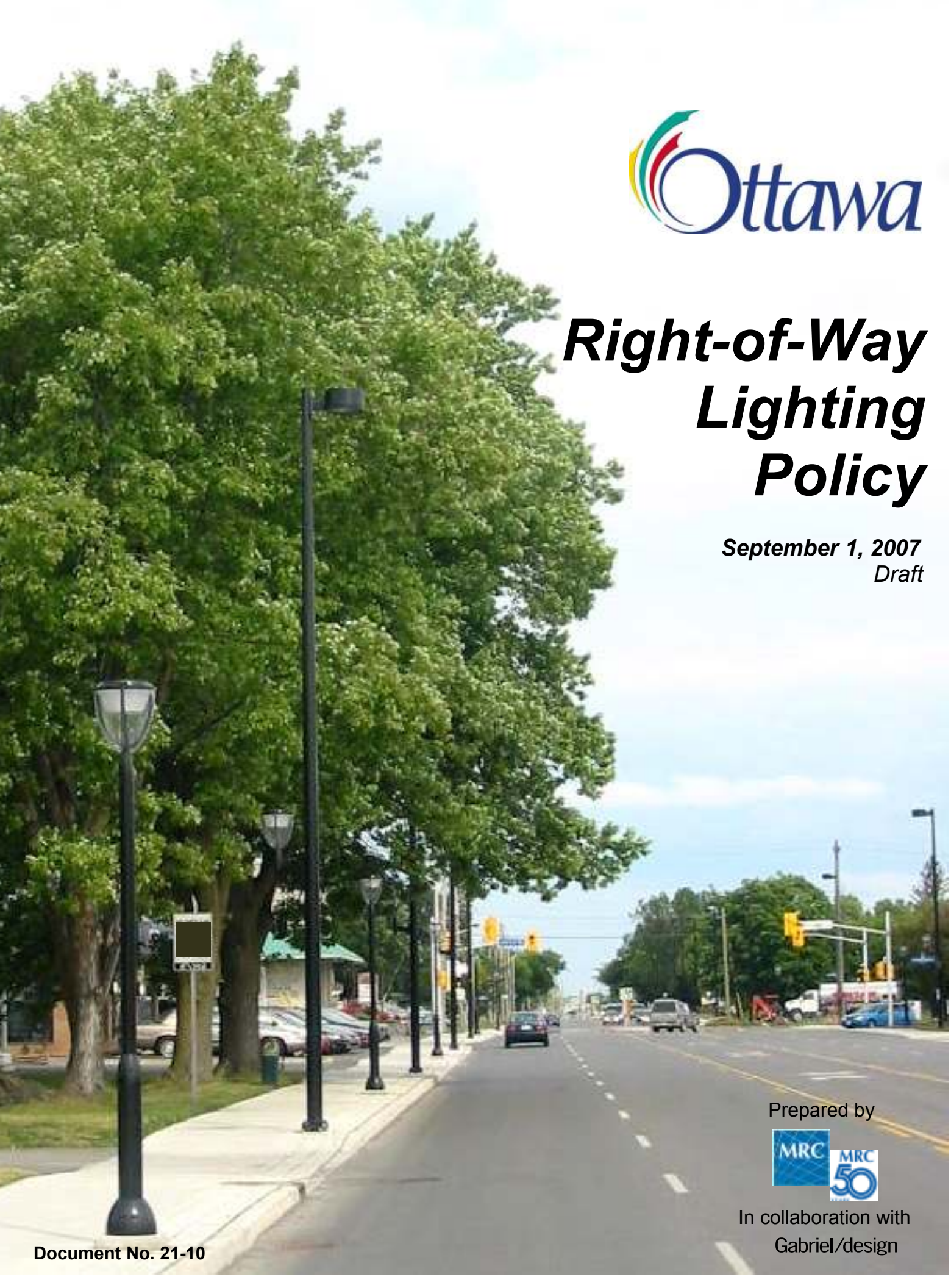

Right-of-Way Lighting Policy

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CHAPTER 1 INTRODUCTION

1.1 GENERAL

With the amalgamation of the former municipalities, it was necessary for the City of Ottawa to develop a Right-of-Way Lighting Policy in an effort to standardize the design and application of roadway and sidewalk lighting within the city boundaries. The Right-of-Way Lighting Policy identifies lighting related issues to be addressed in construction and reconstruction projects and future planning discussions with the public, developers, stakeholders and City officials.

The Right-of-Way Lighting Policy was developed using recognized national and international practices for roadway and sidewalk lighting, including the ANSI / IESNA *RP-8-00 Roadway Lighting*[i] and TAC *Guide for the Design of Roadway Lighting*[ii] as benchmarks. Building upon these benchmarks, the Policy adopted specific standards and modified others in order to develop a more cost-effective and environmentally conscious strategy for lighting rights-of-way. The Policy was also developed in context of the *City of Ottawa Official Plan*[iii] in terms of roadway and land use area classifications. The Policy also incorporates selected components of the *City of Ottawa Residential Street Lighting Policy*, approved on December 12, 2001. The 2001 policy is now superceded by this broader-based lighting policy.

This Policy adopts an approach for right-of-way lighting where all areas of the City are placed into one of two categories; "Special Areas" and "All Other Areas". "Special Areas" of the City includes land use areas as identified in the *City of Ottawa Official Plan Schedules*[iii] *A and B* (e.g. Mixed-Use Centres, Traditional Mainstreets and Central Areas) and also as identified in this Policy (e.g. Community Design Plan (CDP) Core Areas and Rural Area Village *mainstreets*). "All Other Areas" applies to parts of the City outside of the designated "Special Areas". The "Special Areas" will receive decorative style lighting equipment and metal halide lighting (white light) to highlight the distinctiveness of the area. "All Other Areas" will receive standard lighting equipment and high pressure sodium lighting.

The Right-of-Way Lighting Policy includes information on the purpose and impacts of street lighting, minimum required lighting levels, acceptable styles of lighting poles and fixtures, priority and associated aspects of street lighting such as designing with reducing light pollution in mind, and the use of banners on street light poles.

This Policy will be reviewed as needed and updated appropriately to incorporate changes in lighting technologies, lighting hardware and economics. Opportunity for public input to substantive changes in the Policy will be provided through a report to Committee prepared in support of future policy updates and Council approval.

1.2 INTENT

The Right-of-Way Lighting Policy is to be used by lighting designers, the public, developers and City officials in recognizing lighting-related issues to be addressed in undertaking right-of-way lighting projects. The fundamental goal of the Policy is to provide a uniform structure for the ongoing provision of right-of-way lighting across the City carried out by the City, developers and other stakeholders. The Policy strives to achieve the following over time:

i. Reduce overall lighting equipment inventory to achieve savings on maintenance and lifecycle replacement,

ii. Provide a more uniform lighting approach throughout the City of Ottawa,

iii. Provide pole and fixture options that are high quality, cost efficient and maintainable,

iv. Reduce operational and maintenance budgets for right-of-way lighting,

v. Improve maintenance response time for right-of-way lighting,

vi. Improve urban design with uniform right-of-way lighting installation,

vii. Reduce light pollution by lowering lighting levels and requiring use of full cut-off fixtures in specified urban areas and by reducing marker lighting levels in the rural area,

viii. Reduce energy consumption by using energy efficient fixtures, and

ix. Establish guidelines for assessing the need and prioritization of new right-of-way lighting.

The Right-of-Way Lighting Policy applies to roadways and sidewalks within public rights-of-way under the jurisdiction of the City. It does not apply to private properties, parks, open spaces, and pathways. It also does not apply to federal and provincial roadways. Right-of-way lighting on these roadways will be undertaken by the respective roadway authority on a project-by-project basis in cooperation with the City of Ottawa as may be required. Transitway lighting is undertaken by the City in accordance with the *Transitway Design Manual (October 1993)*, as amended from time to time.

Although the Policy addresses several lighting design situations, there may be instances where a lighting design issue is not covered. Where special circumstances in lighting design arise that are not addressed in this policy the Director of Transportation and Parking Operations has authority to vary from the requirements of this policy as may be required.

1.3 PURPOSE OF LIGHTING

The main purpose of right-of-way lighting is to achieve a level of visibility that assists the motorists and pedestrians to perceive distinctly, and with certainty, roadway details such as raised curbs, horizontal bends and obstacles in the roadway.

