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301 INTRODUCTION TO LIGHTING DESIGN

301.1 ABOUT SECTION 300

.1 Section 300 provides the guidelines for the design of lighting installations within the British Columbia highway system. These lighting installations can include not only roadways, but off roadway facilities such as parking lots, rest areas, and pedestrian facilities. The Ministry has standardized design criteria, lighting equipment, and construction methods for most of the installations throughout the province.

.2 Section 300 outlines the engineering standard practice that is to be employed for designing lighting systems for highways and roadways that are under the jurisdiction of the BC Ministry of Transportation. Section 300 also provides basic details of the standard lighting equipment and materials used by the Ministry. Specific and advanced details of the lighting equipment can be found in the Ministry’s Electrical and Signing Material Standards. Construction methods and details for lighting systems can be found in Section 635 of the Ministry’s Standard Specifications for Highway Construction, which are updated and issued yearly.

.3 This manual presents recommended standard practices and design guidelines for roadway and related lighting systems. At all times good engineering practices and sound engineering judgment shall be used in determining the required solutions for the lighting designs. The Ministry Electrical Engineering Centre, providing they are supported by proper engineering principles and sound engineering judgment, will consider variations to these recommended practices.

301.2 PURPOSE FOR ROADWAY LIGHTING

.1 The primary purpose of roadway lighting is to produce accurate and comfortable vision along roadways at night, and through tunnels. However, roadway lighting serves different functions depending on the roadway type and area that is being lighted. For example, lighting on a freeway or major highway is primarily for traffic flow and driver while lighting in a downtown or commercial area serves both vehicular traffic and pedestrians. For the general highway system, roadway lighting provides three specific functions:

.1 Vehicular Traffic: Lighting of the roadway provides visual guidance for the vehicular traffic thereby reducing nighttime
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collisions (and daytime collisions in tunnels) and their associated human and economic costs.

.2 Personal Safety: Lighting reduces pedestrian/vehicle collisions. It also provides an aid to police and enhances the sense of personal security.

.3 Commercial Promotion: Lighting in a commercial area promotes business activities and the use of public facilities during nighttime hours.

.2 The Ministry is primarily responsible for lighting that pertains to vehicular and pedestrian safety and, as such, limits their responsibility to lighting that is necessary for these safety related purposes. In general, lighting that pertains to commercial promotion of a downtown or commercial area is the responsibly of the local municipal jurisdiction.

301.3 ENGINEERING AND REFERENCE DOCUMENTS

.1 These lighting design guidelines, as produced by the Ministry, have been developed following 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 British Columbia highways.

301.3.2 Primary Reference Documents

.1 The following documents and manuals form the technical requirements for lighting design on British Columbia highways. In order to undertake a properly engineered lighting system design, it is mandatory that all lighting designers have access to, and refer to, the following manuals and documents, as produced by the named organizations. Where a new release is issued consult the Ministry Electrical Representative to determine if the newer document shall apply.

.2 Illuminating Engineering Society of North America (IESNA)

.1 Lighting Handbook

.2 RP-8-05 American National Standard Practice for Roadway Lighting

.3 RP-20-98 Lighting for Parking Facilities

.4 RP-22-05 Recommended Practice for Tunnel Lighting

.5 RP-33-99 Lighting for Exterior Environments

.6 DG-19-08 Design Guide for Roundabout Lighting
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.3 Transportation Association of Canada (TAC)
   .1 Illumination of Isolated Rural Intersections
   .2 Guide for the Design of Roadway Lighting - Volume 1 Fundamentals

.4 Transport Canada (TC)
   .1 Transport Canada Road/Railway - Grade Crossing Manual

301.3.3 Auxiliary Reference Documents

.1 The following documents and manuals may be referred to for additional reference information pertaining to lighting systems. All lighting designers should have access to and refer to the latest release of these manuals and documents.

.1 IESNA RP-7 Recommended Practice for Industrial Lighting
.2 IESNA DG-4 Design Guide for Roadway Lighting Maintenance
.3 IESNA G-1 Guideline for Security Lighting for People, Property and Public Places
.4 IESNA LM-50 Photometric Measurements of Roadway Lighting Installations
.5 IESNA LM-52 Photometric Measurements of Roadway Sign Installations
.6 IESNA LM-64 Photometric Measurements of Parking Areas
.7 IESNA LM-69 Interpretation of Roadway Luminaire Photometric Reports
.8 IESNA LM-71 Photometric Measurement of Tunnel Lighting Installations
.9 TC TP-312E Aerodrome Standards and Recommended Practices
.10 TC Standard 621.19 Standards Obstruction Markings
.11 Transport Canada Navigable Waters Bridges Regulations
.12 IESNA RP-17 Recommended Practice for Lighting Airport Road and Automobile Parking Areas
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.13 IESNA RP-19  Recommended Practice for Roadway Sign Lighting

301.3.4 Conflicting Recommendations

.1 Requirements and recommendations provided in the reference documents listed may vary and in some cases may even be in conflict. Where variances and conflicts in requirements and recommendations arise call the Ministry Electrical Representative 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, above, for thorough information on lighting theory, design concepts, and terminology.

.2 The Ministry no longer explicitly includes critical lighting design information such as classification definitions and design criteria in this manual. This required information is referenced by 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 distinct design methods used for calculating roadway lighting levels and producing a roadway lighting design. It should be noted that each of these two methods may produce different designs and different luminaire spacing; although each are acceptable engineering practices. These design methods are the illuminance method and the luminance method; each of which has a different set of design criteria and recommended values. The two design methods are fully explained in the latest edition of the IESNA RP-8-05, American National Standard Practice for Roadway Lighting. The appropriate application of the different design methods is outlined in Clause 304.4 of this manual. Consult the Ministry Electrical Representative to determine the method to be applied.

.4 Further to Clause 301.3, above, designers shall refer to the applicable manuals and documents listed noted in Chapter 104 of this manual.
302 JURISDICTIONS AND COST SHARING

302.1 RESPONSIBILITY

.1 The jurisdictions and areas of responsibility within a highway project can include both the provincial Ministry and local incorporated municipalities and cities. Responsibility for the lighting system can include both financial responsibility and legal liability. Furthermore, the financial responsibility and legal liability for the lighting system may not follow strict jurisdictional lines; that is, under certain circumstances a municipality may be required to assume both financial responsibility and legal liability for the lighting system even though it exists within the Ministry of Transportation’s jurisdictional area.

.2 In general the Ministry has jurisdiction over all provincial highways (numbered and unnumbered), even if the highway runs through a city or municipality. The Ministry also has jurisdiction over all roads, whether they are considered main or local, in unincorporated areas of the province.

.3 In general, a local municipality or city has jurisdiction over the roads that are within its incorporated boundaries, except for the roads or highways that are specifically controlled by the Ministry.

.4 It is not always obvious where the jurisdictional boundaries are within a project, particularly with respect to the roadway lighting. The designer must research and obtain clear direction from the Ministry project officials and, where necessary, from the local municipal officials, as to where the jurisdictions and areas of responsibility are defined.

.5 Third parties having jurisdiction and/or responsibility for roadway lighting are not limited to incorporated municipalities or cities, but may also include regional districts, fire protection districts, unincorporated towns, and others.
302.2 FINANCIAL

302.2.1 Ministry Warranted Lighting

.1 Cost sharing of Ministry warranted lighting is evaluated on a case-by-case basis. Cost sharing may be implemented as determined by the circumstances specific to the installation, at the sole discretion of the Ministry.

