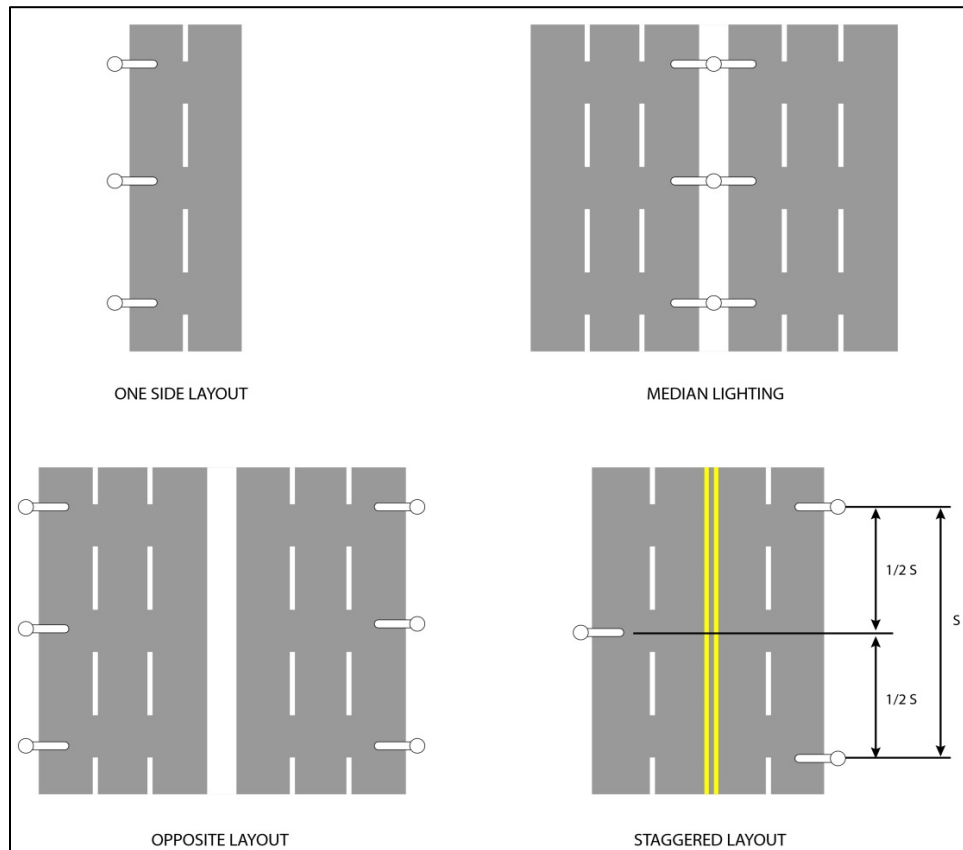


Figure 1. Typical Davit Pole Luminaire Layouts

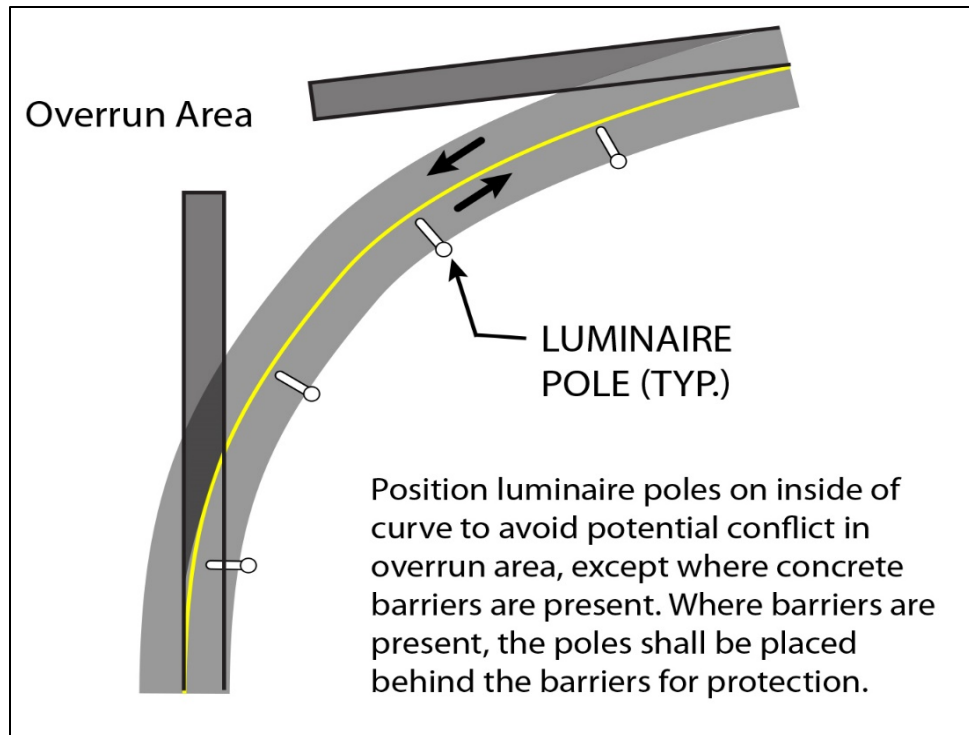


Figure 2. Position of Luminaire Poles on Curved Roads

**307.4 ROADWAY LUMINAIRES AND POLE MOUNTING HEIGHTS**

- .1 Standard davit luminaire pole heights and luminaire specifications can be found in the ministry *Electrical and Signing Material Standards*.
- .2 Designers shall select the most effective luminaire and mounting height combination with consideration given to quality of the lighting design, installation cost, and operating cost. Table 3 below gives typical luminaire and pole height combinations for use on various road types. The designer is not required to restrict the design to these combinations. All possible combinations of luminaire and pole height can be considered. Note: The pole heights listed in Table 4 below include the 2.5m luminaire arm. The actual pole shaft heights without the arm are 6.5m, 8.5m, and 11.0m.

ROAD TYPE	Pole Height	Lumen Output (Typical)
1 to 3 lane roads	9.0 m	10,000 - 12,000
	11.0 m	16,000 - 18,000
4 to 6 lane roads	11.0 m	16,000 - 18,000
	13.5 m	25,000 – 30,000
7 to 8 lane roads	13.5 m	25,000 – 30,000
Freeway and expressway acceleration and deceleration lanes, ramps, and tapers	9.0 m	10,000 - 12,000
	11.0 m	16,000 - 18,000
	13.5 m	25,000 – 30,000

Table 3: Standard Mounting Height and Lumen Output for Various Road Types.

- .3 Prior to selecting the luminaire mounting height, designers shall confirm with the local utility company clearances of any overhead power lines that may be in conflict. Minimum clearances between luminaire poles and power lines shall not be less than as outlined in Figure 3.
  - .1 Where utility poles are being relocated due to road construction, designers shall ensure the minimum clearances outlined in Figure 3 are maintained. This may require that the utility company install taller poles to accommodate the luminaire pole. Designers shall work with the local utility to coordinate any work required to maintain clearances.
  - .2 Where power poles are not being relocated, and overhead lines are in conflict with the proposed luminaire poles, designers shall consider the following options:
    - .1 One-sided lighting with taller poles.
    - .2 Utility company raising the power lines. Obtain a cost estimate from the utility company.

- .3 Custom luminaire arm bracket.
- .4 Short luminaire poles (7.5 m).
- .5 Lease lights on the utility company's poles. Refer to Clause 307.6.4 .
- .3 The best option generally involves using one-sided lighting with taller poles. After reviewing all options, designers shall select the most cost-effective option and then obtain approval from the ministry Electrical Representative.