Right-of-way lighting is an operative tool that provides both economic and social benefits to the public including:

i. Reducing night time accidents,

ii. Facilitating traffic flow,

iii. Promoting commercial activity downtown, in CDP Core Areas, Mixed Use Centres, and Village *mainstreets* by the general public,

iv. Encouraging night time use of public & private facilities such as libraries, community centres, entertainment facilities and commercial areas, and

v. Assisting in crime prevention and police enforcement.

The quality and safety of public rights-of-way is greatly influenced by the application of proper street lighting and while very beneficial when used appropriately, right-of-way lighting may have negative impacts when not implemented correctly such as:

i. Increased nighttime sky glow,

ii. Light trespass onto adjacent properties,

iii. Glare, and

iv. Increased energy consumption resulting in increased energy costs and greenhouse gas emissions.

With careful planning and proper use of lighting poles and fixtures, the design of the right-of-way lighting can provide a comfortable nighttime environment for both motorists and pedestrians using the City's rights-of-way.

CHAPTER 2 LIGHTING LEVELS AND DESIGN REQUIREMETNS

2.1 LIGHTING DESIGN CALCULATIONS

Lighting design calculations shall be carried out as described in *Annex A Calculation and Measurement Parameters* and *Annex B Design Guides and Example* of the ANSI / IESNA RP-8-00 *Roadway Lighting*. When performing lighting calculations, the travelled pavement width on which the calculation is being undertaken, shall include from face of curb to face of curb (or from the painted line / edge of asphalt to the painted line / edge of asphalt where no curb is present). Similarly for sidewalks, the lighting calculations shall be carried out to include the sidewalk from the edge of concrete to edge of the concrete of the sidewalk. The maintenance factor or light loss factor for all roadway and sidewalk lighting calculations shall be 0.7 in the City of Ottawa.

In performing lighting computations, the designer should always attempt to minimize the amount of 'over lighting', inherent in some lighting designs by manipulating one or more lighting parameters (including luminaire mounting height, pole spacing or luminaire lamp wattage). The minimum lighting average must be achieved while still satisfying the lighting uniformity and glare requirements outlined in Table 2.1 *Required Average Roadway Lighting Levels.*

2.2 REQUIRED AVERAGE ROADWAY LIGHTING LEVELS

There are two distinct areas for rights-of-way lighting within the City of Ottawa; "Special Areas" and "All Other Areas". For both areas the required average roadway lighting levels are the same (for similar road classifications) as shown in Table 2.1 *Required Average Roadway Lighting Levels.* In this policy the City has adopted the lighting approach of the former City of Ottawa for average light levels on new Local roads. Table 2.1 therefore shows that Local roads in new residential, Employment Areas and Mixed Use Centres in the Urban Area are to be lit at one-half the IESNA recommended light levels *(*see also Chapter 4 *Context Based Policy Applications* for exceptions). The Table also shows the minimum average Luminance levels, minimum average maintained Illuminance levels, the maximum uniformity ratios and the maximum glare ratio by roadway and area classification.

2.2.1 Illuminance Criteria

The Illuminance method will complement the Luminance lighting criteria for designing roadway lighting of all tangent sections of roadway. Illuminance will be used as a secondary lighting design tool for field measurements and verification of the lighting design. It will only be used on its own to design roadway lighting for curvilinear road sections, sidewalks / walkways and intersections.

2.2.2 Luminance Criteria

The Luminance method will now be utilized to design roadway lighting for all tangent sections of roadway throughout the City of Ottawa. Right-of-way lighting designs will not be required to satisfy both Luminance and Illuminance criteria. Luminance will only be complemented by the Illuminance for field verification of lighting designs with the Luminance criteria taking precedence except as mentioned in Section 2.2.1 *Illuminance Criteria.* Refer to Appendix F *Luminance and Illuminance* for a sample calculation illustrating the impacts of attempting to utilize both criteria for roadway lighting designs.

2.2.3 Small Target Visibility (STV) Criteria

At the time of developing the Policy, the Roadway Lighting Committee of IESNA had yet to decide on the reliability of the STV method for lighting design. Although all of the Committee members concur that a contrast metric was desirable for lighting design, they did not agree that the STV method was that metric. The STV criteria and any new lighting criteria should be investigated further at the time of any future update to the Right-of-Way Lighting Policy.

Table 2.1 Required Average Roadway Lighting Levels

ROADWAY CLASSIFICATION		AREA CLASSIFICATION †	LUMINANCE		GLARE	ILLUMINANCE	
			Average Luminance L_{avg} (Cd/m^2)	Uniformity Ratio L_{avg} / L_{min}	Veiling Luminance Ratio L_{Vmax} / L_{avg}	Minimum Maintained Average E_{avg} (Lux)	Uniformity Ratio E_{avg} / E_{min}
URBAN AREA	ARTERIAL	Mixed Use Centre / Central Area	1.20	3.0	0.3	17.0	3.0
		Employment / Enterprise Area	0.90	3.0	0.3	13.0	3.0
		General Urban Area / Other	0.60	3.5	0.4	9.0	4.0
	MAJOR COLLECTOR	Mixed Use Centre	0.80	3.0	0.3	12.0	3.0
		Employment / Enterprise Area	0.60	4.0	0.4	9.0	4.0
		General Urban Area / Other	0.40	4.0	0.4	6.0	4.0
	COLLECTOR	Mixed Use Centre / Central Area	0.60	3.5	0.4	9.0	4.0
		Employment / Enterprise Area	0.40	4.0	0.4	6.0	4.0
		General Urban Area / Other	0.30	4.0	0.4	4.5	4.0
	LOCAL	Mixed Use Centre / Central Area	0.30 ▲	6.0	0.4	4.5 ▲	6.0
		Employment / Enterprise Area	0.25 ▲	6.0	0.4	3.5 ▲	6.0
		General Urban Area / Other	0.15 ▲	6.0	0.4	2.0 ▲	6.0
RURAL AREA	ARTERIAL	Village *Mainstreet*	0.80	3.0	0.3	12.0	3.0
		All Other Roadways	Marker Lighting Only				
	COLLECTOR	Village *Mainstreet*	0.60	4.0	0.4	9.0	4.0
		All Other Roadways	Marker Lighting Only				
	LOCAL *	Village *Mainstreet*	0.40	6.0	0.4	6.0	4.0
		All Other Roadways	Marker Lighting Only				

† Area Classification as defined by the City of Ottawa Official Plan Schedules A & B and the Right-of-Way Lighting Policy.

* Includes Estate and Village Residential roadways.

▲ Reconstructed existing illuminated Urban Local roadways shall maintain full existing IESNA lighting levels (i.e. 2 x light level shown)

2.3 INTERSECTIONS

2.3.1 Intersections of Public Rights-of-Way

Urban area intersections will be fully lit if one of the intersecting roadways has full continuous lighting. Urban area intersections will also be fully lit if they have traffic signals. This is to promote visibility and safety at night for the intersection as it is a location where pedestrians, cyclists and motorists all meet and negotiate for right of passage with each other at the controlled intersection. The intersection lighting shall be the sum of the intersecting roadway lighting levels. Based on Table 2.1 *Required Average Roadway Lighting Levels,* the Road and Area Classes intersect to form fifteen types of intersections. The required lighting levels for each of these intersections are shown in Table 2.2 *Required Average Lighting Levels for Intersections* that sets out the sum of the lighting values of the two intersecting roadways. To determine the class of the roadway refer to Schedules "E" to "H" of the City of Ottawa Official Plan[iii]. In cases where the sum cannot be achieved (i.e. lower than the required levels in Table 2.2) due to the geometric design or other physical limitations of the intersection, such as the location of Hydro utilities, then the intersection levels, as a minimum, shall be 50% greater than the highest lighting level of the intersecting roads. Table 2.2 will always take precedence for intersection lighting and not until all other alternatives have been exhausted will the 50% exception to Table 2.2 apply. For intersections with only one of the intersecting roads having full continuous lighting, the intersection light levels shall be 50% greater than the levels of the fully lit approaching roadway. The non-illuminated intersecting roadway shall have transition lighting as described in Section 2.11 *Transition Illumination.*

Where the design lighting levels of the intersecting roads exceed the criteria in Table 2.1 *Required Average Roadway Lighting Levels,* the design levels shall then be used to determine the intersection requirements. This is to maintain visibility and safety of everyone using the intersection by 'highlighting' the area with increased lighting levels compared to the levels on the approaching roadway of the intersection.