302.2.2 Lighting Not Warranted by the Ministry

.1 If a municipality requests lighting and Ministry lighting warrants as defined in Chapter 303 are not met, the municipality is responsible for 100 percent of the design and construction costs and for 100 percent of the operational and maintenance costs of the lighting (except as outlined below for some intersection lighting situations). It is the designer’s responsibility to clearly define and document this situation if it arises in a project, and to ensure that the municipality is fully aware of both the immediate and ongoing costs associated with the unwarranted lighting requested.

.2 The Ministry will not share in the cost of design and installation of unwarranted roadway lighting between intersections.

302.2.3 MAINTENANCE

.1 The Ministry Electrical Maintenance Contractor shall perform on all maintenance on electrical equipment within the Ministry right-of-way with the exception of lease lighting which shall be maintained by the electrical utility. Any exceptions must be granted in writing by the Ministry.
302.3 DESIGN REQUIREMENTS FOR UNWARRANTED LIGHTING

.1 In order that proper lighting design guidelines are met for unwarranted lighting, one of the following options, including approvals from the Ministry, must be employed:

.1 Ministry Designs and Installs Standard Roadway Lighting - The Ministry designs and installs the lighting and charges the Municipality for 100 percent of the costs. The Ministry owns, operates, and maintains the lighting and invoices the Municipality, on a quarterly basis, for 100 percent of the operational (power) and maintenance costs. In this option all lighting must be designed to Ministry standards using Ministry standard materials.

.2 Municipality Designs and Installs Standard Roadway Lighting - The Municipality designs and installs the lighting at its own cost. The Ministry owns, operates, and maintains the lighting and invoices the Municipality quarterly for 100 percent of the operational (power) and maintenance costs. In this option all lighting must be designed to Ministry standards using Ministry standard materials.

.3 Power Utility Leased Roadway Lighting - The Municipality 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 Municipality shall pay the power utility company directly for 100 percent of the leasing, operational (power) and maintenance costs. The Ministry may cost share in the operational and maintenance costs of unwarranted intersection lighting providing successful negotiations with the Ministry have been concluded, and the following has been undertaken.

.1 The cost sharing party shall complete and submit form H-380 - Application for Cost Sharing of Intersection Lighting when applying for cost sharing on power utility company leased lighting. Appendix 300.2 to this manual contains a blank form H-380 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.
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.2 The cross street(s) is a designated public access and is not a private driveway(s).

.3 The luminaire offset is no more than 15 m from the cross street shoulder and a maximum of 1 m from the edge of traveled lane on the highway.

.4 The IESNA classification and light distribution of the luminaire is approved by the Ministry.

.2 A cost sharing agreement is produced by the Ministry and signed by both parties.

.4 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 meet listed in this document

.2 Luminaire poles are structurally designed for use in traffic locations.

.3 The Ministry approves the lighting source.

.4 Pole locations are compatible with other facilities within the project area.

.5 For various intersection configurations, where required, poles shall have frangible or breakaway bases and meet the general requirements of Clause 504.3 Frangible and Breakaway Bases.

.6 The Ministry Electrical Representative approves the lighting design.

.7 The Municipality owns, operates, and maintains the lighting and is 100 percent responsible for the costs of design, installation, operation and maintenance.
303 LIGHTING WARRANTS

303.1 GENERAL

.1 Designers shall review all roadways in a project and determine their warrant status. The warrant status shall be reviewed and approved by the Ministry Electrical Representative prior to commencing the detailed design of any lighting systems.

.2 Situations may occur where lighting is warranted but cannot be installed because power is not available (i.e., not economically feasible). The Ministry will monitor the site on an ongoing basis and install lighting when power becomes available.

303.2 DEFINITIONS

.1 Continuous Lighting refers to lighting that runs continuously along a highway between intersections or interchanges.

.2 Full Lighting refers to lighting covering an intersection or interchange in a uniform manner over the entire traveled portions of the roadway. Full lighting for an interchange may include continuous lighting along ramps and arterial / collector roads within the interchange area.

.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, referred to as “sentry” lighting, that marks an intersection location for approaching traffic, or to the illumination of vehicles on a cross road.
303.3 **WARRANTS**

303.3.1 **Situations Warranting Lighting**

.1 Sub-clauses 303.3.2 to 303.3.19 describe situations where the Ministry will consider lighting as being warranted.

.2 Lighting in all other situations will be considered unwarranted and, if required or requested by a project, will be subject to the jurisdictional and cost sharing rules as outlines in Chapter 302 - Jurisdictions and Cost Sharing.

303.3.2 **Continuous Lighting**

.1 Continuous lighting is only typically required between intersections or interchanges in the following situations:

.1 Areas with nighttime collision rates repeatedly above the critical rates as determined by the Ministry Electrical Representative or the Project Traffic Engineer.

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

303.3.3 **Intersections**

.1 The need for full, partial or delineation intersection lighting is based on a warrant analysis in accordance with the TAC Illumination of Rural Intersections document.

303.3.4 **Roundabouts**

.1 All roundabouts and approaches shall be lighted.

303.3.5 **Interchanges**

.1 Interchanges shall be partially illuminated at on/off ramp merge and diverge areas as defined in Figures 14 and 15 Typical Off and On-Ramp - Partial Lighting. Continuous lighting may be required in
urban areas where adjacent interchanges have continuous lighting or in scenarios listed under 303.03.2 above.

303.3.6 **Bridges, Underpasses and Overpasses**

.1 **Roadway Lighting**

.1 Bridges, overpasses and underpasses do not typically require roadway lighting.

.2 Roadway lighting on bridges is not required unless warranted as per 303.03.1 above. Roadway lighting may be considered, at the discretion of the Ministry Electrical Representative 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 Navigable Waterways/Rail Coordinator, Engineering Branch, Victoria.

.3 **Bridge Piers in Navigable Waters**

.1 Bridge pier floodlighting or marker lighting may be required on some bridge projects for safety reasons, such as heavy marine traffic on the water, or for aesthetic and architectural reasons.

.2 The designer shall confirm the need for floodlighting or marker lighting on bridge piers with the Ministry Navigable Waterways/Rail Coordinator and the Ministry Electrical Representative.

.4 **Aircraft Obstruction Lights on Bridges**

.1 The purpose of aircraft obstruction lighting is to provide an effective means of indicating the presence of likely hazards to aircraft safety.
.2 The requirements for aircraft obstruction lights on bridges are determined by the application of TC Standard 621.19, Chapter 2 (view at http://www.tc.gc.ca).

.3 The designer shall confirm the need and requirements for aircraft obstruction lights on bridges with tall towers with the Ministry Navigable Waterways/Rail Coordinator, Engineering Branch, Victoria.

303.3.7 Tunnels

.1 The sole purpose of general roadway lighting is to provide for nighttime vision. However, the primary purpose of tunnel lighting is to provide proper internal pavement and wall luminance to counteract the effects of entering a dark restricted area during the daytime.

.2 Lighting warrants for daytime and nighttime lighting in tunnels shall be determined by the application of IESNA RP-22. It should be noted that the lighting requirements methodology 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 adjacent roadway is warranted for lighting.

.3 Lighting is generally warranted in walkway and bikeway tunnels. The designer shall confirm the lighting warrant with the Ministry Electrical Representative.