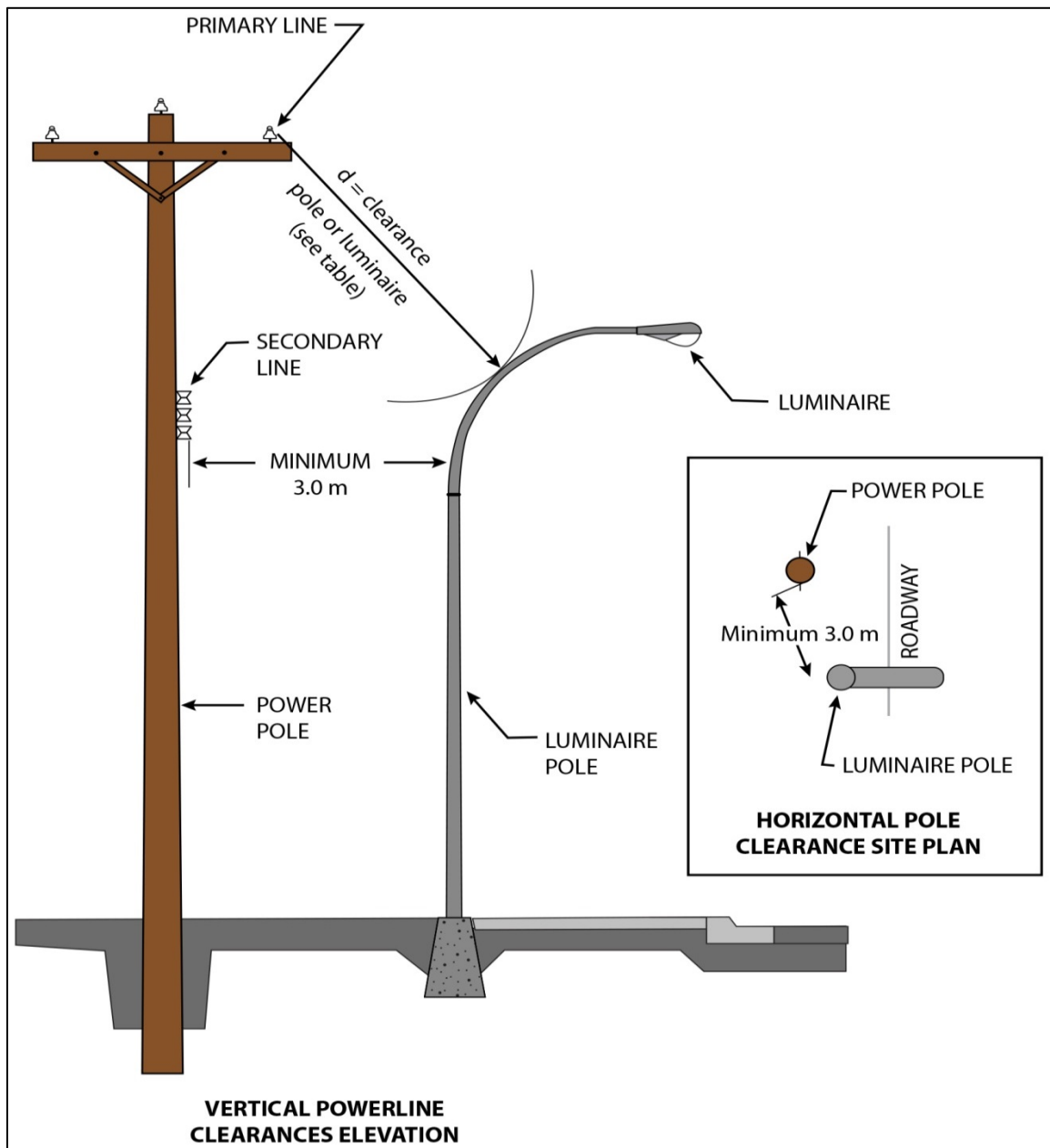


Figure 3: Minimum Clearances Between Power Lines and ministry Luminaire Poles.

**PRIMARY LINE CLEARANCE TABLE**

Voltage Class	d
750V to 75kV*	3.0m
>75kV to 250kV*	4.6m
>250kV to 550kV*	6.1m

\*Maximum power line sag shall be confirmed by the utility.

**307.5 SPECIAL CONSIDERATIONS**

- .1 Many situations arise that require special design consideration. The designer shall refer to IESNA RP-8 for design methods and recommendations for special situations.

**307.6 TYPICAL DESIGN RECOMMENDATIONS****307.6.1 Intersection Lighting**

- .1 Lighting requirements at intersections are determined in Clause 303.3 - Warrants. The warrant analysis will determine one of the following lighting options for the intersection:
  - .1 No lighting.
  - .2 Delineation lighting.
  - .3 Partial lighting.
  - .4 Full lighting.
- .2 Luminaire lumen output and pole mounting heights at intersections shall match those on the approach roads if continuous lighting is required between intersections. For isolated intersections, pole heights and luminaire lumen output shall be consistent with those used on the types of intersecting roads.
- .3 If the intersection is signalized, the luminaires shall be mounted using combination signal/luminaire poles and positioned to provide optimal levels and uniformity. Consideration shall be given to the possible future signalization of intersections with the interim luminaire poles placed where signal poles would normally be located.
- .4 Suggested luminaire pole layouts for typical intersection configurations are shown in Figures 4 to Figure 13 below. The designer shall determine pole heights and luminaire lumen output to suit the size and configuration of the intersection and the lighting design criteria.
- .5 Pole locations shown on illustrations are approximate and intended to be used as a general guideline.



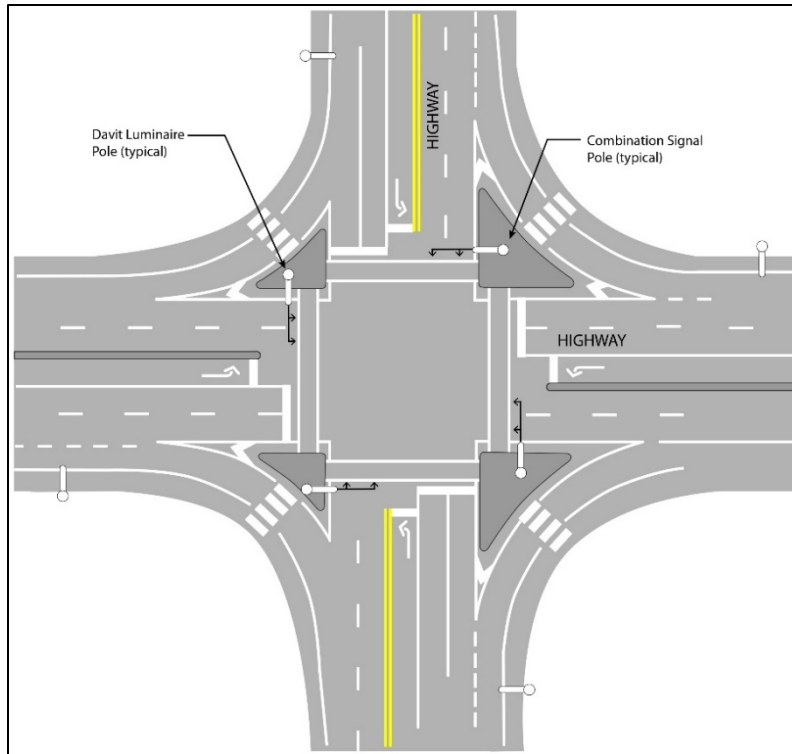


Figure 4. Typical Major Intersection of Two Highways - Full Lighting

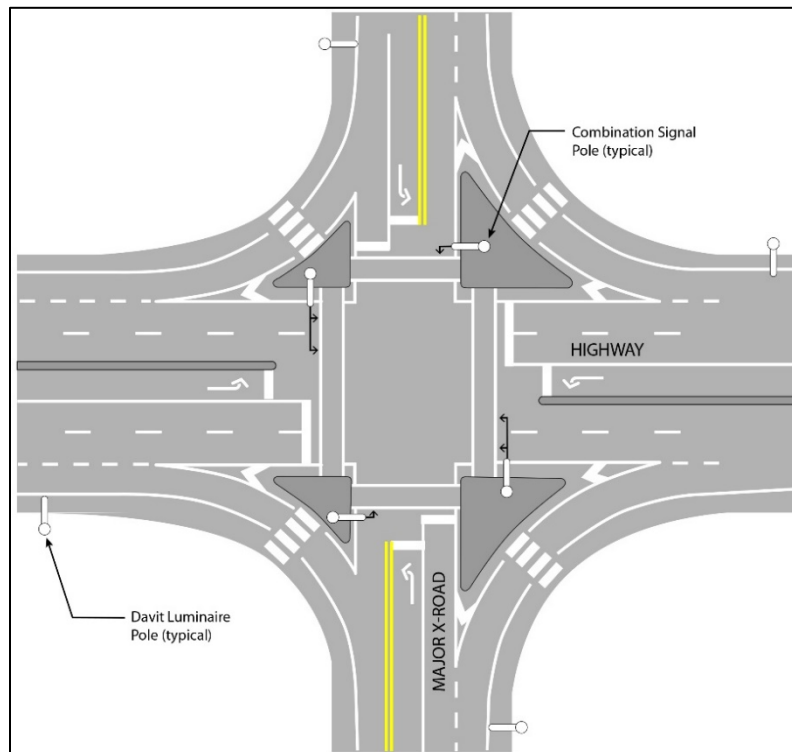


Figure 5. Typical Major Intersection Major X Road - Full Lighting.