2.3.2 Intersections of Public Rights-of-Way with Transitways

Lighting of intersections of Transitways with public road rights-of-way will be the sum of the Transitway lighting level as required by the *Transitway Design Manual (October 1993)* and the public roadway lighting level as set out in Table 2.1 *Required Average Roadway Lighting Levels.* In cases where the sum cannot be achieved due to the geometric design or other physical limitations of the intersection, such as the location of Hydro utilities, then the intersection levels, as a minimum, shall be 50% greater than the highest lighting level of the intersecting public roadway and Transitway.

Table 2.2 Required Average Lighting Levels for Intersections

INTERSECTING ROADWAY CLASSIFICATION [iii]	MINIMUM MAINTAINED AVERAGE (Lux) BY AREA CLASSIFICATION [vi]			Uniformity Ratio E_{avg} / E_{min}
	Mixed Use Centre / Central Area	Employment / Enterprise Area	General Urban Area / Other	
ARTERIAL & ARTERIAL	34.0	26.0	18.0	3.0
ARTERIAL & MAJOR COLLECTOR	29.0	22.0	15.0	3.0
ARTERIAL & COLLECTOR	26.0	19.0	13.5	3.0
ARTERIAL & LOCAL	26.0	20.0	13.0	3.0
ARTERIAL & LOCAL *(½ IESNA[i])*	21.5	16.5	11.0	3.0
ARTERIAL & TRANSITWAY	37.0	33.0	29.0	3.0
MAJOR COLLECTOR & MAJOR COLLECTOR	24.0	18.0	12.0	3.0
MAJOR COLLECTOR & COLLECTOR	21.0	15.0	10.5	3.0
MAJOR COLLECTOR & LOCAL	21.0	16.0	10.0	3.0
MAJOR COLLECTOR & LOCAL *(½ IESNA[i])*	16.5	12.5	8.0	4.0
MAJOR COLLECTOR & TRANSITWAY	32.0	29.0	26.0	3.0
COLLECTOR & COLLECTOR	18.0	12.0	9.0	4.0
COLLECTOR & LOCAL	18.0	13.0	8.5	4.0
COLLECTOR & LOCAL *(½ IESNA[i])*	13.5	9.5	6.5	4.0
COLLECTOR & TRANSITWAY	29.0	26.0	24.5	4.0
LOCAL & LOCAL	18.0	14.0	8.0	6.0
LOCAL & LOCAL *(½ IESNA[i])*	13.5	10.5	6.0	6.0
LOCAL *(½ IESNA[i])* & LOCAL *(½ IESNA[i])*	9.0	7.0	4.0	6.0
LOCAL & TRANSITWAY	29.0	27.0	24.0	6.0
LOCAL *(½ IESNA[i])* & TRANSITWAY	24.5	23.5	22.0	6.0

2.4 SIDEWALKS

A sidewalk is a dedicated pedestrian facility located within a public road right-of-way. The minimum illumination levels for sidewalks shall be as indicated in Table 2.3 *Required Average Lighting Levels for Sidewalks* and is applicable to both "Special Areas" and "All Other Areas". For the purposes of achieving the required average lighting levels shown in Table 2.3 *Required Average Lighting Levels for Sidewalks*,

sidewalks are assumed to be located adjacent to or within 2.5 m from the light pole. The roadway lighting levels will take precedence over sidewalk lighting levels for sidewalks located more than 2.5 m away from the light pole. Therefore roadways will not be over lit in order that the lighting of sidewalks in distant locations or on the side of the road opposite a single sided lighting installation achieves the average lighting levels in Table 2.3.

Sidewalks will be illuminated at the same time as the adjacent roadway is illuminated based on available capital funding and in accordance with the priority ranking of the abutting roadway. Sidewalk lighting will be provided through 'back lighting' of the roadway lighting system and only on streets where there is a roadway lighting system. No separate dedicated sidewalk lighting systems will be installed in the City.

Sidewalks in "Special Areas" and in "All Other Areas" will be lit to the lighting levels and uniformity ratios as shown in Table 2.3. In "Special Areas", there is also the option of either utilizing pedestrian-scale poles in conjunction with 'tall-height' light poles and/or pedestrian-scale luminaires mounted onto the 'tall-height' light poles as determined through future public processes (refer to Section 3.1 *Lighting Strategy for "Special Areas"*). Without a dedicated pedestrian lighting system, the Vertical Illuminance component of the sidewalk lighting criteria identified in ANSI / IESNA *RP-8-00 Roadway Lighting*, will not be practical to implement in some circumstances such as median lighting installations and therefore is not utilized by this Policy.

Sidewalks that are lit with existing lighting from a pedestrian scale lighting system ("Special Areas") or from 'back lighting' resulting from an existing street lighting system ("All Other Areas") shall remain as is until such time when major reconstruction occurs. At that time the sidewalk lighting levels will conform to Table 2.3 *Required Average Lighting Levels for Sidewalks* as may be required.

Table 2.3 Required Average Lighting Levels for Sidewalks

ROADWAY CLASSIFICATION ADJACENT TO SIDEWALK [viii]	Maintained Illuminance Levels	
	Average Horizontal E_{avg} (Lux)	Uniformity Ratio E_{avg} / E_{min}
ARTERIAL	10.0	4.0
MAJOR COLLECTOR	5.0	4.0
COLLECTOR	3.0	4.0
LOCAL	2.0	6.0

2.5 LIGHTING POLE LOCATION AND OFFSET REQUIREMENT

Poles can be located in protected areas, unprotected areas or be mounted on structures. Poles in protected areas include poles that are located behind a physical barricade such as a guide rail or concrete barrier wall. Poles in unprotected areas include poles that are not located behind any physical barricade and are typically located behind barrier type curb or the shoulder 'rounding.' These poles are susceptible to impact by a vehicle accidentally leaving the roadway.

2.5.1 Pole Offsets

2.5.1.1 Poles in Protected Areas

Poles in protected areas shall be located on a project-by-project basis in accordance with the barrier deflection characteristics and the proposed field conditions such as finished grades and right-of-way width.

2.5.1.2 Poles in Unprotected Areas

The offset for poles in unprotected areas is defined as the distance from the front face of the barrier type curb (or edge of traveled asphalt (solid white painted line) if no barrier type curb is present) to the nearest face of the pole. Poles in unprotected areas shall have a minimum offset from the barrier type curb or edge of traveled asphalt as indicated in Table 2.4 *Pole Offsets for Poles Located in Unprotected Areas.* When using Table 2.4 the following shall be noted:

i. Deviations from the minimum pole offsets may only be approved at the discretion of the Director, Traffic and Parking Operations.

ii. The use of frangible bases on decorative and standard lighting poles shall not be permitted where the posted speed of the roadway is equal to or less then 60km/h.

iii. The pole offsets are for tangent road sections only.

iv. For curvilinear road sections, the pole offset shall be dealt with on a project-by-project basis. Refer to the *Roadside Safety Manual* [iv] for guidelines and recommendations for pole locations and offsets on curvilinear roadway sections

Table 2.4 Pole Offsets for Poles Located in Unprotected Areas

Road Class [viii]	Curbs	Minimum Permissible Pole Offset (Metres (m)) (Note 1)	
		Concrete Pole Direct Buried	Aluminum Pole Base Mounted
Arterial (Roadside)	Y	2.4 (Note 4 & 5)	0.6
	N	4.0	4.0
Arterial (Median) (Note 3)	Y	Note 2	0.6
	N	Note 2	4.0
Major Collector	Y	2.4 (Note 5)	0.6
	N	4.0	2.4
Collector	Y	1.5 (Note 5)	0.6
	N	3.0	1.5
Local	Y	1.5 (Note 5)	0.6
	N	1.5	1.5

Note:

1. Minimum permissible pole offsets can be increased as per the City's approved Urban and Rural Road Cross Sections. The minimum permissible pole offsets may be reduced if all other design options have been exhausted and the reduced offset must be approved by the Director, Traffic and Parking Operations.
   These minimum permissible pole offsets in Table 2.4 may be revised by approved City Cross Section Designs without amendment to this Policy.
2. Concrete poles direct buried are not allowed to be installed within a median.
3. Median width shall be a minimum of 1.5 m for pole installation.
4. Base-mounted aluminum poles should be given first consideration
5. For locations where there is a permanent dedicated 'on-street' parking bay abutting the traveled portion of the roadway, the minimum permissible pole offset may be reduced to 600 mm.