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 Underpasses/overpasses are not classed as tunnels unless their length and physical configuration will reduce the driver’s ability to see objects within the structures. Typically underpasses and overpasses are less than 25m in length and are a wide and open multi-lane cross-section to allow sufficient daylight penetration so additional daytime lighting is not warranted however night-time lighting maybe required to maintain the continuity of the roadway lighting. Where the underpass or overpass are two lanes in width or less and have vertical walls then daytime lighting should be considered due to lack of daylight penetration. Where sidewalks are present lighting may also be required.
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 Ramps to pedestrian overpasses
.2 Locations of stairs of more than 2 risers high or others similar hazards
.3 Walkways in known high security areas as determined by the Ministry Electrical Representative

303.3.10  **Signs**

.1 New signs will be supplied with high reflective sheeting (ASTM Type 9 or higher). Therefore sign luminaires will not be required. Generally signs will be supplied with high reflective sheeting. Where relocating or modifying an existing sign with sign lighting it is recommended the sign be replaced with one with high reflective sheeting so the sign luminaire can be removed.

303.3.11  **Rest Areas**

.1 Rest areas have a high mix of both vehicular and pedestrian traffic and such require special treatment to ensure safety and security.

.2 Lighting is required in all rest areas that are part of major highways and are open to the public at night.

.3 Lighting is required in rest areas along minor highways that are open to the public at night, when specifically requested by the District Transportation Manager responsible for the area.

303.3.12  **Weigh Scale Areas**

.1 Weigh scale areas have a high mix of both vehicular and pedestrian traffic, as well as workers undertaking particular tasks such as vehicle inspections. As a result, full area lighting is required at all weigh scales that are operational at night, for not only roadway and area lighting, but to also increase worker safety and for weigh scale operators to perform inspections of the vehicles using the facility.
.2 For weigh scales that are closed or non-operational at night, only basic security area lighting shall be provided.

.3 Lighting may be required where security cameras are used.

303.3.13 **Roadways Under CCTV Surveillance**

.1 All roads under surveillance by closed circuit television cameras may require special CCTV level lighting if the surveillance is intended to extend into the nighttime.

.2 Continuous lighting may be required in areas of continuous CCTV surveillance, such as freeway traffic management systems. Some cameras switch to black and white or infrared at night and operate at very low light with no supplementary lighting. The requirements for lighting for CCTV system shall be confirmed with the Ministry Electrical Representative.

.3 Partial CCTV lighting may be required in areas of remote surveillance, such as Web cameras along mountain highways. The partial lighting shall extend for the field of view of the camera, including multiple viewing areas if pan, tilt, and zoom are employed.

.4 Infrared illuminators may be considered where roadway lighting is not effective or suitable for the area.

303.3.14 **Brake Check Areas and Chain-up Pullouts**

.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 For the purposes of this manual, chain-up and chain-off pullouts are considered one and the same.
.3 Brake check areas and chain-up pullouts have a medium mix of both vehicular and pedestrian traffic and, as such, require special treatment to ensure safety and security.

.4 Lighting is required in all formal brake check areas and chain-up pullouts that are part of major highways.

.5 Lighting is required in informal brake check areas and chain-up pullouts along minor highways, only under the special request of the District Transportation Manager responsible for the area.

303.3.15 **Ferry Terminals**

.1 Road and Area Lighting

.1 Ferry terminals have a high mix of both vehicular and pedestrian traffic, as well as workers undertaking particular tasks such as loading and unloading vehicles and pedestrians. As a result, full area lighting is required at all ferry terminals that will be operational at night, not only for roadway and pedestrian lighting, but also to increase worker safety while performing their work tasks.

.2 For ferry terminals that are closed or non-operational at night, only basic security area lighting shall be provided.

.2 Marine Navigation Lights

.1 The designer shall confirm the need and requirements for marine navigation lighting at ferry terminals with the Ministry Navigable Waterways/Rail Coordinator, Engineering Branch, Victoria.

.3 Piers in Navigable Waters

.1 Terminal pier floodlighting or hazard marker lighting may be required at some ferry terminal projects for safety reasons, such as heavy ship traffic along the water, 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 Navigable Waterways/Rail Coordinator and the Ministry Electrical Representative.
303.3.16 **Toll Plazas**

.1 Toll Plazas have a high mix of both vehicular and pedestrian traffic, as well as workers undertaking particular tasks such as accepting toll payments. Furthermore, traffic at toll plazas tends to be erratic with unusually high vehicle/vehicle and pedestrian/vehicle conflicts. As a result, full area lighting is required at all toll plazas.

303.3.17 **Parking Facilities**

.1 Most surface parking facilities are owned and operated by jurisdictions rather than the Ministry. However, in special circumstances, such as Park-and-Rides, the parking facility may fall under the Ministry’s jurisdiction.

.2 Lighting is required for “formal” parking facilities under the Ministry’s jurisdiction in urban or suburban areas when these facilities are used during nighttime hours. The designer shall confirm the requirement for full or partial lighting with the Ministry Electrical Representative.

.3 Lighting is required for “informal” parking facilities or for parking facilities in rural areas only when specifically requested by the District Transportation Manager responsible for the area.

303.3.18 **Construction Detours**

.1 Lighting is required at all temporary construction detours where roadway lighting existed before the detour was put in place.

.2 Lighting is required at detours, as determined by the Ministry Electrical Representative, when any one of the following conditions exists:

.1 The road geometry is overly 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 vehicular and pedestrian traffic only. These are not to be applied 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.
303.3.19 Other Situations Requiring Lighting

.1 There may be other situations within a project where lighting is not generally warranted but may be warranted on a special basis. The designer is encouraged to review IESNA RP-8, Annex D, which describes situations that may require special consideration for lighting. The designer shall review the entire project in detail to determine if, in the designer’s opinion, any such special situations exist. The designer shall confirm the need for lighting these special situations with the Ministry Electrical Representative.

.2 Special lighting systems may be required in areas with nighttime collision rates repeatedly above the critical rates as determined by the Ministry’s Regional Traffic 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 Land Use Classifications

.1 Land Use Classifications, such as urban, suburban, and rural are no longer formally used in lighting engineering. These terms may, however, be informally used in sections of this document.

304.2.2 Roadway Classifications

.1 Roadway classifications, which describe the general conditions of vehicular traffic interaction, are detailed in IESNA RP-8.

.2 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, and shall not just apply traffic or municipal engineering roadway definitions to the lighting design.

304.2.3 Pedestrian Walkway and Bikeway Classifications

.1 Pedestrian Walkway and Bikeway classifications are detailed in IESNA RP-8.

304.2.4 Pedestrian Conflict Area Classifications

.1 Pedestrian Conflict Area Classifications which describe vehicle/pedestrian interaction as high, medium or low are defined in IESNA RP-8.
304.2.5 Pavement Classifications

.1 Pavement Classifications are based on the pavement reflection characteristics of the CIE Four Class system. Pavement classifications are detailed in IESNA RP-8.

.2 Roadway lighting calculations for Ministry projects generally use pavement reflectance values for R2/R3 pavement classification as the majority of Ministry roads are asphalt surfaced. The designer should take special note that in some cases (bridges, tunnels, snowsheds, etc.) the road surface may be Portland cement concrete. As such, the use of a road surface classification of 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 required design criteria with the Ministry Electrical Representative before proceeding with the lighting design.