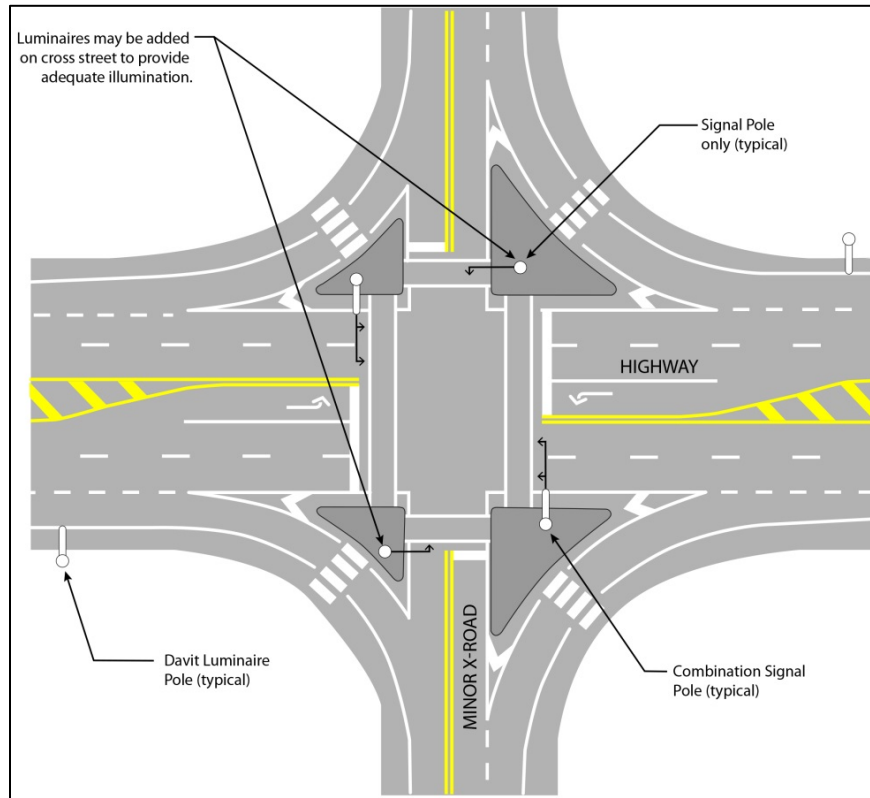


Figure 6. Typical Major Intersection with Minor X-Road – Full Lighting

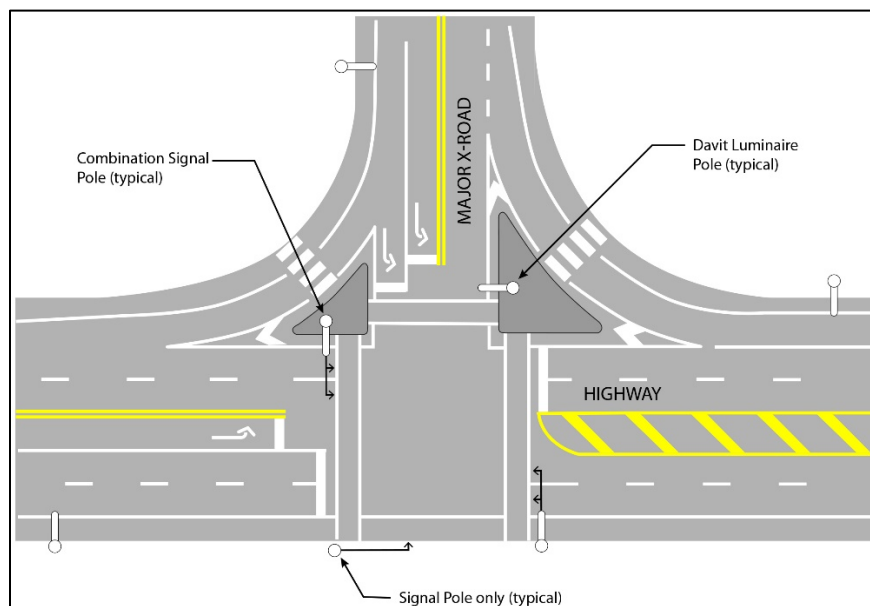


Figure 7. Typical Major 'T' Intersection with Major X-Road - Full Lighting

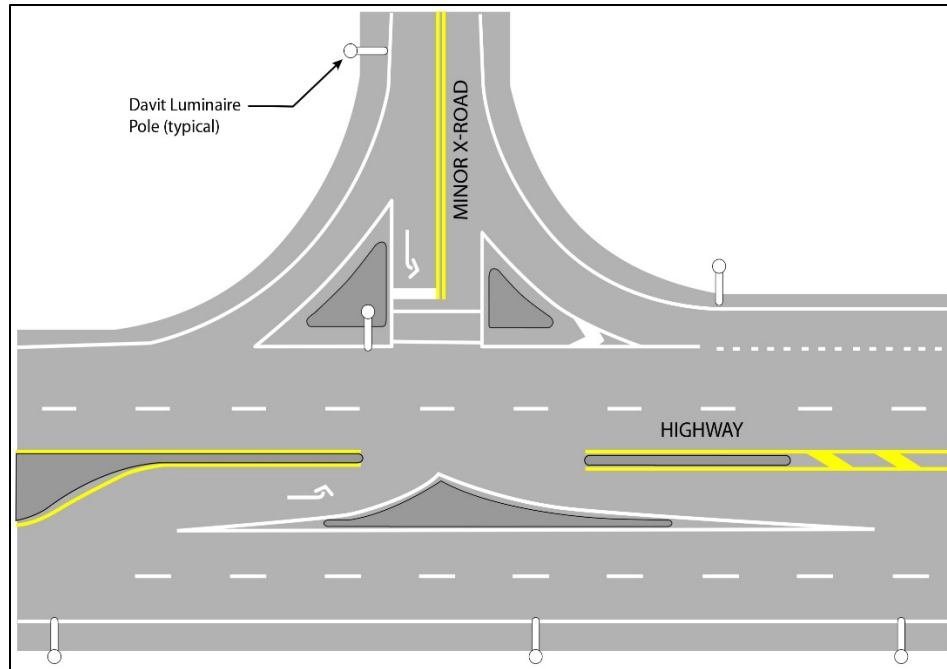


Figure 8. Typical Major 'T' Intersection with Minor X-Road - Full Lighting

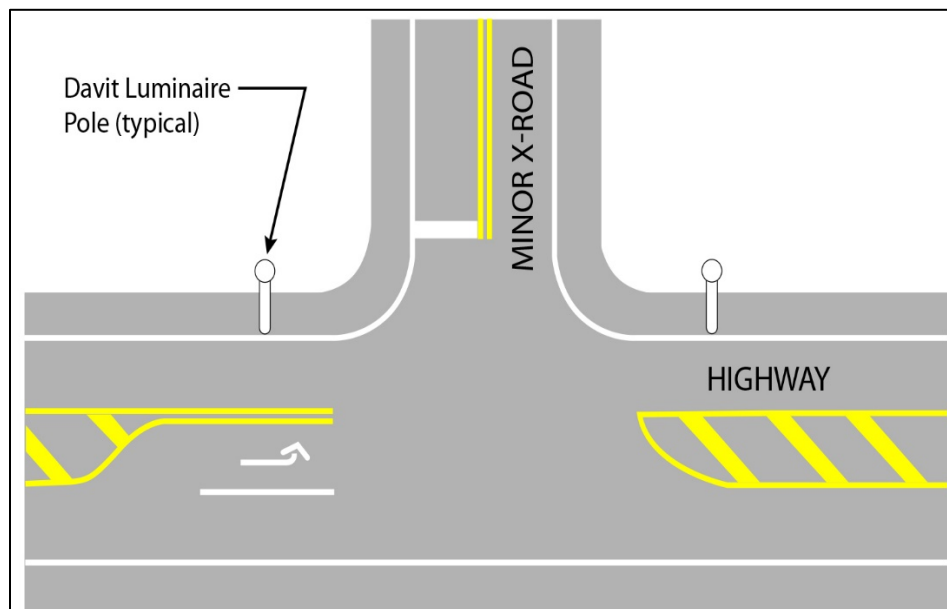


Figure 9. Typical Major 'T' Intersection with Minor X-Road - Partial Lighting