2.6 LIGHTING DESIGNS IN PROXIMITY TO AIRPORTS

Lighting designs in proximity to airports must adhere to Transport Canada's aerodrome standards and recommended practices. These requirements will typically restrict the height of the luminaires.

2.7 REDUCED ROADWAY LIGHTING LEVELS (ONE-HALF IESNA)

New local roads[viii] constructed in Residential, Employment and Mixed-Use Centre areas are to be lit in accordance with Table 2.1 *Required Average Roadway Lighting Levels* (at one-half of the IESNA[i] recommended light levels). However, to ensure right-of-way illumination consistency in the completion of neighbourhoods that are partially constructed or are approved for development (i.e. *Composite Utility Plan* has been approved) when this policy comes into effect, future development phases shall have right-of-way lighting designed and installed to match the existing street lighting levels up to the nearest adjacent existing or planned arterial[viii] or collector[viii] roadway. As described in Section 4.1.1 *"All Other Areas" Under Development,* Section 4.1.2 *Infill of Existing Developments* and Section 4.1.3 *"Special Areas" Under Development*, where a substantive portion of vacant development land within the adjacent arterial[viii] or collector[viii] roadway boundaries has not been approved for development (i.e. prior to *Draft Plan of Subdivision* approval), the Director, Planning Branch has the authority to select an alternate road or land use boundary (i.e. change from residential to commercial) up to which the existing street light level of illumination will apply. The one-half IESNA[i] light levels will apply to new local roads constructed beyond the existing or planned arterial[viii] road or collector[viii] road, alternate road or land use boundary.

2.8 UNDERPASS, TUNNEL, BRIDGE & AT-GRADE RAILWAY CROSSING LIGHTING APPLICATIONS

Underpasses under the jurisdiction of the City will be illuminated using wall or overhead mounted fixtures as listed in Appendix B *Approved Lighting Equipment*. The roadway lighting levels for the underpass shall be similar to the adjoining roadway and conform to Table 2.1 *Required Average Roadway Lighting Levels*. Underpasses must be illuminated if the approaches are fully illuminated. The light loss factor for underpass lighting fixtures shall be 0.7, similar to the roadway fixtures. Lighting of bridges and at-grade railway crossings will be at the same level as the adjoining roadway and be dealt with on a project by project basis based on available capital funding and priority ranking of the associated roadway. The illumination of tunnels shall be dealt with on a project-by-project basis based on available capital funding.

2.9 BICYCLE LANES

Bicycle lanes are dedicated travel lanes for bicycles located on the roadway adjacent to the curb or edge of pavement. The lanes are delineated with pavement markings and are considered part of the roadway. As such, they will be illuminated based on the required roadway lighting levels stipulated in Table 2.1 *Required Average Roadway Lighting Levels,* and any illumination requirements will be governed by the strategy for roadway lighting as set out in this Policy.

2.10 URBAN NATURAL FEATURES

Lighting design undertaken within 50 metres of a Category 1 or Category 2 Urban Natural Feature (UNF) as identified in the City's Urban Natural Features Strategy shall consider ways to mitigate potential adverse impacts that right-of-way lighting may have on the natural habitat within the UNF. Lighting design considerations in these circumstances include:

i. Placing luminaires in the right-of-way in a location that minimizes the amount of light entering the UNF.

ii. Selecting a luminaire type with lighting optics that directs light along the length of the right-of-way minimizing light spillage into the UNF.

iii. Designing to provide for reduced average light levels that meet or exceed the minimum required average light level for the roadway class, but that result in minimizing the amount of light entering the UNF.

2.11 TRANSITION ILLUMINATION

Where sections of roadways that are fully illuminated are located adjacent to sections that are not, the street lighting shall be transitioned as recommended by the *Guide for the Design of Roadway Lighting*[ii] Transitioning of the roadway illumination will allow for easier adaptation of the driver's eye from a lit to a dark section of roadway. A consistent style of lighting equipment will be used in the transition area selected from Appendix B *Approved Lighting Equipment*.

2.11.1 Full Continuous Lighting up to a Boundary Road

For unique situations where an urban road designation is being fully illuminated up to the boundary of an urban / rural area, the full illumination shall be transitioned as recommended by the *Guide for the Design of Roadway Lighting* [ii]. The transition illumination will be extended into the rural area up to and including the point where the roadway tapers from an urban cross section (four lanes with curb) to a rural cross section (two lanes without curb).

2.11.2 Transition Illumination at Intersections

For intersections where only one of the intersecting roads has full continuous lighting and the light levels at the intersection are 50% greater than the light levels of the approaching illuminated roadway (as required by Section 2.3 *Intersections*), the non-illuminated intersecting road shall have transition lighting designed to extend the lighting beyond the intersection with a maximum of two pole cycles for each approach.

2.12 MARKER TYPE LIGHTING

Marker type lighting shall consist of one of the following:

i. A single pole and luminaire located on the far right hand side of a 'T' intersection, or

ii. A single pole and luminaire located at 'super mailbox' locations, or

iii. Two poles and luminaires located diagonally opposite to each other at 'four-way' intersections.

The luminaire shall be a semi-cut off classification complete with a maximum lamp wattage of 100 watts except at 'super mailbox' locations where the luminaire shall be a full cut-off classification. Marker type lighting will only be installed for the intersection of two public rights-of-way where the rights-of-way are travelled and maintained all year round. For an intersection of a public right-of-way and a private roadway refer to Section 4.11 *Lighting of Privately Owned Roads and Lanes* for lighting recommendations. Refer to Section 4.2 *Rural Local Roads* and Section 4.3 *Existing Unlit Urban Local Roads* for context based marker type lighting installations. The installation of the marker type lighting shall be subject to the availability of both existing electric power and capital funding.

2.13 HYDRO UTILITY WITHIN THE RIGHTS-OF-WAY

2.13.1 Conditions of Service

Roadway lighting systems shall meet the *Conditions of Service* set out by the local Electrical Supply Authorities and the Electrical Safety Authority (ESA).

2.13.2 Joint Use Hydro Light Pole

Where Hydro utility poles are located within public rights-of-way, it is desirable to utilize these poles where possible for the installation of luminaires in order to minimize the number of poles within rights-of-way. These joint use Hydro / street light poles must be coordinated with the local Electrical Supply Authority and shall satisfy the requirements of *Ontario Regulation 22/04 Electrical Distribution Safety*[v] for third party equipment mounted on Hydro utility poles.

2.14 CITY APPROVAL OF LIGHTING DESIGNS BY THIRD PARTIES

Lighting design for rights-of-way in the City of Ottawa shall be performed or supervised by a Professional Electrical Engineer, registered in the Province of Ontario. The lighting design together with the lighting calculation summary shall be submitted to the Program Manager, Street Light Asset Management Unit of the City of Ottawa for review and final approval.

2.15 ROUNDABOUTS

Roundabouts shall be treated as an intersection and illuminated accordingly. Refer to Section 2.3 *Intersections* for more information.

2.16 OTHER JURISDICTIONS

Within the City of Ottawa, there are rights-of-way that are owned by, under the control of and/or that are subject to design input by other public authorities such as the National Capital Commission (NCC), the Ministry of Transportation Ontario (MTO) and Parks Canada. The NCC and MTO have their own lighting policies which take precedence over the City's Right-of-Way Lighting Policy. Parks Canada has authority for providing design input on the lighting of bridges over the Rideau Canal.

The following is a partial listing of roadways/bridges that are under the control of or subject to lighting design input by other authorities:

ROADWAYS	HIGHWAYS	BRIDGES
Aviation Parkway	Highway 17	Chaudière
Colonel By Drive	Highway 417	Portage
Confederation Boulevard	Highway 416	Alexandria
Island Park Drive		MacDonald-Cartier
Ottawa River Parkway		Billings
Queen Elizabeth Drive		Cummings
Rockcliffe Parkway		Pretoria
Experimental Farm Drive		Bank Street
Lady Grey Drive		MacKenzie King
Roads through the Greenbelt		Laurier Avenue
		Union Street
		Dunbar

As roadways/bridges are approved through future federal/municipal processes, these roadways/bridges will be subject to the respective authority's lighting policies without amendment to the above list or this Policy.