.4 Specific design criteria and design requirements are referenced in the following sub-clauses.

.5 Designers are encouraged to use energy efficient lighting sources provided they are cost effective and meet the required design criteria.

304.3.2 Continuous Roadway Lighting

.1 Recommended roadway lighting design values when using the illuminance method are detailed in IESNA RP-8.
304.3.3 **Intersection Lighting**

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

304.3.4 **Roundabouts**

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

304.3.5 **Interchange Lighting**

.1 Interchanges shall meet the lighting design values 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 lighting design values detailed in IESNA RP-8.

304.3.8 **Tunnel Lighting**

.1 Recommended lighting design values for vehicle tunnels are detailed in IESNA RP-22.

.2 Recommended lighting 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.
304.3.10  Parking Facility Lighting

.1 Recommended lighting design values for parking lots are detailed in IESNA RP-20.

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. Building lighting design criteria are the responsibility of the building design team.

<table>
<thead>
<tr>
<th>AREA DESCRIPTION</th>
<th>LUX (AVG)</th>
<th>UNIFORMITY (AVG:MIN)</th>
<th>GLARE $L_{\text{max}}/L_{\text{avg}}$</th>
<th>LUMINAIRE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Roads (Ingress and Egress)</td>
<td>14</td>
<td>6:1</td>
<td>0.3</td>
<td>Cobra head (flat glass)</td>
</tr>
<tr>
<td>Parking Areas</td>
<td>18</td>
<td>6:1</td>
<td>0.3</td>
<td>Cobra head (flat glass)</td>
</tr>
<tr>
<td>Public Areas</td>
<td>22</td>
<td>6:1</td>
<td>0.3</td>
<td>Cobra head (flat glass)</td>
</tr>
<tr>
<td>On/Off Ramps</td>
<td></td>
<td></td>
<td></td>
<td>Refer to IESNA RP-8 for design values</td>
</tr>
</tbody>
</table>

Table 1. Maintained Horizontal Illuminance Levels for Rest Areas.

304.3.12  Brake Check Area and Chain-up Pullout Lighting

.1 Recommended lighting design values for brake check areas and chain-up pullouts 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. The required task lighting must be provided by the vehicle or vehicle operator.

304.3.13  Weigh Scale Lighting

.1 The IESNA does not have any recommendations or design documents specifically related to weigh scale lighting. 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. Certain working task design values have been developed using IESNA RP-7 Industrial Lighting.

.2 Recommended lighting design criteria for weigh scales, during their operational hours, are detailed in Table 2 below.

<table>
<thead>
<tr>
<th>AREA DESCRIPTION</th>
<th>LUX (AVG)</th>
<th>UNIFORMITY (AVG:MIN)</th>
<th>GLARE ( \frac{L_{\text{max}}}{L_{\text{avg}}} )</th>
<th>LUMINAIRE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Roads (Ingress and Egress) roads</td>
<td>14</td>
<td>3:1</td>
<td>0.3</td>
<td>Cobra head (flat glass)</td>
</tr>
<tr>
<td>Parking Areas</td>
<td>18</td>
<td>3:1</td>
<td>0.3</td>
<td>Cobra head (flat glass)</td>
</tr>
<tr>
<td>Inspection Area</td>
<td>30</td>
<td>3:1</td>
<td>0.3</td>
<td>Cobra head (flat glass)</td>
</tr>
<tr>
<td>Weigh scales</td>
<td>50</td>
<td>3:1</td>
<td>0.3</td>
<td>Wall mount on building or cobra head (flat glass)</td>
</tr>
<tr>
<td>On/Off Ramps</td>
<td>Refer to IESNA RP-8 for design values</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Maintained Horizontal Illuminance Levels for Brake Check Areas, Chain-up Pullouts and Weigh Scale Facilities

.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.

.4 The determined lighting levels for weigh scales shall be confirmed with the Ministry Electrical Representative prior to proceeding with the detailed design.

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-17.

.2 Lighting design criteria for roadways in the vicinity of airports shall be as recommended in IESNA RP-8 for the type of road. Only luminaires with full cutoff optics shall be used.
.3 Recommended lighting design criteria for parking areas can be found in IESNA RP-20. Only luminaires with full cutoff optics shall be used.

.4 The designer shall give particular consideration to the following special requirements as defined in IESNA RP-17 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 also insure 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 certain areas relative to runways.

.6 The designer shall contact the following prior to and during preparation of the lighting design:

.1 Transport Canada Western Region Safety Branch, Edmonton AB at (780) 495-3850 to determine if TC has jurisdiction in the area of the proposed lighting, and for approval of the proposed lighting design.

.2 Local airport operator or manager to determine factors that may affect luminaire pole location and height, and luminaire type and wattage.

.3 Ministry Electrical Representative to confirm the scope and requirements of the lighting affected by the airport prior to proceeding with 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 Ferry Terminal Lighting

.1 Ferry terminals have a high mix of both vehicular and pedestrian traffic and closely resemble either parking lots or rest areas. The designer shall analyze the project and determine whether to use the design criteria for parking facilities or for rest areas, or a combination of both.
.2 Ferry terminals that are closed or non-operational during nighttime hours shall have their area lighting levels reduced to the basic security lighting design values as detailed in IESNA RP-20.

.3 The determined lighting levels for the outdoor areas of ferry terminals shall be confirmed with the Ministry Electrical Representative prior to proceeding with the detailed design.

.4 These special recommendations apply to area lighting for vehicular and pedestrian traffic only. These are not recommendations for the task lighting that may be required for ferry terminal workers. The Work Safe BC regulates lighting requirements for specific worker tasks.

.5 These design criteria are provided for area lighting only. Building lighting design criteria are the responsibility of the building design team.

304.3.16 Toll Plaza Lighting

.1 Toll plazas have a high mix of both vehicular and pedestrian traffic and as such closely resemble either parking lots or rest areas. Toll Plaza lighting shall meet the design values in the TAC Guide for the Design of Roadway Lighting.

.2 The determined lighting levels for the outdoor areas of toll plazas shall be confirmed with the Ministry Electrical Representative prior to proceeding with the detailed design.

.3 These special recommendations apply to area lighting for vehicular and pedestrian traffic only. These are not recommendations for task lighting that may be required for toll plaza workers. Where possible the WorksafeBC lighting requirements for specific tasks shall be applied.

.4 These design criteria are provided for area lighting only. Building lighting design criteria are the responsibility of the building design team.

304.3.17 CCTV Lighting

.1 Where roadway lighting is warranted in an area where CCTV surveillance is required, the design criteria for continuous roadway lighting shall be used. Roadway lighting design values provide sufficient illumination for CCTV cameras.

.2 Where roadway lighting is not warranted in an area where CCTV surveillance is required roadway lighting may be warranted to enhance
camera images for those monitoring the roadways. If lighting is required for a CCTV system it shall meet the light level requirements for classification of roadway, pavement type and pedestrian conflict present. The lighting requirements may however be increased depending on the level of image resolution required and the type of cameras. The designer shall verify the camera systems and investigate lighting requirements.

304.3.18 Construction Detour 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 303.3.16), 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 vehicular 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 the WorksafeBC. Refer to the current edition of the Ministry Standard Specifications for Highway Construction, Chapter 194.

304.3.19 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 PR-8.