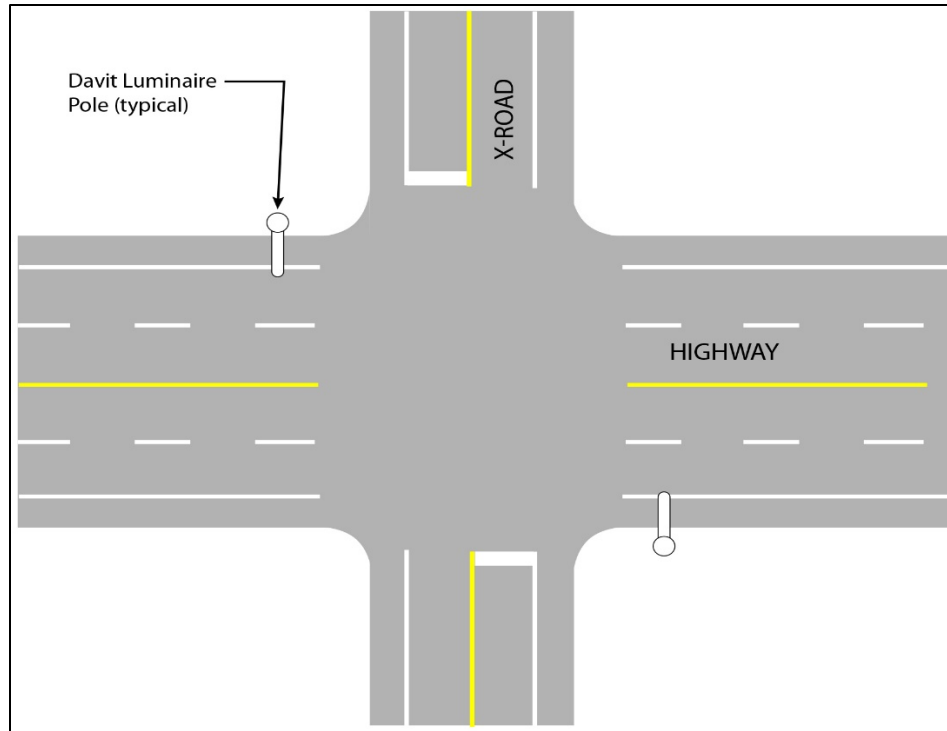


Figure 10. Typical Minor Intersection with Large Area - Partial Lighting.

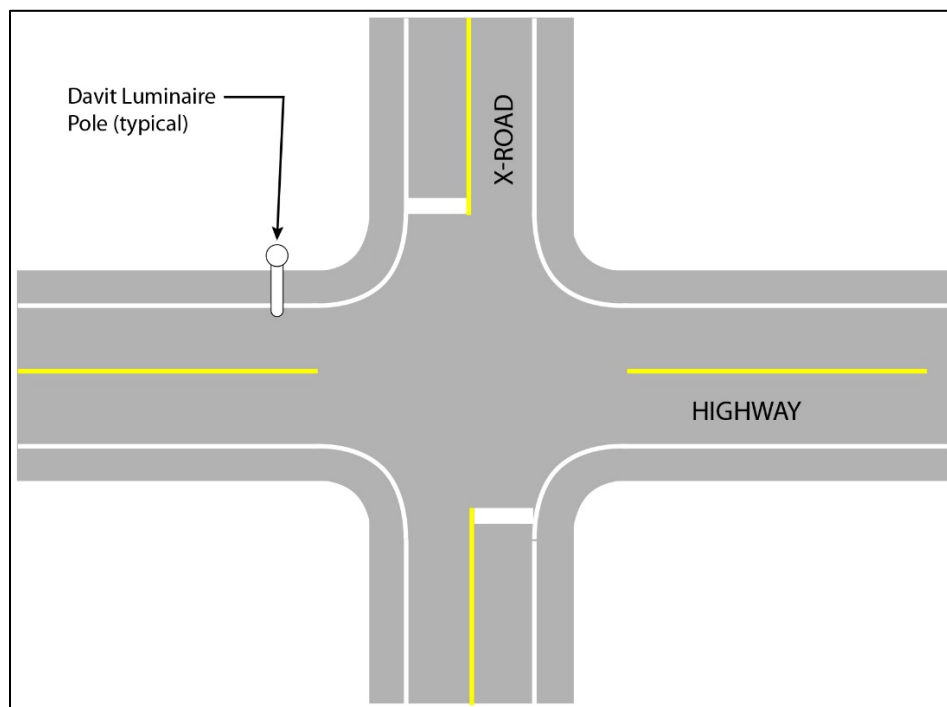


Figure 11. Typical Minor Intersection with Small Area - Partial Lighting.

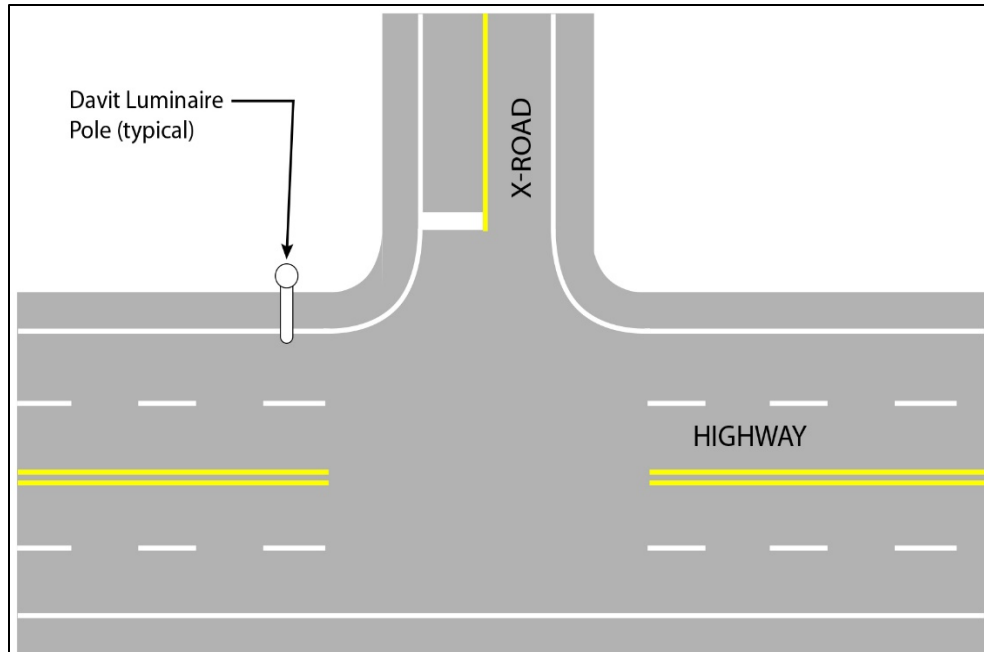


Figure 12. Partial Lighting for Typical Minor "T" Intersection.

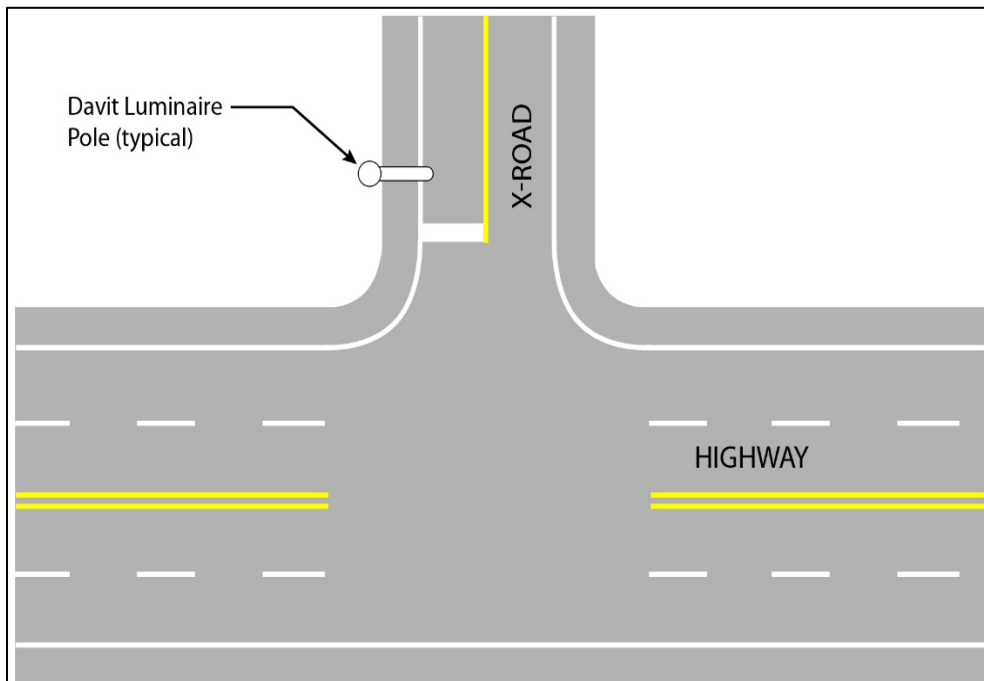


Figure 13. Delineation Lighting for Minor "T" Intersection.