2.17 THIRD PARTY ELECTRICAL ATTACHMENTS ON LIGHT POLES

Electrical attachments such as Christmas lights and wreaths are not permitted on light poles located within any City right-of-way..

CHAPTER 3 "SPECIAL AREAS"

"Special Areas" are to receive decorative style lighting equipment in accordance with this subsection. The following locations are subject to the Special Area lighting strategy:

a. Central Area,
b. Mixed-Use Centres,
c. Town Centres,
d. Arterial Mainstreets
e. Traditional Mainstreets,
f. Heritage Conservation Districts,
g. Business Improvement Area *mainstreets*,
h. Rural Village *mainstreets* and
i. Community Design Plan (CDP) Core Areas

Areas (a) through (e) are designated and identified in the *City of Ottawa Official Plan – Schedule B Urban Policy Plan* [iii]. Area (f) is identified in Annex 4 to the *City of Ottawa Official Plan.*[iii] Areas (g) and (h) are identified in the Right-of-Way Lighting Policy and discussed in Section 3.4 *Rural Area Village Mainstreets* and Section 3.5 *Business Improvement Areas*. CDP Core Areas (i) are as shown in Section D.2 *CDP Core Areas* of Appendix D *Map Schedules* and consist of existing or future high density, mixed-use residential and commercial locations that have been identified through a Council approved Community Design Plan (CDP) process but are not identified in the map schedules to the *City of Ottawa Official Plan*. CDP Core Areas are subject to the Special Area lighting strategy as part of this Right-of-Way Lighting Policy (e.g. Riverside South CDP Core Area). CDP Core Areas may be located both in urban and in rural (village) locations. New CDP Core Areas, Village *mainstreets* and BIA *mainstreets* identified through a future public process approved by Council are subject to Special Area lighting without amendment to this Policy.

The decorative lighting equipment selection process for any "Special Area" may be initiated when one or more of the following public consultation processes occurs:

i. Commencement of an Environmental Assessment and / or design for major roadway reconstruction,
ii. Part of major lifecycle re-lighting project without roadway reconstruction,
iii. Part of preparation of a Community Design Plan for all or applicable parts of the Special Area and,
iv. Other process as approved by the Director, Traffic and Parking Operations.

Rights-of-way within any Special Area that are the subject of an Environmental Assessment (EA) or detailed road design to provide for upgrading or new construction, including sections of connecting streets, may be identified for installation of decorative lighting. When these rights-of-way have been approved through a future public process approved by Council they are subject to Special Area lighting without amendment to this Policy.

3.1 LIGHTING STRATEGY FOR "SPECIAL AREAS"

Decorative lighting shall be used on all rights-of-way in "Special Areas" except as otherwise provided for in this Policy (i.e. in BIA's and in Rural Area Villages only identified *mainstreets* are to be lit with decorative lighting equipment - other streets in these areas are to be lit with standard lighting equipment). There are three options for lighting "Special Areas" as follows:

i. 'Mid-height' pole complete with a decorative luminaire (Type E1, E2, E3, C, B1a or B2) attached to the pole by either a bracket arm or post top mounted. The decorative luminaire is complete with a Metal Halide (MH) lamp. This lighting option is applicable to all roadway classifications except arterials.

ii. 'Tall-height' pole complete with a decorative luminaire (Type C1, C2, D1 or D2) complete with a metal halide lamp and bracket arm. This lighting option is only applicable to Arterial Roads [vi].

iii. 'Tall-height' and 'Short-height' pole combination; the combination consists of a 'tall-height' pole with a single 'short-height' pole mid-span between the 'tall-height' poles. The 'tall-height' pole is complete with a decorative luminaire (Type C1, C2, D1 or D2) with a MH lamp and a bracket arm. The 'short-height' pole is complete with a decorative post top luminaire (Type B1a, B1b, B1c B1d or B2) with a MH lamp. There is also the option to have an additional 'short height' style luminaire attached to the 'tall-height' pole on the opposite side of the 'tall-height' style luminaire for additional lighting on the sidewalk side. This lighting option is applicable to all roadway classifications.

All poles and luminaires for the "Special Area" lighting shall be selected from the "Special Area" equipment list in Appendix B, Section B.1 *"Special Areas"*. All new and existing decorative lighting poles used in "Special Areas" may accommodate banner and/or planter arms at the request by a proponent subject to the following. The proponent shall submit in addition to the request for the addition of banner and/or planter arms on lighting poles, an engineering report certified by a licensed Professional Engineer in the province of Ontario. The engineering report must confirm that the integrity of the light pole will not be compromised and that it can safely accommodate the additional load of the banner and/or planter arms. The report shall also illustrate the proposed mounting height on the pole, minimum vertical clearance from the ground and dimensions of the banner and/or planter.

All new lighting options selected, including the addition of banners and/or planters, are subject to approval through a public consultation process described in Chapter 3 *"Special Areas"*. For existing decorative lighting installations, the request to add banners and/or planters is subject to approval by the Director, Planning Branch and Director, Traffic and Parking Operations.

In addition to providing a certified engineering report, any banners placed on decorative poles are subject to the City's Signs By-law and must meet minimum vertical clearances as approved by the Director, Traffic and Parking Operations. Any planters placed on decorative poles shall also meet minimum vertical clearances as approved by the Director, Traffic and Parking Operations.

Within the boundary of any individual Special Area, all rights-of-way under the control of the City that are subject to special lighting will use the same style of decorative luminaire and pole to provide both for continuity in design and to simplify lighting maintenance.

3.2 HIERARCHY FOR "SPECIAL AREA" LIGHTING

Certain Special Area designations overlap with other Special Area categories. For example, a Traditional Mainstreet may be located within a Business Improvement Area, and both may lie within a Heritage Conservation District. To deal with situations such as this, a hierarchy approach has been developed to assist in determining the style of right-of-way lighting to be applied. The following "Special Areas" are listed in order of precedence for the application of the Policy in "Special Area" lighting:

i. Heritage Conservation Districts (HCD)
ii. Business Improvement Areas (BIA)
iii. Central Area
iv. Traditional Mainstreets, Arterial Mainstreets and Village *mainstreets*

In the example given above, because the HCD has higher illumination priority than the BIA and the Traditional Mainstreet, the right-of-way lighting style of the HCD will take precedence and apply within the overlap area only.

3.3 HERITAGE CONSERVATION DISTRICTS

Heritage Conservation Districts (HCD's) are identified in the *City of Ottawa Official Plan Annex 4 Heritage Conservation Districts*[iii]. HCD's including designated heritage areas and bridges will be subject to special (decorative style) lighting poles and fixtures.

The style of poles, luminaires and light source colour will be selected as part of a future public consultation process conducted on a district-by-district basis with the public, affected residents and stakeholders. For local roads in HCD's, the light level can also be selected as part of the future public consultation process provided that it is not less than a "marker" standard and not greater than the recommended light levels for local roads shown in Table 2.1 *Required Average Roadway Lighting Levels* (one-half IESNA recommended light level). Once a style of lighting equipment is selected through the consultative process, the same style of equipment will be required in all future right-of-way lighting or re-lighting projects within the respective HCD. This is consistent with the intent of the lighting policy to reduce the range of lighting equipment across the City while providing opportunity for community input and tailoring the lighting design to the needs of each HCD.

3.3.1 Public Consultation Process

The lighting equipment selection process within any HCD may be initiated when one or more of the following public consultation processes occurs:

i. Commencement of an Environmental Assessment and / or design for major roadway reconstruction,

ii. Part of major lifecycle re-lighting project without roadway reconstruction,

iii. Part of preparation of a Community Design Plan for all or applicable parts of the HCD and,

iv. Other process as approved by the Director, Traffic and Parking Operations.

Lighting poles and fixture styles for HCD's may be selected from one of the following:

i. Specific decorative lighting equipment used in an established HCD as shown in Appendix E *Lighting Styles in Existing Heritage Conservation Districts* or,

ii. The approved Special Area decorative style lighting equipment as listed in Appendix B *Approved Lighting Equipment* or,

iii. One new or customized equipment type to suit the individual nature of the HCD.

New or customized lighting equipment must be approved by both Planning, Transit and Environment and by Public Works and Services and must meet or exceed the lighting performance standards of this Policy.