304.3.20 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 review the circumstances with, and gain approval to design to modified design criteria from the Ministry Electrical Representative prior to proceeding.
304.4  CALCULATIONS

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

304.4.2  Calculation Methods
.
1 The IESNA provides two distinct design and calculation methods for roadway lighting. These methods are the Illuminance and Luminance. Different design criteria apply to each of these methods.

2 It is the requirement of the Ministry that at least one of the lighting design and calculation methods, along with its corresponding design criteria, be met when designing a Ministry roadway lighting project. It is not required that the design requirements for both calculation methods be met.

3 The different design and calculation methods will produce different designs and lighting layouts for the same project. Furthermore, one method of lighting design is not always more efficient than another because different design and calculation methods suit different road geometrics. As such, the designer should select the most appropriate design and calculation method to produce the most energy efficient lighting design.

4 The designer should refer to IESNA RP-8 for design suggestions and comparisons of the different design methods. The designer should pay particular attention to the system changes and modifications that can be employed and their effect on pavement luminance.

304.4.3  Computer Programs for Lighting Design
.
1 The designer must ensure that the lighting design programs used on a project meet the requirements of all IESNA design methodologies and design criteria, i.e., as a minimum they must be able to calculate and analyze lighting levels, uniformity, and glare. Programs must use luminaire photometrics in the IESNA standard format. Not all lighting programs will adequately calculate all types of lighting designs. In particular the designer shall note the following;
.1 Certain roadway lighting programs may not be adequate for area lighting such as parking lots and rest areas if they cannot calculate the lighting on vertical surfaces.

.2 Indoor lighting programs are not acceptable for outdoor lighting designs. Indoor lighting uses different design methods than outdoor lighting.

.3 Tunnel lighting design requires special programs that are specific to tunnels. Most roadway lighting programs cannot adequately calculate tunnel lighting designs because they do not take interior reflectance into account. Indoor lighting programs cannot adequately calculate tunnel lighting designs because they have no parameters for pavement reflectance and generally cannot calculate luminance.

.2 Where computer lighting calculations are being performed, designers shall use the manufacturer’s IESNA format photometrics. The luminaire manufacturer upon request generally provides IESNA format photometrics in digital file. Pre-approved manufacturers’ photometric file numbers are shown on the Ministry Recognized Products List.

304.4 Calculation Area

.1 A grid shall define the extents of the lighting calculation area. Different procedures are required when selecting a grid for roadways, parking areas, tunnels, signs, etc. Also, different grid arrangements may be required for straight roadway sections, for curves, and for intersections and traffic conflict areas. The selection of the lighting calculation areas and the appropriate grid for a lighting design are outlined in the appropriate IESNA document for the area under design.

304.4.5 Light Loss Factors

.1 Lighting calculations shall be prepared using initial rated lamp lumens and the total light loss factor (LLF). Lamp lumen values for the standard Ministry Pre-approved HID lamps may be found in the Ministry Electrical and Signing Materials Standards, Chapter 502 - HID Lamps. Total light loss factors and their components vary depending on the area and the objects to be lighted and are outlined in the appropriate IESNA document for the facility under design.

.2 The Ministry has standardized the light loss factors to be used in roadway lighting calculations. The light loss factors to use for all Ministry lighting design calculations can be found in Table 3 below.
## Table 3. Standardized Light Loss Factors

<table>
<thead>
<tr>
<th>Area</th>
<th>Lamp Lumen Depreciation (LLD)(^{(3)})</th>
<th>Luminaire Dirt Depreciation (LDD)(^{(3)})</th>
<th>Luminaire Component Depreciation (LCD)(^{(4)})</th>
<th>Equipment Factor (EF)(^{(5)})</th>
<th>Total Light Loss Factor (LLF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General (^{(1)})</td>
<td>0.88</td>
<td>0.88</td>
<td>0.98</td>
<td>0.97</td>
<td>0.78</td>
</tr>
<tr>
<td>Special (^{(2)})</td>
<td>0.88</td>
<td>0.82</td>
<td>0.98</td>
<td>0.97</td>
<td>0.69</td>
</tr>
</tbody>
</table>

**Notes:**

(1) This applies to most areas of British Columbia, including small to medium sized towns. This is the default classification.

(2) Typically areas with heavy industrialization. This classification is rarely used and applies to very few industrial areas in the Province. This classification may only be used if confirmed with Ministry Electrical Representative.

(3) Based on a 4 year maintenance cycle

(4) Degradation of the reflector and refractor

(5) Effect of ambient temperature, voltage fluctuations, and the ballast and lamp factors
305 OBTRUSIVE LIGHT AND LIGHT POLLUTION

305.1 INTRODUCTION

.1 Obtrusive light, sometimes referred to as Light Pollution, has become a common concern of the general public. Obtrusive light not only detracts from the enjoyment of the nighttime setting, but also has been shown by recent research to have negative effects on biological systems. Furthermore, most obtrusive light is the result of light not directed specifically at the area of consideration and, therefore, can be considered as wasted light. All wasted light is also wasted energy. Therefore the reduction of obtrusive light will typically lead to the increased energy efficiency of the lighting design.

.2 Obtrusive Light can be classified into three categories:

.1 Light Trespass can be described as the effects of light that strays from its intended purpose and becomes an annoyance, a nuisance or a detriment to visual performance.

.2 Sky Glow is the result of stray light being scattered in the atmosphere, resulting in added “sky brightness”.

.3 Glare, which can be described as unwanted source luminance, 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 With the absence of legislation, the Ministry has developed the following recommendations that shall be followed in developing a lighting design. These recommendations shall be applied to all Ministry lighting design projects.

.2 In certain circumstances, and in special geographical areas, obtrusive light may be considered as a specifically important factor in the design development process. In these cases, as determined and identified by the Ministry Electrical Representative, 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 Refer to the Ministry Electrical and Signing Material Standards Manual for roadway lighting equipment specifications.

.2 All lighting equipment used on Ministry projects must be Ministry pre-approved. A current copy of the Ministry’s Recognized Products List can be viewed on the Ministry website at http://www.th.gov.bc.ca/publications/eng_publications/geotech/recognized_products_book.pdf.

.3 Although the Ministry has standardized on its lighting equipment, material suppliers and equipment specifications may change from time to time. The designer shall have a current copy of the Ministry’s Recognized Products List to insure that all equipment used in Ministry designs is listed.

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 30m, 35m, 40m and 45m high multisided or round galvanized steel poles. The designer may consider custom mounting heights;

   .2 1000W HPS highmast luminaires;

   .3 The luminaires shall be mounted on a lowering ring. The luminaire mounting ring is supported by two cables and is raised and lowered by an electrically driven double drum winch located inside the pole hand hole. An internal or portable drive motor drives the winch;

   .4 A power distribution panel is located inside the handhole of each pole.

   .5 Highmast lighting on cellular antenna towers shall meet the required design criteria. The Manager, Electrical Services must approve maintenance procedures.
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 the Ministry Electrical Representative on a project-by-project basis. This equipment typically includes, but is not limited to, the following:

.1 Highmast luminaires
.2 Vehicular tunnel luminaires
.3 Floodlights

.2 If specialty lighting equipment is specified, it shall be of the highest standard and quality. Non-standard equipment must be readily available and easy to maintain, and all products of a similar nature must be of a single manufacturer. Custom products shall be avoided because they can cause maintenance problems.
307 ROADWAY LIGHTING

307.1 CONTINUOUS, FULL AND PARTIAL LIGHTING

.1 The Ministry’s general policy is to minimize lighting while maintaining uniformity, veiling luminance and light level requirements as recommended by the IESNA, TAC and TC, as applicable. Prior to starting any roadway lighting design the extent of the required lighting must be determined following by application of the requirements in Chapter 303 - Lighting Warrants.