**307.6.2 Continuous Lighting Between Intersections**

- .1 Where continuous lighting is required between intersections, the luminaire poles shall use one-sided, staggered, opposite, or median spacing as illustrated in Figure 1.
- .2 The pole locations at intersections shall have priority. The pole spacing between intersections shall be designed to accommodate the locations of poles at intersections.
- .3 When spacing luminaires between intersections, designers shall measure the distance from the near side of each intersection, then determine the optimum spacing that will be required to achieve the proper lighting levels and consistent pole spacing.
- .4 In cases where the pole spacing changes due to a change in required lighting levels, the spacing shall change in a smooth transition over several pole cycles. For example if, due to the narrowing of the roadway, the spacing distance must change from 40m to 60m, it is recommended to change in increments of 5m.
- .5 Optimal pole spacing, as determined by lighting calculations, may not result in consistent pole spacing between intersections. The designer shall use good engineering judgment to either decrease or increase the distance between poles so that consistent pole spacing is achieved.

**307.6.3 Interchange Lighting**

- .1 Interchanges are generally made up of on/off ramps, acceleration and deceleration lanes, the main highway (typically a freeway or expressway), and a crossroad. Interchanges can come in several shapes and configurations from diamond interchanges to full cloverleaf interchanges. Connections between two freeways or expressways are often served by large high-speed complex interchanges with multiple levels, ramps, overpasses, and flyovers.

**307.6.4 Power Utility Leased Lighting**

- .1 Although the ministry generally prefers that new lighting systems are designed and constructed using ministry owned and operated infrastructure, special situations may arise where the use of power utility company leased lighting systems are appropriate due to financial considerations or restrictions that impose limitations on construction.
- .2 Power utility company leased lighting consists of cobra head luminaires and mast arm brackets mounted on utility poles. These luminaires and brackets are generally supplied, installed, owned, operated, and maintained by the local power utility and are “leased” or rented to the ministry for an annual fee.
- .3 Power utility leased lighting may be used on projects, for either ministry warranted or unwarranted lighting, if approved for use by the ministry Electrical and ITS Engineering. Leased lights are typically used where no other practical option exists.

Due to the lack of control the ministry has over leased lighting, they are normally not considered to be part of ministry lighting designs.

## 308 TUNNEL AND UNDER/OVERPASS LIGHTING

### 308.1 WALKWAY AND BIKEWAY TUNNEL LIGHTING

#### 308.1.1 Lighting Requirements

- .1 Refer to Chapter 303 - Lighting Warrants for walkway and bikeway tunnel lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for walkway and bikeway tunnel lighting design criteria.

#### 308.1.2 Lighting Materials

- .1 Lighting fixtures suitable for use in pedestrian and bicycle tunnels are listed on the ministry *Recognized Products List*.

[https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/recognized-products-list/recognized\\_products\\_list.pdf](https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/recognized-products-list/recognized_products_list.pdf)

#### 308.1.3 Lighting Layout

- .1 Pedestrian and cycling tunnels shall be illuminated to the levels and uniformity recommended in IESNA RP-8. The designer must calculate for both the recommended daytime and nighttime levels to maintain ambient levels during daytime and adequate levels during nighttime.
- .2 Pedestrian and bicycle tunnels require external lighting at the entrances and exits of the structures. Refer to Section 311 for details on walkway lighting. For tunnels that are in areas of non-continuous lighting, a fixture will be required at a strategic location near each end of the tunnel. For tunnels that are in the vicinity of roadway lighting, adequate lighting at the tunnel entrances may be possible with strategic placement of the roadway luminaires.



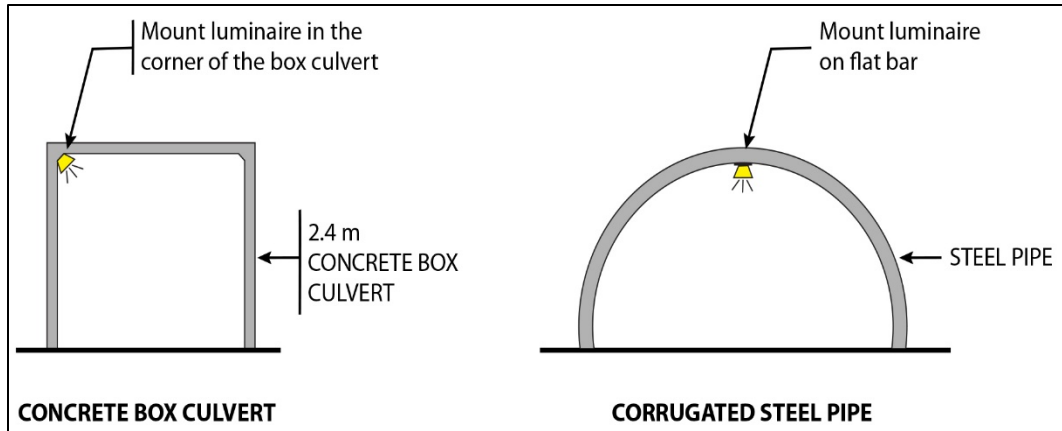


Figure 14. Typical Pedestrian and Bicycle Tunnel Lighting.

## 308.2 VEHICLE TUNNEL LIGHTING

### 308.2.1 Lighting Requirements

- .1 For the definition of a tunnel refer to IESNA RP-22. Tunnel lighting for vehicles differs from standard roadway lighting. There are special considerations such as matching the ambient light and providing a luminous intensity gradient near the portals. Every tunnel is unique and will require a lighting design best suited for the particular tunnel. Prior to commencing the design of a tunnel lighting system, designers shall review the project with the ministry Electrical and ITS Engineering.
- .2 Refer to Chapter 303 – Lighting Warrants for vehicle tunnel lighting warrants.
- .3 All tunnel lighting systems shall be designed to meet the lighting design requirements of IESNA RP-22 Tunnel Lighting.

### 308.2.2 Lighting Materials

- .1 Tunnel lighting fixtures are not listed on the ministry *Recognized Products List*. Each tunnel is unique and requires a specific design to meet the criteria based on IESNA RP-22. Vehicle tunnel luminaries must be able to withstand the harsh environment and be specifically designed for use in tunnels. Prior to selecting any tunnel luminaire review requirements listed in IESNA RP-22 and consult with ministry Electrical and ITS Engineering.

### 308.2.3 Lighting Design

- .1 The lighting design and calculations shall be undertaken by using the methods outlined in IESNA RP-22. The lighting design criteria will vary depending on the

size, length, orientation and geographical area of the tunnel. In consultation with the ministry Electrical and ITS Engineering the designer shall determine the lighting design criteria and select the most appropriate method for lighting the tunnel.

- .2 Lighting system economic analyses shall be considered in all designs and a 25-year life cycle cost analysis shall be undertaken for all proposed and competing design methods as outlined in IESNA RP-22.
- .3 For new tunnel projects, tunnel lighting design principles shall be presented and discussed with the structural and architectural designers of the tunnel. Architectural features of tunnel approaches and portals, and highly reflective tunnel wall and ceiling materials, can greatly affect the amount of lighting required in a tunnel, and therefore the capital and ongoing operational costs. Recommendations for these considerations are outlined in IESNA RP-22.
- .4 Energy efficiency is a key consideration in a tunnel lighting design. In order to reduce energy consumption multi-level lighting controls are required for all tunnel projects. Major tunnels should have at least three daytime lighting levels and a separate nighttime lighting level.
- .5 The preferred method for controlling lighting levels within the tunnel should be by using a luminance meter to measure ambient light levels at the tunnel portals.
- .6 Roadway lighting is required at the external approaches to all tunnels that warrant nighttime lighting. The lighting design criteria for these areas are outlined in IESNA RP-22.
- .7 The lighting design must be accepted by ministry Electrical and ITS Engineering.

### **308.3 UNDERPASS / OVERPASS LIGHTING**

#### **308.3.1 Lighting Requirements**

- .1 When a highway passes under a crossroad it is called an underpass; when a highway passes over a crossroad it is called an overpass. All references to underpass and overpass lighting refer to the lighting beneath the upper structure, which could be illuminating either the highway or the crossroad.
- .2 Refer to Chapter 303 – Lighting Warrants for underpass and overpass lighting warrants.
- .3 Refer to Chapter 304 - Lighting Design for underpass and overpass lighting design criteria.

#### **308.3.2 Lighting Materials**

- .1 Underpasses and overpasses are generally illuminated with ministry pre-approved LED wall mount luminaires as listed on the ministry *Recognized Products List*.

**308.3.3 Lighting Layout**

- .1 Where possible underpass and overpass lighting shall be provided by the strategic placement of luminaires on either side of the roadway approaching the structure. Sufficient lighting may be provided by the overlap of the luminaire beam spread providing that shadowing does not occur from either the poles being too high, or the structure being too low.
- .2 Luminaire poles along the road beneath the structure should be located a minimum of one pole height away from the structure to provide good lighting distribution under the structure while, at the same time, limiting obtrusive glare on the roadway along the top of the structure.
- .3 If the roadway luminaires located adjacent to the structure do not provide proper lighting on the roadway below the structure, wall mount luminaires may be required, located as shown on Figure 15, below.