3.3.2 Boundary Roads of Heritage Conservation Districts

Supplementary standard (non-decorative) lighting equipment will be used on arterial and collector roadways that pass through or form the boundary of a HCD in order to satisfy Table 2.1 *Required Average Roadway Lighting Levels*. The standard lighting equipment shall be selected from Appendix B *Approved Lighting Equipment*. The lighting equipment of a local road that forms the boundary of a HCD will be selected from one of the following:

i. The existing special lighting equipment style from within the adjoining HCD,

ii. The special lighting equipment style selected through an approved study process, or

iii. If neither (i) nor (ii) apply, the equipment style that is to be used on the boundary road will be the same as that to be used on the same roadway beyond the HCD boundary.

3.4 RURAL AREA VILLAGE *MAINSTREETS*

There are a total of twenty-six villages within the Rural Area identified in the *City of Ottawa Official Plan – Schedule G Rural Road Network* [iii] including:

Galetta	Kinburn	Fitzroy Harbour
Constance Bay	Dunrobin	Carp
Ashton	Munster	Richmond
Fallowfield	Manotick	North Gower
Kars	Osgoode	Greely
Metcalfe	Kenmore	Vernon
Marionville	Vars	Carlsbad Springs
Navan	Sarsfield	Cumberland
Burritt's Rapids	Norte-Dame-des Champs	

Designated Village *mainstreets* shall have decorative lighting equipment while all other rights-of-way within the Village shall have standard street lighting equipment.

3.4.1 Rural Village *Mainstreet* Classification

The use of the term *mainstreet* within this Policy refers to the primary (i.e. commercial and/or residential) street(s) of a Special Area including the designations, "Traditional Mainstreet" or "Arterial Mainstreet" of the *City of Ottawa Official Plan – Schedule B Urban Policy Plan*[iii] and other suggested *mainstreets* subject to a future public consultation process as identified in Appendix C *Mainstreet Roads*.

Within the boundaries of a rural Village, only arterial and collector *mainstreet* roadways that provide direct, through access in to and out of the Village as well as local *mainstreet* roadways that provide access to commercial and or 'mixed-use' properties are candidate roads to receive special (decorative) lighting equipment.

Appendix C.2 *Rural Area Villages* provides suggested *mainstreets* for each of the twenty-six rural area Villages in the City. In some cases, only parts of the roads listed would be considered as a *mainstreet* for decorative lighting purposes within the Village. The number and extent of *mainstreet* Roads in any Village may be refined as part of a future public consultation process. Other collector and local roadways internal to the Village are to receive "marker" lighting with standard lighting equipment selected from Appendix B *Approved Lighting Equipment*.

3.4.2 Public Consultation Process

The extent of Village *mainstreet* roads that are to be lit, the light source colour and the style of poles and luminaires will be selected as part of a future public consultation process carried out on a village-by-village basis with affected Village residents and stakeholders.

Once a style of lighting is selected through the consultative process, the same style of lighting equipment is required to be used in future lighting or re-lighting projects on other applicable *mainstreet* roads in the respective Village. This is consistent both with the intent of the lighting policy to reduce the range of lighting equipment across the City and with the desire to achieve design consistency in terms of a lighting theme for each Village.

The lighting equipment selection and *mainstreet* identification process for any Village *mainstreet* will be initiated when one or more of the following public consultation processes occurs:

i. Commencement of an EA and / or design for major *mainstreet* reconstruction,

ii. Part of major lifecycle re-lighting project without *mainstreet* reconstruction,

iii. Part of preparation of a Community Design Plan for all or applicable parts of a Village and,

iv. Other process as approved by the Director, Traffic and Parking Operations.

The decorative style lighting equipment for the rural area Village *mainstreets* shall be selected from the approved Special Area decorative lighting equipment listed in Appendix B *Approved Lighting Equipment*.

3.5 BUSINESS IMPROVEMENT AREAS

Existing Business Improvement Areas (BIAs) are shown in Section D.1 *Business Improvement Areas* of Appendix D *Map Schedules.* There are currently thirteen designated BIAs in the City as follows:

Bank	Byward	Preston
Rideau	Somerset	Somerset Village
Sparks	Vanier	Westboro
Barrhaven	Orleans	Carp
Manotick		

The number and location of Business Improvement Areas are subject to change without amendment to the Right-of-Way Lighting Policy. Only the *mainstreets* within a BIA District are candidates for special street lighting equipment (refer to Appendix C.1 *Business Improvement Area* for existing *mainstreet* Roads). All other roadways within the BIA District shall be lit with standard street lighting equipment. The special and standard street lighting equipment shall be selected from Appendix B *Approved Lighting Equipment.*

3.5.1 Public Consultation Process

The style of poles and luminaires (decorative and/or standard) and the *mainstreets* to which they will apply will be selected as part of a future public consultation process carried out on an area-by-area basis and undertaken in consultation with the public, affected residents and stakeholders.

Once a style of lighting is selected through the consultative process the same style of lighting equipment is required to be used in future lighting or re-lighting projects on other *mainstreets* within the respective BIA identified either in the Right-of-Way Lighting Policy (Appendix C.1 *Business Improvement Area*) or through another process as described below, as may be applicable. This is consistent both with the intent of the lighting policy to reduce the range of lighting equipment across the City and with the desire to achieve design consistency in terms of a lighting theme for each BIA.

The lighting equipment selection process for any BIA *mainstreet* will be initiated when one or more of the following public consultation processes occurs:

i. Commencement of an EA and / or design for major *mainstreet* reconstruction,

ii. Part of major lifecycle re-lighting project along the *mainstreet* without roadway reconstruction,

iii. Part of preparation of a Community Design Plan for all or applicable parts of a BIA and,

iv. Other process as approved by the Director, Traffic and Parking Operations.

For the public consultation process, the lighting pole and fixture style may be selected from one of the following:

i. Existing BIA's with decorative style lighting will continue to use, when decorative lighting is extended or the BIA boundary is enlarged, the same style of equipment along designated *mainstreets* within the respective BIA or,

ii. New BIA's and existing BIA's subject to *major roadway reconstruction* [1] along identified *mainstreets* shall select the Special Area decorative lighting equipment from Appendix B *Approved Lighting Equipment.*

3.5.2 Boundary Roads of Business Improvement Areas

Lighting of any *mainstreet* road that forms the boundary of a BIA will be undertaken using one of the following:

i. The existing special lighting equipment style from within the adjoining BIA or,

ii. The decorative lighting equipment style from Appendix B *Approved Lighting Equipment* as selected through an approved study process, or

iii. If neither (i) nor (ii) apply, the equipment style that is to be used on the boundary road will be the same as that to be used on the same roadway beyond the BIA boundary.

CHAPTER 4 CONTEXT-BASED POLICY APPLICATION

4.1 AREAS UNDER DEVELOPMENT – LIGHTING LEVELS AND STYLE

The following requirements will ensure consistency in right-of-way lighting for areas under development at the time the Policy is approved.

4.1.1 "All Other Areas" under Development

To ensure right-of-way illumination consistency in the completion of neighbourhoods that are partially constructed or are approved for development (i.e. *Composite Utility Plan* has been approved) when this policy comes into effect, future development phases shall have right-of-way lighting designed and installed to match the existing street lighting levels and equipment style up to the nearest adjacent existing or planned arterial or collector roadway. However, where a substantive portion of vacant development land within the adjacent arterial or collector roadway boundaries has not been approved for development (i.e. prior to *Draft Plan of Subdivision* approval), the Director, Planning Branch has the authority to select an alternate road or land use boundary (i.e. change from residential to commercial) up to which the existing street light level of illumination and equipment style will apply.

For example, if a specific style of lighting equipment (e.g. a lantern style luminaire), was chosen for the abutting development then that same style fixture is to be used in the new adjoining development up to the nearest existing or planned arterial or collector road designation, or other approved boundary, regardless of change in land ownership / developer.

4.1.2 Infill of Existing Developments

For infill developments, the existing roadway lighting levels of the abutting developed land shall apply. Compatible style of roadway lighting poles and luminaires shall be utilized for the street lighting design. The lighting equipment shall be selected from Appendix B *Approved Lighting Equipment*.