307.2 CONVENTIONAL DAVIT LIGHTING

307.2.1 Conventional Davit Lighting

.1 Roadways are illuminated with flat glass 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:
ROADWAY LIGHTING

.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

.2 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.

.3 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 and transit authorities.

.4 Consideration must always be given to the aesthetic affect that the highmast poles and luminaires have on the nigh 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 Representative.

307.3 ROADWAY LUMINAIRE LAYOUT

.1 Cobra head luminaires mounted on davit poles, which are referred to as luminaire poles, are generally configured as shown on Figure 1.
Figure 1. Typical Davit Luminaire Pole Layouts

2 Davit luminaire pole spacings shall be applied as follows:

1 One side lighting is generally used on one and two lane roads.

2 Staggered or opposite lighting is generally used on roads three lanes or wider.

3 Opposite lighting is generally used on very wide roads.

4 Median lighting is generally used on roads that have wide medians or centre concrete barrier.

3 Designers should examine the possibility of future road widening. If road widening is planned for within a reasonable timeframe, then the lighting design should be consistent with the ultimate design required in the future.
.4 Where possible, for safety reasons davit luminaire poles shall be placed on the inside of curves as shown in Figure 2, if concrete roadside barrier is not present or proposed (providing that one sided lighting produces an acceptable design).

.5 Refer to Figure 18 in Chapter 309 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 2. Position of Luminaire Poles on Curved Roads

307.4 ROADWAY LUMINAIRE S AND POLE MOUNTING HEIGHTS

.1 Standard davit luminaire pole heights and luminaire wattages can be found in the Ministry Electrical and Signing Material Standards Manual.

.2 Designers shall select the most effective luminaire wattage and mounting height combination with consideration given to quality of the lighting design, installation cost and operating cost. Table 4 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 wattage and pole height can be
considered. Poles use a 2.5m high luminaire arm so when specifying the overall pole height the shaft heights are 6.5m, 8.5m and 11m.

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Pole Height</th>
<th>Luminaire Wattage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 3 lane roads</td>
<td>9.0 m</td>
<td>150W HPS</td>
</tr>
<tr>
<td></td>
<td>11.0 m</td>
<td>250W HPS</td>
</tr>
<tr>
<td>4 to 6 lane roads</td>
<td>11.0 m</td>
<td>250W HPS</td>
</tr>
<tr>
<td></td>
<td>13.5 m</td>
<td>400W HPS</td>
</tr>
<tr>
<td>7 to 8 lane roads</td>
<td>13.5 m</td>
<td>400W HPS</td>
</tr>
<tr>
<td>Freeway and expressway acceleration and</td>
<td>9.0 m</td>
<td>150W HPS</td>
</tr>
<tr>
<td>deceleration lanes, ramps, and tapers</td>
<td>11.0 m</td>
<td>250W HPS</td>
</tr>
<tr>
<td></td>
<td>13.5 m</td>
<td>400W HPS</td>
</tr>
</tbody>
</table>

Table 4. Luminaire Mounting Heights and Wattages for Various Road Types

.3 Prior to selecting the luminaire mounting height, designers shall determine the height of any overhead power lines that may be in conflict with the lighting. The designer shall also confirm the required overhead power line clearances with the local utility company. Designs shall not exceed the minimum clearances required between luminaire poles and power lines as outlined in Figure 3.

.1 Where utility poles are being relocated due to road construction, designers shall confirm that the minimum clearances outlined in Figure 3 are maintained. This may require the utility company installing taller poles to accommodate the required luminaire pole mounting heights. Designers shall coordinate the required power line heights with the utility company by working with the utility company designer.

.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 Luminaire poles as short as 7.5 m.
.5 Using 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 Horizontal and Vertical Clearances Between Power Lines and Luminaire Poles
307.5 SPECIAL CONSIDERATIONS

.1 Many situations arise that require special design consideration. The designer shall refer to and be fully familiar with 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 can result in:

.1 No lighting required
.2 Delineation lighting required
.3 Partial Lighting required, or
.4 Full Lighting required

.2 Luminaire wattages and pole mounting heights at intersections shall match those on the approach roads if continuous lighting is required between intersections. For isolated intersection lighting, pole heights and luminaire wattages 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 suit the traffic signal. Consideration shall be given to the possible future signalization of intersections with the interim luminaire poles located accordingly.

.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 wattages to suit the size and configuration of the intersection and the lighting design criteria.
Figure 4. Typical Major Intersection of Two Highways - Full Lighting

Figure 5. Typical Major Intersection with Major X-Road - Full Lighting
Figure 6. Typical Major Intersection with Minor X-Road - Partial 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
ROADWAY LIGHTING

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

Figure 11. Typical Minor Intersection with Small Area - Delineation Lighting
Figure 12. Delineation Lighting for Typical Minor ‘T’ Intersection

Figure 13. Delineation Lighting for Typical Minor “T” Intersection
307.6.2 Continuous Lighting Between Intersections

.1 Where continuous lighting is required between intersections, the luminaire poles shall be positioned in a one-sided spacing, a staggered spacing, an opposite spacing, or a median spacing as illustrated in Figure 1.

.2 The pole locations at intersections, as determined in Sub-clause 306.7.1, above, shall take priority in a lighting design. The lighting spacing between intersections shall be designed to suit these preferred locations of poles at the intersections.

.3 When spacing luminaires between intersections, designers shall measure the distance from the near side of each intersection, then calculate and determine the optimum spacing that will be required to achieve the proper lighting levels, as well as to provide a consistent spacing of the luminaire poles.

.4 Roadways that change their width or required lighting levels, and therefore change the luminaire pole spacing distance, shall change spacing distances in a smooth transition over several pole cycles. For example, if the spacing distance must change from 40m to 60m (due to the narrowing of the roadway), it is advisable to change in increments of 5m.

.5 The optimum pole spacing, as calculated to meet the theoretical design criteria, may not suit an even or consistent spacing between intersections. The designer shall use good engineering judgment to either compress or stretch out the theoretical pole spacing so that even and consistent pole spacings are 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.
Figure 14. Typical Off-Ramp - Partial Lighting

Figure 15. Typical On-Ramp - Partial Lighting
ROADWAY LIGHTING

Figure 16. Pole Location in Gore Area

307.6.4 Power Utility Company 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 either desirable due to financial considerations, or necessary due to physical constraints or constructability.

.2 Power utility company leased lighting consists of cobra head luminaires and mast arm brackets mounted on utility company poles. These luminaires and brackets are generally supplied, installed, owned, operated, and maintained by the local power utility company.

.3 Power utility company leased lighting may be used on projects, for either Ministry warranted or unwarranted lighting, if approved for use by the Ministry Electrical Representative. Only lease lights paid for by the Ministry shall be considered as part of the lighting design. If the lease lights are paid for by others then the Ministry has no control over their operation and therefore the lease light should not be considered in the lighting design.
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 Pedestrian and bicycle tunnels are generally illuminated with 70W HPS listed on the Ministry Recognized Product List. Photometrics for this luminaire is available on diskette in IESNA format from the luminaire manufacturer. The Ministry will consider alternative light sources such as LEDs provided they are cost effective from a life cycle standpoint and meet the lighting requirements.