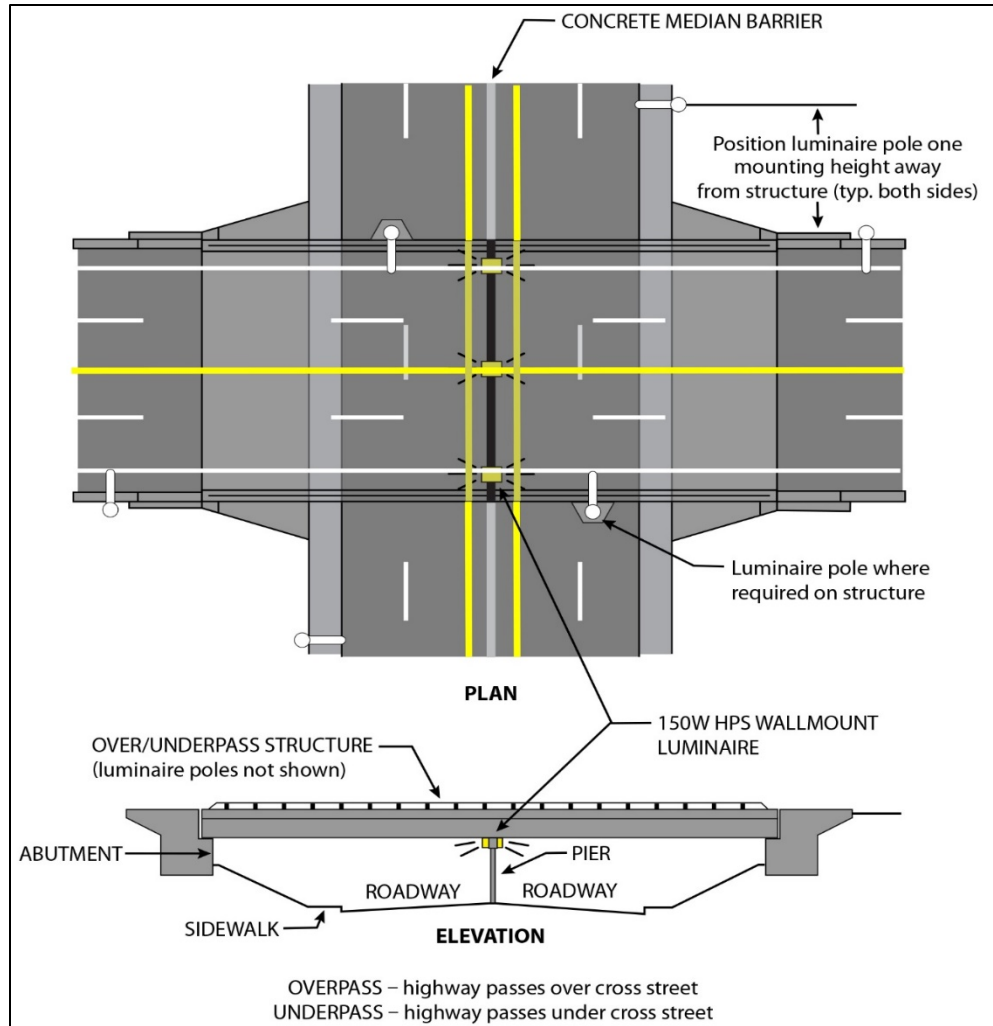


Figure 15. Typical Underpass/Overpass Lighting.

## **309 BRIDGE LIGHTING**

### **309.1 ROADWAY LIGHTING ON BRIDGES**

#### **309.1.1 Lighting Requirements**

- .1 Major bridges generally have unique lighting design requirements and will often have requirements specific to each particular bridge. Prior to designing a major bridge lighting system, designers shall review the project with ministry Electrical and ITS Engineering.
- .2 Minor bridge projects, including the roadways along the tops of under/overpasses, are generally treated the same as the roadway, and require no special consideration for lighting.
- .3 Refer to Chapter 303 - Lighting Warrants for bridge roadway lighting warrants.
- .4 The design requirements for lighting along bridge roadways follow the same requirements as roadway lighting. Refer to Chapter 304 –Lighting Design for roadway lighting design criteria.
- .5 If lighting is not warranted along a bridge but may be in the future, it is recommended that the conduit and pole bases be considered on the bridge structure to accommodate future lighting. Designers shall discuss the requirement for installing pole bases and conduit on the bridge with the ministry Electrical and ITS Engineering.

#### **309.1.2 Lighting Materials**

- .1 For most projects standard ministry roadway lighting materials and equipment shall be used for bridge roadway lighting. Approved materials are listed on the ministry *Recognized Products List*.
- .2 In all cases the designer shall ensure pole hand-holes are easily accessible. Special modified pole designs may be required with hand-holes located in maintainable locations.

#### **309.1.3 Lighting Layout**

- .1 If roadway lighting is required on a bridge structure, the designer shall:
  - .1 Locate the luminaire poles off the side of the bridge structure, parapet, or deck.
  - .2 Orient pole hand holes to allow easy maintenance access from the bridge deck.
  - .3 Where feasible, avoid the use of junction boxes in bridges by making wiring connections in the pole hand holes, except on bridges with parapets.
- .2 Typical luminaire pole mounting details on bridge structures are shown in Figure 16.

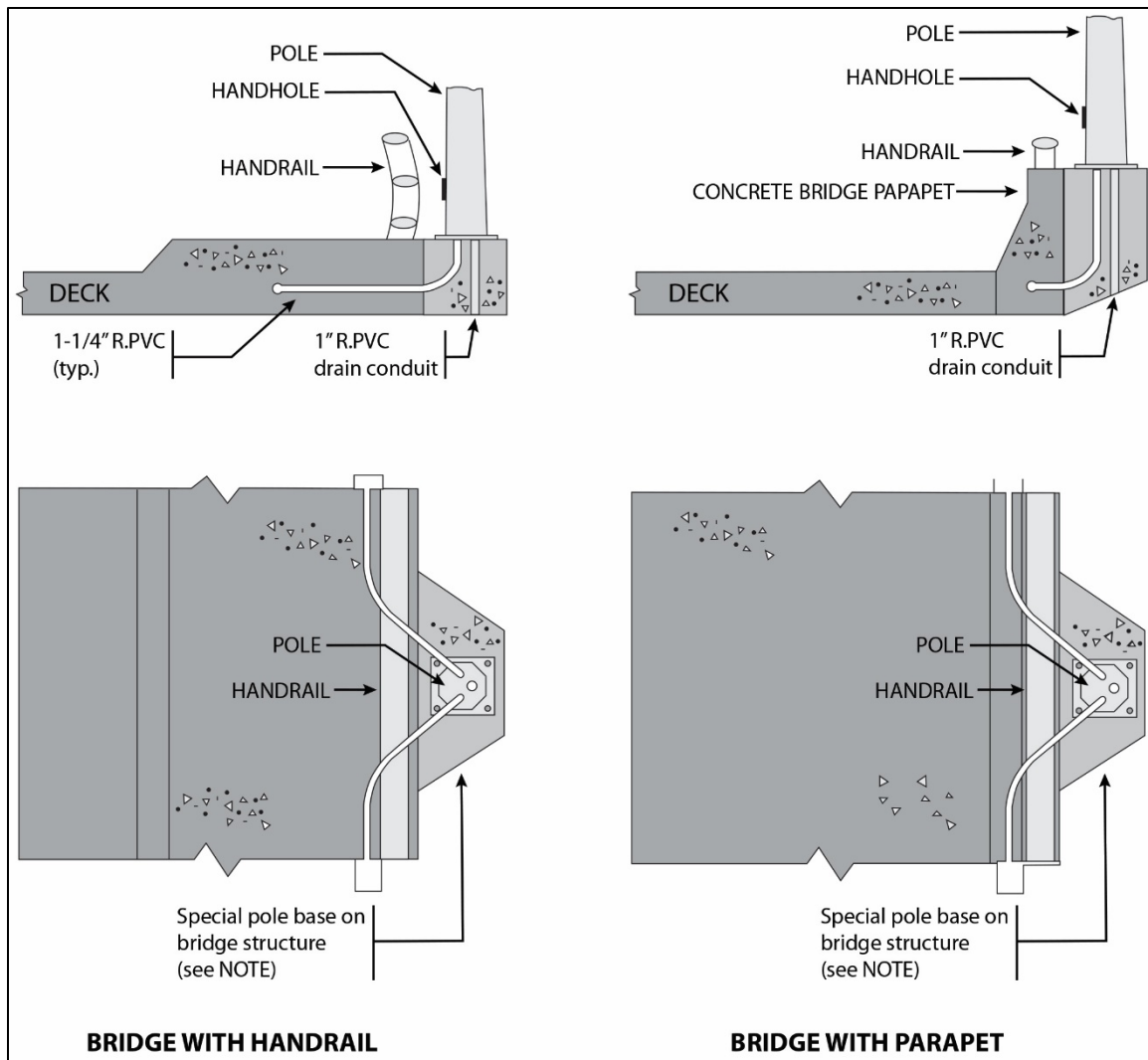


Figure 16. Typical Luminaire Pole Mounting on Bridge Structures.