4.1.3 "Special Areas" Under Development

Where an area subject to Special Area lighting policies is partially constructed or is approved for development at the time this Policy comes into effect (e.g. Kanata Town Centre), future development phases shall have right-of-way lighting designed and installed to match the existing street lighting levels and style of equipment for the remaining development land up to the nearest adjacent existing or planned collector roadway, arterial roadway or land use boundary (i.e. change from residential to commercial). However, where a substantive portion of vacant development land within the adjacent collector road, arterial road or land use boundaries has not been approved for development (i.e. prior to *Draft Plan of Subdivision* approval), the Director, Planning Branch has the authority to select an alternate road or land use boundary up to which the existing street lighting 'style of equipment' will be installed.

4.2 RURAL ROADS

New and existing rural roads[vii] shall receive marker type lighting installations as outlined in Section 2.12 *Marker Type Lighting*. Rural Village *mainstreets* are the exception to this rule and shall be lit in accordance with Section 3.4 *Rural Area Village Mainstreets.*

4.3 EXISTING UNLIT URBAN LOCAL ROADS

Unlit urban local roads[vii] shall receive an upgrade to marker type lighting installations as outlined in Section 2.12 *Marker Type Lighting*. In addition to the availability of both electric power and capital funding (Section 2.12 *Marker Type Lighting)*, the installation of the marker lighting shall be based on the priority ranking of this Policy. The priority ranking of some of the local roads in some instances is the same and therefore any marker type lighting shall be completed based on the availability of both electric power and capital funding.

4.4 EXISTING URBAN LOCAL ROADS WITH MARKER LIGHTING

Existing urban local roads[vii] with marker lighting at the intersection shall remain as is. At the time of any major roadway reconstruction the existing marker lighting will be reinstated but the lighting equipment shall be selected to conform with Appendix B *Approved Lighting Equipment*.

4.5 EXISTING URBAN LOCAL ROADS WITH PARTIAL LIGHTING

Existing urban local roads[vii] with partial mid-block illumination shall remain as is. At the time of any major roadway reconstruction the partial mid-block illumination will be reinstated as per existing conditions except that the lighting equipment will conform to Appendix B *Approved Lighting Equipment*. Unlit intersections in the vicinity of the partial mid-block lighting shall be upgraded to marker type lighting as outlined in Section 2.12 *Marker Type Lighting.*

4.6 LIGHTING FOR THE FORMER CITY OF OTTAWA AREA

The roadways within the former City of Ottawa have full continuous illumination. The existing lighting levels are slightly higher compared to ANSI / IESNA[i] for arterial roadways and are lower for collector and local roadways. At the time of major roadway reconstruction in the former Ottawa area, the existing illumination levels for arterial roads[viii] will be reduced and the collector road designation[viii] lighting levels will be increased to meet the requirements of this Policy as shown in Table 2.1 *Required Average Roadway Lighting Levels*. Local roads[viii] that are currently lit at one-half of the IES standard light level for local roads will remain unchanged conforming to Table 2.1 *Required Average Roadway Lighting Levels*.

4.7 URBAN / RURAL AREA BOUNDARY RIGHTS-OF-WAY

For rights-of-way that form the boundary between urban and rural areas, the urban classification shall always take precedence over the rural policy for lighting that specific right-of-way. However, if the rural area falls under a Special Area designation the Special Area lighting policy shall take precedence only within the limits of the Special Area.

4.8 URBAN LOCAL ROADS IN NEW RESIDENTIAL, EMPLOYMENT & MIXED-USE CENTRE AREAS

Urban local roads in new Residential, Employment, and Mixed Use Centre Areas constructed after approval of this Policy will be illuminated to one-half the ANSI/IESNA[i] recommended lighting levels as shown in Table 2.1 *Required Average Roadway Lighting Levels.* The lighting equipment shall conform to that as listed in Appendix B *Approved Lighting Equipment* and the luminaires will be of Full Cut-Off style with a maximum lamp wattage of 100 watts.

4.9 LANEWAYS

A laneway is typically a narrow roadway found in urban residential areas running between or behind houses in neighbourhood blocks. This Policy applies to laneways owned and maintained by the City. Laneways lit prior to the approval of this Policy shall remain as is with the same number of pole(s) and luminaire(s). For existing laneways without lighting, only marker lighting consisting of a single pole and luminaire shall be installed. The installation of the marker lighting will be considered if initiated by the abutting property owners and as approved by the Director, Traffic and Parking Operations. The lighting shall be subject to a lighting warrant review and availability of both capital funding and electric power. The marker lighting shall only be located at the intersection of the laneway with the public road and not within the laneway. New laneways shall be lit to a marker lighting standard at the intersection of the laneway with the road and not within the laneway.

4.10 THROUGH-BLOCK PEDESTRIAN WALKWAYS

Through-block pedestrian walkways are short, mid-block connections between two public rights-of-way. The installation of lighting for existing unlit and new through-block pedestrian walkways shall only be installed on an as requested basis and only if the through-block pedestrian walkway connects two lit public rights-of-way where both the rights-of-way and the through-block pedestrian walkway are open and maintained by the City throughout the year. The lighting of the existing through-block pedestrian walkways shall be subject to a lighting warrant review and the availability of both electric power and capital funding. For new through-block pedestrian walkways, lighting requirements shall be provided during the development of the through-block pedestrian walkway.

Typically through-block pedestrian walkways shall be lit to 2.0 Lux with a Uniformity of 4.0:1. If the through-block pedestrian walkway lighting is approved, only full cut off, 'shoe box' style luminaires (Group D) mounted at 4.6 metres above finished grade on approved lighting poles shall be used (refer to Appendix B *Approved Lighting Equipment* for equipment description).

4.11 LIGHTING OF PRIVATELY OWNED ROADS AND LANES

Lighting of privately-owned roadways and lanes shall be installed and maintained at the expense of the owner(s) of the private road or laneway. The lighting style and location is subject to the approval of the Director, Planning and Infrastructure Approvals and cannot be located in the public right-of-way.

If the private road intersection with the public right-of-way warrants the installation of a traffic control signal system, then it will be lit to City standards at the expense of the owner(s). The equipment shall conform to Appendix B *Approved Lighting Equipment*.

4.12 EXISTING CITY-OWNED LAWN LAMPS

Portions of two neighbourhoods in the former municipality of Kanata have lawn lamps installed within public rights-of-way that are owned, operated and maintained by the City of Ottawa. The existing lawn lamps are located on residential streets in the Beaverbrook and Katimavik neighbourhoods as illustrated in D.3 *Existing Lawn Lamps* in Appendix D *Map Schedules*. These lawn lamps are to be replaced with standard lighting equipment selected from Appendix B *Approved Lighting Equipment* at the time the existing fixtures reach the end of their life cycle as determined by the Director of Traffic and Parking Operations. When the lawn lights are upgraded to the standard street lighting equipment, the lighting levels will also be upgraded to meet the requirements of Table 2.1 *Required Average Roadway Lighting Levels,* i.e. one half the ANSI/IESNA [i] recommended light levels.

4.13 MAJOR RE-LIGHTING PROJECT

A major re-lighting project occurs when the existing street lighting equipment (including poles, luminaires and underground ducts and cables) has reached the end of its life expectancy and based on available funds, it is scheduled for replacement with new lighting equipment selected from Appendix B *Approved Lighting Equipment.* When the re-lighting project occurs without any major roadway reconstruction, then the extent of the re-lighting project will be the replacement of the old equipment with new and maintaining the existing lighting levels except as outlined in Section 4.6 *Lighting For The Former City of Ottawa Area.* If the major re-lighting project occurs in conjunction with a major roadway reconstruction involving a change in roadway geometry, then the re-lighting project must include a lighting design to ensure the appropriate lighting levels are achieved on the new roadway geometry as shown in Table 2.1 *Required Average Roadway Lighting Levels.* Major roadway reconstruction involves one or more of the following; underground utilities work, sidewalk and/or curb reconstruction and/or roadway geometry changes.

CHAPTER 5 LIGHTING EQUIPMENT

5.1 BACKGROUND

The City of Ottawa has developed performance criteria that the street lighting poles and luminaires included in Appendix B *Approved Lighting Equipment* meet or exceed. These requirements are in place to ensure lighting systems provide quality lighting that are efficient in terms of energy consumption, operation and maintenance.

The City will continue to use High Intensity Discharge (HID) lamps for lighting all rights-of-way; High Pressure Sodium (HPS) for "All Other Areas" and Metal Halide (MH) for "Special Areas". HID lamps are the most commonly used in luminaires for roadway lighting due to its high efficacy (light output over the life of the lamp), long service life and energy efficiency.