308.1.3  Lighting Layout
.1 For pedestrian or bicycle box culvert tunnels (as per figure 19 below) luminaries can typically be spaced at no greater than 1.8m to produce the required daytime illumination and uniformity. The designer shall confirm the spacing via calculation.

.2 Pedestrian and bicycle tunnels that are wider than standard pathways will require lighting design calculations to determine the required luminaire spacing to meets the required design criteria.

.3 Pedestrian and bicycle tunnels require lighting at the entrances and exits of the structures. Refer to Chapter 311 for details on walkway lighting. For tunnels that are in areas of non-continuous lighting, one post-top walkway light will be required at a strategic location near the 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.
308.2 VEHICLE TUNNEL LIGHTING

308.2.1 Lighting Requirements

.1 For the definition of a tunnel refer to IESNA RP-22. All vehicle tunnel projects are considered to be special projects and, as such, require project specific research into the best solutions for the lighting design. Prior to designing a tunnel lighting system, designers shall thoroughly review the project with the Ministry Electrical Representative.

.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 criteria and requirements of IESNA RP-22 American National Standard Practice for Tunnel Lighting.

308.2.2 Lighting Materials

.1 No Ministry recognized products exist as vehicle tunnel luminaries. Vehicle tunnel luminaries must be IP66 rated and shall be designed for the specific purpose of lighting a tunnel. Prior to selecting any tunnel luminaire review requirements listed in IESNA RP-22 and consult with the Ministry Electrical Representative.
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 Representative 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 determining factor in a tunnel lighting design given the large quantity of luminaries required for a tunnel project. In order to achieve the best energy efficiency, multi-level lighting controls will be required for all tunnel projects. Illuminance levels should be at the highest level in bright sunlight and at the lowest level in darkness. Typically major tunnels should have at least three daytime lighting levels and a separate nighttime lighting level.

.5 Lighting is required for the external approach zone and exit zone of all tunnels that warrant nighttime lighting. The lighting design criteria for these areas are outlined in IESNA RP-22.

.6 The Ministry Electrical Representative, prior to proceeding with the detailed design, must approve the selected tunnel lighting design criteria and design method.

308.3 UNDERPASS / OVERPASS TUNNEL LIGHTING

308.3.1 Lighting Requirements

.1 Refer to Chapter 303 - Lighting Warrants for underpass and overpass lighting warrants.
.2 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 150W HPS wall mount luminaires as listed in the Ministry’s Recognized Products List.

308.3.3 Lighting Layout

.1 Where possible, underpass and overpass lighting shall be provided by the strategic placement of roadway luminaire poles on either side of 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 20.
Figure 18. Typical Underpass/Overpass Lighting
309 BRIDGE LIGHTING

309.1 ROADWAY LIGHTING ON BRIDGES

309.1.1 Lighting Requirements

.1 All major bridge projects are considered to be special projects and, as such, have project specific requirements particular to bridges. Major bridge projects will require project specific research into the best solutions for the lighting designs. Prior to designing a major bridge lighting system, designers shall thoroughly review the project with the Ministry Electrical Representative.

.2 Minor bridge projects, including the roadways along the tops of under/overpasses, are generally treated the same as the roadway that they form part of, 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 for roadway lighting design criteria.

.5 If lighting is not warranted along a bridge, but it is expected or conceivable that lighting may be required in the future due to future road improvements, or future reclassification of the roadway or land use, it is recommended that the conduit and pole bases be considered on the bridge structure to accommodate the installation of lighting in the future. Designers shall discuss the requirement for installing pole bases and conduit on the bridge with the Ministry Electrical Representative.

309.1.2 Lighting Materials

.1 For most projects standard Ministry roadway lighting materials and equipment shall be used for bridge roadway lighting.

.2 In all cases the designer shall ensure pole handholes are easily accessible. Special modified pole designs may be required with handholes located in maintainable locations.
.3 Luminaires on bridges shall be specified with anti-vibration devices, which are supplied as an option by the Ministry pre-approved cobra head luminaire suppliers.

309.1.3 Lighting Layout

.1 If roadway lighting is required to 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.

.2 Typical luminaire pole mounting details on bridge structures are shown in Figure 19.
NOTE: Size and shape of base shall be designed by the Bridge Engineer. Where 2" R.PVC or larger is required a junction box shall be cast into the sidewalk and a 1-1/4" R.PVC shall feed from the J.B. to the pole base.

Figure 19. 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 Navigable Waterways/Rail Coordinator, Engineering Branch, Victoria.

.2 If navigation lighting is required, the navigation lights shall be:

.1 Located on each side of the bridge
.2 Positioned over the centre of the navigable channel
.3 Illuminated 24 hours a day
BRIDGE LIGHTING

.3 Navigation lights shall be 175W mercury vapour (Crouse-Hinds Model No. VMVC-3-TW-175-GP, colour and voltage as required). LED lighting should also be considered.

.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 Navigable Waterways/Rail Coordinator, Engineering Branch, 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 indicating the hazard of 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 shall be metal halide. The most efficient floodlight wattage and beam spread shall be used for the installation. Piers shall be illuminated to a level adequate for proper visibility for vessels on the water. Floodlight type and lighting levels shall meet the approval of the Ministry Electrical Representative.

.3 Marker lights shall be 175W mercury vapour (Crouse-Hinds Model No. VMVC-3-TW-175-GP, colour and voltage as required). LED lighting should also be considered.

.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 warning of the structure.

.6 Floodlights or hazard markers shall be controlled by a photocell for nighttime only operation.
.7 Floodlights shall be shielded to reduce light trespass or glare onto adjacent areas, including the reduction of disability glare in the direction of traveling watercraft.
310 PEDESTRIAN WALKWAY AND BIKEWAY LIGHTING

310.1 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.

310.2 LIGHTING MATERIALS
.1 Walkways and bikeways requiring a separate lighting system and are generally illuminated with Ministry standard 150W HPS Cobra Head Luminaires mounted on Type 2 - 6.5 m shafts to reduce light trespass. The poles will require a special tenon to attach the cobra head to the shaft of the Type 2 shaft. Post top luminaries with full cut-off optics may also be considered.

.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.

310.3 LIGHTING LAYOUT
.1 If a walkway or bikeway runs adjacent to a roadway lighting system, designers shall determine whether spill lighting from 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 Rest areas shall be illuminated using Ministry standard pre-approved flat glass cobra head luminaires and davit poles.
.2 Luminaires with cut-off optics and poles shall be selected from 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 enhance the facilities usefulness 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 are designed and installed by the British Columbia Building Corporation (BCBC). However, the power for BCBC lighting systems may be fed from the Ministry of Transportation 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 and BCBC.
.4 Figure 22 is an example of a typical rest area facility.
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 Weigh scales shall be illuminated using Ministry standard pre-approved flat glass cobra head luminaires and davit poles. Highmast lighting may also be used for lighting large weigh scale facilities. The use of highmast lighting for weigh scales shall meet the approval of the Ministry Electrical Representative.

.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.
.3 All roadway lighting shall be high pressure sodium, except for the inspection area and weigh scale deck, which shall be metal halide for better colour rendition.