### 309.2 MARINE NAVIGATIONAL LIGHTS ON BRIDGES

- .1 The designer shall confirm the need and requirements for marine navigation lighting on bridges over navigable waterways with the ministry Rail, Navigable Waters Coordinator.
- .2 If navigation lighting is required, the navigation lights shall be:
  - .1 Located on each side of the bridge.
  - .2 Positioned over the center of the navigable channel.
  - .3 Illuminated 24 hours a day.
- .3 Navigation lights approved for use are listed on the ministry *Recognized Products List* under Electrical Equipment, Marine Lighting.

- .4 Where possible and for ease of maintenance, the designer shall install the navigation lights on a special swing hanger and locate them near the bridge deck level.

### **309.3 AIRCRAFT OBSTRUCTION LIGHTS ON BRIDGES**

- .1 Designers shall confirm the need and requirements for aircraft obstruction lights on bridge towers with the ministry Rail, Navigable Waters Coordinator, Bridge Engineering, Victoria.
- .2 Aircraft obstruction lights shall be specified to suit the latest requirements of Transport Canada as defined in the latest edition of TC 312E Aerodrome Standards and Recommended Practices.

### **309.4 LIGHTING BRIDGE PIERS**

- .1 The preferred method of illuminating a bridge pier is by floodlighting. However, floodlighting may not be practical for some bridge structure designs or for small bridges. If floodlighting is not practical hazard marker lighting may be required at the base of the pier.
- .2 Floodlights approved for use are listed on the ministry *Recognized Products List* under Electrical Equipment, Marine Lighting.
- .3 Hazard marker lights approved for use are listed on the ministry *Recognized Products List* under Electrical Equipment, Marine Lighting.
- .4 Where possible and for ease of maintenance, the designer shall install the floodlights on a special swing hanger and locate them near the deck level.
- .5 Hazard marker lights shall be located near the base of the pier to provide proper illumination of the structure.
- .6 Floodlights or hazard marker lights shall be controlled by a photocell for nighttime only operation.
- .7 Floodlights shall be shielded to reduce light trespass, including the reduction of disability glare in the direction of traveling watercraft.

## **310 PEDESTRIAN WALKWAY AND BIKEWAY LIGHTING**

### **310.1 LIGHTING FOR WALKWAYS AND BIKEWAYS**

#### **310.1.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for pedestrian walkway and bikeway lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for pedestrian walkway and bikeway lighting design criteria.

#### **310.1.2 Lighting Materials**

- .1 Walkways and bikeways requiring a separate lighting system and are generally illuminated with ministry standard LED cobra head luminaires mounted on Type 2 - 6.5 m shafts. Post top luminaires with a zero up-light rating may be considered where circumstances dictate.
- .2 Luminaires and poles shall be listed on the ministry *Recognized Products List*.

#### **310.1.3 Lighting Layout**

- .1 If a walkway or bikeway runs adjacent to a roadway lighting system, designers shall determine whether the roadway lighting system provides adequate lighting on the walkway.



## 311 MISCELLANEOUS LIGHTING APPLICATIONS

### 311.1 REST AREA LIGHTING

#### 311.1.1 Lighting Requirements

- .1 Refer to Chapter 303 - Lighting Warrants for rest area lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for rest area lighting design criteria.
- .3 Lighting for on and off ramps to a freeway or expressway facility shall meet the requirements of freeway interchange ramps.

#### 311.1.2 Lighting Materials

- .1 Lighting materials shall be selected on the ministry's *Recognized Products List*.

#### 311.1.3 Lighting Layout

- .1 The ministry lights rest areas to increase public safety and security as well as to permit the facility to be used at night.
- .2 Lighting levels for certain facilities may require adjustment based on site conditions as determined by the ministry Electrical Representative. The ministry may request designers to reduce lighting levels in areas where the adjacent highway has a low level of lighting.
- .3 Information kiosk and restroom lighting systems may be powered from ministry of Transportation electrical services. Designers shall make allowances for load and circuit requirements for restroom and information kiosk lighting. Confirm the load and circuit requirements with the ministry Electrical Representative.
- .4 Figure 17 is an example of rest area lighting. Illuminated areas highlighted in pink.

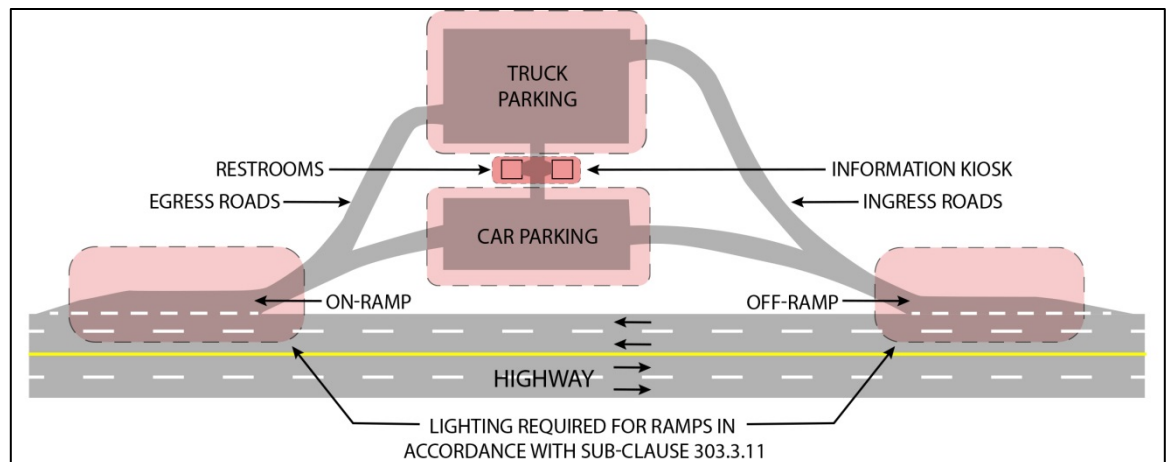


Figure 17. Example of Rest Area Lighting

## **311.2 WEIGH SCALE LIGHTING**

### **311.2.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for weigh scale lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for weigh scale lighting design criteria.
- .3 Lighting for on and off ramps to a freeway or expressway facility shall meet the requirements of freeway interchange ramps.

### **311.2.2 Lighting Materials**

- .1 Lighting materials must be selected from the ministry *Recognized Products List*.
- .2 Highmast lighting may be used for large weigh scale facilities. Highmast lighting must be approved by the ministry Electrical and ITS Engineering.
- .3 All new roadway and area lighting shall be LED.

### **311.2.3 Lighting Layout**

- .1 Weigh scale lighting serves several purposes, including increasing worker safety, and providing operators sufficient illumination to perform truck inspections. Although the IESNA has no specific documents relating to weigh scales, recommendations for lighting designs and layouts in weigh scales can be abstracted from IESNA RP-20 Lighting for Parking Facilities.
- .2 Lighting designs should take into consideration the requirements specific to each location.
- .3 Weigh scale building lighting and controls generally operated by the building maintenance contractor and are not part of the weigh scale lighting system.
- .4 Weigh scale Open/Closed and Truck Weight signs use LED character displays that do not require external lighting. If any other type of sign is to be considered it must be approved by ministry Electrical and ITS Engineering..
- .5 Full lighting is only required when the weigh scale is operational at night. Controls shall be used to downgrade the lighting to security levels when the facility is non-operational.
- .6 Figure 18 below illustrates an example of a typical weigh scale facility. Illuminated areas highlighted in pink.