311.2.3 Lighting Layout

.1 The Ministry lights weigh scales to increase worker safety, and for weigh scale operators to perform inspections of the trucks using the facility. 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.

.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 isolated areas with very low truck volumes.

.3 Weigh scale building lighting and controls shall generally be provided by the British Columbia Building Corporation (BCBC).

.4 Weigh scale open/closed signs and truck weight signs require sign lighting in accordance with the Chapter 308. Lighting may also be required for directional signs where the decision making process is overly complex or critical in reaction time. Lighting of directional signs must meet the approval of the Ministry Electrical Representative.

.5 Full-scale lighting is only required for the time of night that the weigh scale is operational. Time programmable controls shall be used to downgrade the lighting to security levels when the facility is non-operational.

.6 Figure 23 illustrates an example of a typical weigh scale facility.
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 Brake check areas and chain-up pullouts shall be illuminated using Ministry standard pre-approved flat glass cobra head luminaires and davit poles.

.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.
311.3.3 **Lighting Layout**

.1 The Ministry lights brake check areas and chain-up pullouts to increase safety and security as well as to enhance the facilities usefulness at night.

.2 Lighting is provided at brake check areas and chain-up pullouts for vehicle and pedestrian safety, not for task lighting. The light source for brake inspection tasks must, by law, be provided by the vehicle.

.3 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.

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 Ferry terminals shall be illuminated using Ministry standard pre-approved flat glass cobra head luminaires and davit poles. Highmast lighting may also be used for lighting large ferry terminal facilities. The use of highmast lighting for ferry terminals shall meet the approval of the Ministry Electrical Representative.

.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.

.3 All roadway and area lighting shall be high pressure sodium, except for the payment booth area, which shall be metal halide for better colour rendition.
311.4.3 **Lighting Layout**

.1 **Road and Area Lighting**

.1 The Ministry lights ferry terminals to increase driver control and safety, and for ferry terminal workers to perform their duties of loading, unloading, and directing traffic. 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.

.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 isolated areas with very low traffic volumes.

.3 Ferry terminal lighting and controls shall generally be provided by the British Columbia Ferry Corporation (BCFC).

.4 Lighting may be required for ferry terminal directional signs where the decision making process is overly complex or critical in reaction time. Lighting of directional signs must meet the approval of the Ministry Electrical Representative.

.5 Full-scale lighting is only required for the time of night that the ferry terminal is operational. Time programmable controls shall be used to downgrade 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 Navigable Waterways/Rail Coordinator, Engineering Branch, Victoria.

.2 If navigation lighting is required, the navigation lights shall be:

.1 175W mercury vapour

.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 shall be 175W mercury vapour (Crouse-Hinds Model No. VMVC-3-TW-175-GP, voltage as required). LED lighting should also be considered.
.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 shall be metal halide. The most efficient floodlight wattage and beam spread shall be used for the installation. Piers shall be illuminated to a level adequate for proper visibility for vessels on the water. Floodlight type and lighting levels shall meet the approval of the Ministry Electrical Representative.

.3 Hazard marker lights shall be 175W mercury vapour (Crouse-Hinds Model No. VMVC-3-TW-175-GP, voltage as required). LED lighting should also be considered.

.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 reduce light trespass or glare onto adjacent areas, including the reduction of disability glare in the direction of traveling watercraft.

311.5 TOLL PLAZA LIGHTING

311.5.1 Lighting Requirements

.1 Refer to Chapter 303 - Lighting Warrants for toll plaza lighting warrants.

.2 Refer to Chapter 304 - Lighting Design for toll plaza lighting design criteria.

.3 Lighting for toll plaza approach roads shall meet the requirements of continuous roadway lighting or intersection lighting.

311.5.2 Lighting Materials

.1 Toll plazas shall be illuminated using Ministry standard pre-approved flat glass cobra head luminaires and davit poles. Highmast lighting may also be used for lighting large toll plaza facilities. The use of highmast lighting for toll plazas shall meet the approval of the Ministry Electrical Representative.
MISCELLANEOUS LIGHTING APPLICATIONS

.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.

.3 All roadway and area lighting shall be high pressure sodium, except for the payment booth area, which shall be metal halide for better colour rendition.

311.5.3 Lighting Layout

.1 The Ministry lights toll plazas to increase driver control and safety, and for facility operators to perform their tasks. Although the IESNA has no specific documents relating to toll plazas, recommendations for lighting designs and layouts in toll plazas can be abstracted from IESNA RP-20.

.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 isolated areas with very low traffic volumes.

.3 The British Columbia Building Corporation (BCBC) shall generally provide toll facility building lighting and controls.

.4 Toll plaza lane control and open/closed signs may require sign lighting in accordance with the Chapter 308 depending on the technology utilized. Lighting may also be required for directional signs where the decision making process is overly complex or critical in reaction time. Lighting of directional signs must meet the approval of the Ministry Electrical Representative.

311.6 CLOSED CIRCUIT TELEVISION (CCTV) LIGHTING

311.6.1 Lighting Requirements

.1 Refer to Chapter 303 - Lighting Warrants for CCTV lighting warrants.

.2 Refer to Chapter 304 - Lighting Design for CCTV lighting design criteria.

311.6.2 Lighting Materials

.1 Lighting materials for CCTV shall be consistent with roadway lighting in the area.
.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.

**311.6.3 Lighting Design**

.1 Where CCTV systems are installed along a roadway with continuous lighting, the normal roadway lighting should provide sufficient illumination for satisfactory operation of the cameras however this will need to be confirmed with the CCTV designer.

.2 Only the illuminance method of lighting design is appropriate for CCTV. The luminance method, with its metric of pavement luminance, is inappropriate for CCTV due to the requirement that CCTV surveillance is for all objects (vehicles, pedestrians, etc.) not just the pavement.

.3 Uniformity is particularly important for proper CCTV operation. The sensitivity of modern digital cameras requires a high degree of uniformity.

.4 For CCTV operation in rural areas, lighting must be provided for the full field as required by the surveillance objective. This may also include multiple fields of view if the pan, tilt, and zoom are operated.

**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 pre-approved flat glass cobra head luminaires and davit poles.

.2 Luminaires and poles shall be selected from the Ministry’s Recognized Products List.
311.7.3 Lighting Layout

.1 The Ministry lights parking facilities to increase public safety and security as well as to enhance the facilities usefulness at night. Recommendations for lighting designs and layouts in parking facilities are outlined in IESNA RP-20.

.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 Full-scale lighting is only required for the time of night that the parking facility is in active operation. Time programmable controls shall be used to downgrade the lighting to security levels when the facility is not actively 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 in whole, or in part, by the permanent lighting installation of the project. This can many times be achieved by the early installation in a project of the electrical systems.

.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 flat glass for appropriate glare control.
MISCELLANEOUS LIGHTING APPLICATIONS

.4 Floodlights are not permitted for temporary detour lighting unless it can be shown to the Ministry Electrical Representative’s satisfaction that proper glare and light pollution controls can be achieved.

311.8.3 Lighting Layout

.1 All lighting designs for temporary construction detours must meet all roadway lighting design requirements, including the secondary criteria such as uniformity and glare.

.2 All temporary lighting systems in urban and sub-urban areas, as well as those in rural areas where residents have a view of the project, must be sensitive to the local concerns regarding light pollution as outlined in Chapter 305.