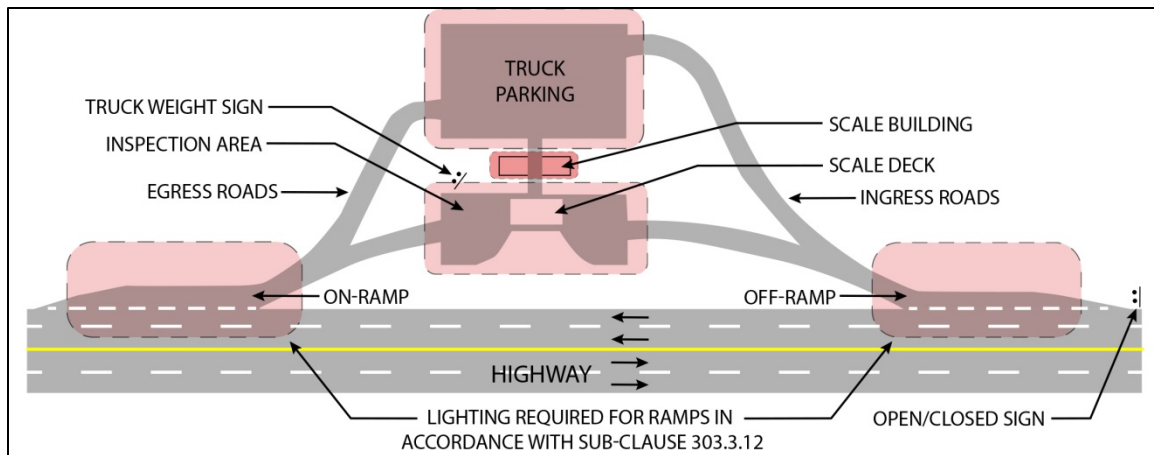


Figure 18. Example of Weigh Scale Lighting

### 311.3 BRAKE CHECK AND CHAIN-UP AREA LIGHTING

#### 311.3.1 Lighting Requirements

- .1 Refer to Chapter 303 - Lighting Warrants for brake check area and chain-up pullout lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for brake check area and chain-up pullout lighting design criteria.
- .3 Lighting for on and off ramps to a freeway or expressway facility shall meet the requirements of freeway interchange ramps.

#### 311.3.2 Lighting Materials

- .1 Lighting materials must be listed on the ministry's *Recognized Products List*.

#### 311.3.3 Lighting Layout

- .1 The ministry illuminates brake check areas and chain-up pullouts to increase safety and security as well as to permit the facility to be used at night.
- .2 Lighting is provided at brake check areas and chain-up pullouts for motorist and pedestrian safety. This lighting is not intended to be task lighting for brake inspections.
- .3 Lighting designs should take into consideration the requirements specific to each location.

## **311.4 FERRY TERMINAL LIGHTING**

### **311.4.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for ferry terminal lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for ferry terminal lighting design criteria.
- .3 Lighting for ferry terminal approach roads shall meet the requirements of continuous roadway lighting or intersection lighting.

### **311.4.2 Lighting Materials**

- .1 Lighting materials must be listed on the ministry *Recognized Products List*.
- .2 Highmast lighting may be used for large ferry terminals. Highmast lighting must be approved by ministry Electrical and ITS Engineering.
- .3 All new roadway and area lighting shall be LED.

### **311.4.3 Lighting Layout**

- .1 Road and Area Lighting
  - .1 The ministry illuminates ferry terminals to increase safety for motorists and ferry terminal workers performing traffic control. Although the IESNA has no specific documents relating to ferry terminals, recommendations for lighting designs and layouts in ferry terminals can be abstracted from IESNA RP-20, Lighting for Parking Facilities.
  - .2 Lighting levels for certain facilities may require adjustment based on site conditions as determined by ministry Electrical and ITS Engineering.
  - .3 Lighting for British Columbia Ferry Corporation (BCFC) terminals is maintained and operated BCFC. Lighting for inland ferry terminals is maintained by the ministry Electrical Maintenance Contractor.
  - .4 Lighting may be required for ferry terminal guide signs if requested by Senior Traffic Operations Engineer.
  - .5 Full lighting is only required for the time of night that the ferry terminal is operational. Automatic controls shall be used to lower the lighting to security levels when the facility is non-operational.
- .2 Marine Navigation Lights
  - .1 Designers shall confirm the need and requirements for marine navigation lighting at ferry terminals with the ministry Rail, Navigable Waters Coordinator, Engineering Branch, Victoria.
  - .2 If navigation lighting is required, the navigation lights shall be:
    - .1 Listed on the ministry *Recognized Products List*.

- .2 Located on each side of the bridge.
- .3 Positioned over the centre of the navigable channel
- .4 On 24 hours a day.
- .3 Navigation lights approved for use are listed on the ministry *Recognized Products List* under Electrical Equipment, Marine Lighting.

.3 Pier Floodlighting

- .1 The preferred method of indicating the marine hazard at a ferry terminal is by floodlighting. However, floodlighting may not be practical for some terminal structures. If floodlighting is not practical hazard marker lighting may be required at the base of the pier.
- .2 Floodlights approved for use are listed on the ministry *Recognized Products List* under Electrical Equipment, Marine Lighting.
- .3 Hazard marker lights approved for use are listed on the ministry *Recognized Products List* under Electrical Equipment, Marine Lighting.
- .4 Hazard marker lights shall be located near the base of the pier to provide proper warning of the structure.
- .5 Floodlights or hazard markers shall be controlled by a photocell for nighttime only operation.
- .6 Floodlights shall be shielded to minimize light trespass, including the reduction of disability glare in the direction of traveling watercraft.

### **311.5 TOLL GANTRY LIGHTING**

#### **311.5.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for toll gantry lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for toll gantry lighting design criteria.
- .3 Lighting for toll gantry approach roads shall meet the requirements of continuous roadway lighting or intersection lighting.

#### **311.5.2 Lighting Materials**

- .1 Toll gantries shall be illuminated using ministry standard LED roadway luminaires.
- .2 Luminaires and poles shall be listed on the ministry *Recognized Products List*.
- .3 All roadway and area lighting shall be LED.

#### **311.5.3 Lighting Layout**

- .1 The ministry lights toll gantries to support tolling equipment operations.

- .2 Lighting levels for certain facilities may require adjustment based on site conditions as determined by ministry Electrical and ITS Engineering.

## **311.6 VIDEO CAMERA LIGHTING**

### **311.6.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for video camera lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for video camera lighting design criteria.

### **311.6.2 Lighting Materials**

- .1 Lighting materials for video shall be consistent with roadway lighting in the area.
- .2 Lighting materials shall be listed on the ministry *Recognized Products List*.

### **311.6.3 Lighting Design**

- .1 Where video systems are installed along a roadway with continuous lighting the roadway lighting is normally sufficient; however, this must be confirmed with the video system designer.
- .2 The designer shall consult with ministry Electrical and ITS Engineering to determine which method, Illuminance or Luminance, is appropriate for the lighting design.
- .3 Uniformity is particularly important for video system lighting as modern digital cameras are sensitive to varying light levels.
- .4 For video systems operation in rural areas, illumination must be provided for the full field of view and may require several luminaires (or infra-red illuminators) if pan-tilt-zoom is used.

## **311.7 PARKING FACILITY LIGHTING**

### **311.7.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for parking facility lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for parking facility lighting design criteria.
- .3 Lighting for on and off ramps to a freeway or expressway facility shall meet the requirements of freeway interchange ramps.

### **311.7.2 Lighting Materials**

- .1 Parking facilities shall be illuminated using ministry standard LED cobra head luminaires.

- .2 Lighting materials shall be listed on the ministry *Recognized Products List*.

### **311.7.3 Lighting Layout**

- .1 The ministry illuminates parking facilities to allow the facility to be used at night, provide security, and increase public safety. Recommendations for lighting designs and layouts in parking facilities are outlined in IESNA RP-20, *Lighting for Parking Facilities*.
- .2 Lighting levels for certain facilities may require adjustment based on site conditions as determined by ministry Electrical and ITS Engineering.
- .3 Full lighting is only required during the time of night that the parking facility is operational. Controls shall be used to lower lighting to security levels when the facility is not operating.

## **311.8 CONSTRUCTION DETOUR LIGHTING**

### **311.8.1 Lighting Requirements**

- .1 Refer to Chapter 303 - Lighting Warrants for construction detour lighting warrants.
- .2 Refer to Chapter 304 - Lighting Design for construction detour lighting design criteria.

### **311.8.2 Lighting Materials**

- .1 Where possible, construction detour lighting shall be provided by the permanent lighting installed by the project. This can be achieved by installing electrical systems at the early stages of a project.
- .2 Where construction detour lighting cannot be provided by the permanent lighting installation, or must be supplemented by additional lighting, standard ministry style lighting can be used, and then subsequently be re-used as part of the permanent installation elsewhere in the project.
- .3 If it is impractical to use ministry style lighting equipment for the temporary construction detour, a temporary wood pole system with overhead wiring is permissible. All luminaires must be listed on the ministry *Recognized Products List*.
- .4 Floodlights are not permitted for temporary detour lighting unless approved by the ministry Electrical Representative and appropriate consideration has been given to limit glare, trespass, and light pollution.

### **311.8.3 Lighting Layout**

- .1 Temporary lighting systems for construction detours must meet all roadway lighting design requirements, including the secondary criteria such as uniformity and glare.

- .2 Temporary lighting systems must take into consideration light trespass and the concerns of local residents as outlined in Chapter 305.