Light Emitting Diode (LED) lamps were considered for street lighting as it is an emergent technology that is advancing, but at this time more testing and technical information is required before it can be considered for right-of-way lighting projects within the City. With a potential longer 'lamp' life than HID lamps and significant energy savings, the LED technology should be revisited at the time of the next Policy update.

Another emergent lighting technology considered in the preparation of this policy was the induction lamp (or sometimes referred to as the electronic light bulb). Similar to HID lamps, the induction lamp has a high efficacy and an even longer lamp life. Currently, no manufacturing standards have emerged in the production of induction lamps resulting in varying lamp performance from manufacturer to manufacturer. At present, the induction lamp is more expensive to purchase compared to the standards in this policy and also requires special equipment to operate which would result in increased maintenance costs for the City. These higher costs are not offset by the longer lamp life of the induction lamp. With no standardized method for manufacturing and the initial higher cost, the induction lamp was not considered a viable option to include in the Policy. This lighting technology should be revisited at the time of the next Policy update.

Smart lighting systems were also looked at in an effort to conserve energy. The smart lighting system would simply either turn off or dim the street lights at a predetermined time. The high cost of the specialized hardware and software for this system is the primary limiting factor, and even with the expected energy savings, will realize a payback period of approximately 7.5 to 14 years. Again this technology should be revisited in future updates to the Policy.

Another technology that was investigated to provide energy savings was solar-powered street lighting equipment. Unfortunately with LED lighting still in its infancy and not making the approved lighting equipment list, the solar power option will not be a viable option if it is to be used with the standard street lighting equipment. With LED lighting requiring little energy to operate it would be ideal for a solar power application. Solar power applications should be revisited for future Policy updates as new lighting technologies are approved for use such as LED lighting.

All lighting equipment in this Policy, including but not limited to poles, luminaires, bracket arms and lamps, meets or exceeds the City of Ottawa Material Specifications. The City, in its own discretion, shall revise the Approved Lighting Equipment list by substituting similar style fixtures in the approved

equipment list on an as-needed basis (e.g. manufacturer no longer makes the approved item) and for other technical reasons.

5.2 LUMINAIRE CLASSIFICATION SYSTEM

The luminaire classification used in this Policy (i.e. *Semi Cut Off* and *Full Cut Off*) are based on the terminology of the ANSI/IESNA *RP-8-00 Roadway Lighting* [i] document. At the time of writing this Policy, the IESNA was developing a new classification system which categorized luminaires based on their lumen output in various zones as follows:

i. High Angle Light Zone
i. Forward Light Zone
ii. Back Light Zone and,
iii. Up Light Zone

When the Policy is scheduled for updating in the future, the luminaire classification system adopted from *RP-8-00 Roadway Lighting*[i] should be reviewed and revised to reflect the new terminology.

All decorative and standard luminaires listed in Appendix B *Approved Lighting Equipment* have a minimum luminaire cut-off distribution of Semi-Cut Off .

5.3 POLE COLOURS

The approved colours for the lighting poles in Appendix B *Approved Lighting Equipment* are as follows:

i. Natural (typical aluminum or concrete pole finish)
ii. Black
iii. Grey
iv. Dark Bronze
v. Dark Green

Pole colour finishes shall be in conformance with the City of Ottawa Material Specifications which supplements this Policy.

5.4 DECORATIVE LIGHTING EQUIPMENT

"Special Area" lighting equipment is listed in Section B.1 *"Special Areas"* in Appendix B *Approved Lighting Equipment* and shown in Section 5.5 *Luminaire Grouping for "Special Areas"*. Selected "Special Area" lighting equipment is also found in the lighting equipment for "All Other Areas" in Section 5.7 *Luminaire Grouping for "All Other Areas*". "Special Areas" are to be lit using uniform lighting installations with the decorative style poles and fixtures. Section 5.5 "Luminaire Grouping for Special Areas" sets out the different assemblies for decorative 'tall-height', ''mid-height' and 'short-height' poles with decorative luminaires and bracket arms. The different assemblies are also summarized

in Table 5.1 *Roadway Lighting Equipment for "Special Areas"*. Lighting of all rights-of-way in "Special Areas" shall use equipment shown in Figures 5.5 to 5.9 and in accordance with Table 5.1. Other combinations of the approved decorative poles and luminaires if requested through a public consultation process shall be subject to approval from the Director, Traffic and Parking Operations.

5.4.1 'Short-Height' Lighting Equipment

'Short-height' lighting equipment is typically comprised of a 4.3 metre high decorative pole or a 4.6 metre standard pole and a top mounted (post top) decorative luminaire. The 'short-height' pole is a pedestrian-scale pole mainly providing sidewalk lighting with a slight contribution to the roadway lighting. The maximum allowable wattage for luminaires on this type of pole is 70 watts. Because of the short height of the pole, higher wattages may produce glare that can be distracting to both the motorists and the pedestrians. Due to the low wattage, 'Short-height' poles are always used in conjunction with 'Tall-height' poles in order to achieve the required average levels shown in Table 2.1 *Required Average Roadway Lighting Levels* for the roadway.

'Short-height' lighting equipment is illustrated in Figures 5.5 & 5.6 *Decorative Lighting Assemblies For 'Short-Height' Poles*. For 'short-height' lighting installations, the 'short-height' poles and Group B luminaires can be interchanged to create different lighting assemblies compared to those shown in Figures 5.5 & 5.6 *Decorative Lighting Assemblies For 'Short-Height' Poles.*

5.4.2 'Mid-Height' Lighting Equipment

'Mid-height' lighting equipment is typically comprised of a 6.0 metre high decorative pole or a 6.1 metre standard pole and a decorative luminaire either top-mounted (post top) or side-mounted with a bracket arm. Mid-height equipment is the standard for all "Special Areas" except for local streets in BIA's and Villages as previously mentioned.

'Mid-height' lighting equipment is shown in Figures 5.7 to 5.8. For 'mid-height' lighting installations, the 'mid-height' poles and only Groups B and C luminaires can be interchanged to create different lighting assemblies compared to those shown in Figures 5.7 & 5.8 *Decorative Lighting Assemblies For 'Mid-Height' Poles.* Group E luminaires are matched exclusively to a specific decorative pole and bracket arm creating a unique lighting assembly as shown in Figure 5.8 *Decorative Lighting Assemblies For 'Mid-Height' Poles* and cannot be interchanged.

5.4.3 'Tall-Height' Lighting Equipment

'Tall-height' lighting equipment is comprised of a 9.8 metre or a 10.7 metre high pole with a decorative luminaire, side mounted onto the pole with a bracket arm. This equipment is to be used on its own for rights-of-way along Arterial Mainstreets [vi] and also in conjunction with 'short-height' poles in all other "Special Areas" as determined through the public consultation process described in Section 3.1 *Lighting Strategy for "Special Areas"*.

'Tall-height' lighting equipment is shown in Figure 5.9 *Decorative Lighting Assemblies for 'Tall-Height' Poles.* For 'tall-height' lighting installations, only the Group D1 luminaire can be interchanged with other approved 'tall-height' poles to create different lighting assemblies compared to that shown in Figure 5.9. The Group D2 luminaire is exclusive to a specific decorative pole and bracket arm creating a unique

lighting assembly as shown in Figure 5.9 *Decorative Lighting Assemblies for 'Tall-Height' Poles.* Substitution of Group D2 fixtures with other lighting poles and bracket arms is not allowed.

5.5 LUMINAIRE GROUPING FOR "SPECIAL AREAS"

The following are images of the approved Special Area lighting equipment. Please refer to Section B.1 *"Special Areas"* of Appendix B *Approved Lighting Equipment* for the manufacturer's product reference information and City standard requirements.

Figure 5.1 Group B Luminaires for "Special Areas"

B1a – Square Lantern

B1b – Hex Lantern

B1c – Round Lantern

B1d – Cone Style

B1e – Round Lantern

B2 – Square Lantern

Figure 5.2 Group C Luminaires for "Special Areas"

C – Round Cylinder

Figure 5.3 Group D Luminaires for "Special Areas"

D1 – Wing Style

D2 – Streamlined Style

Figure 5.4 Group E Luminaires for "Special Areas"

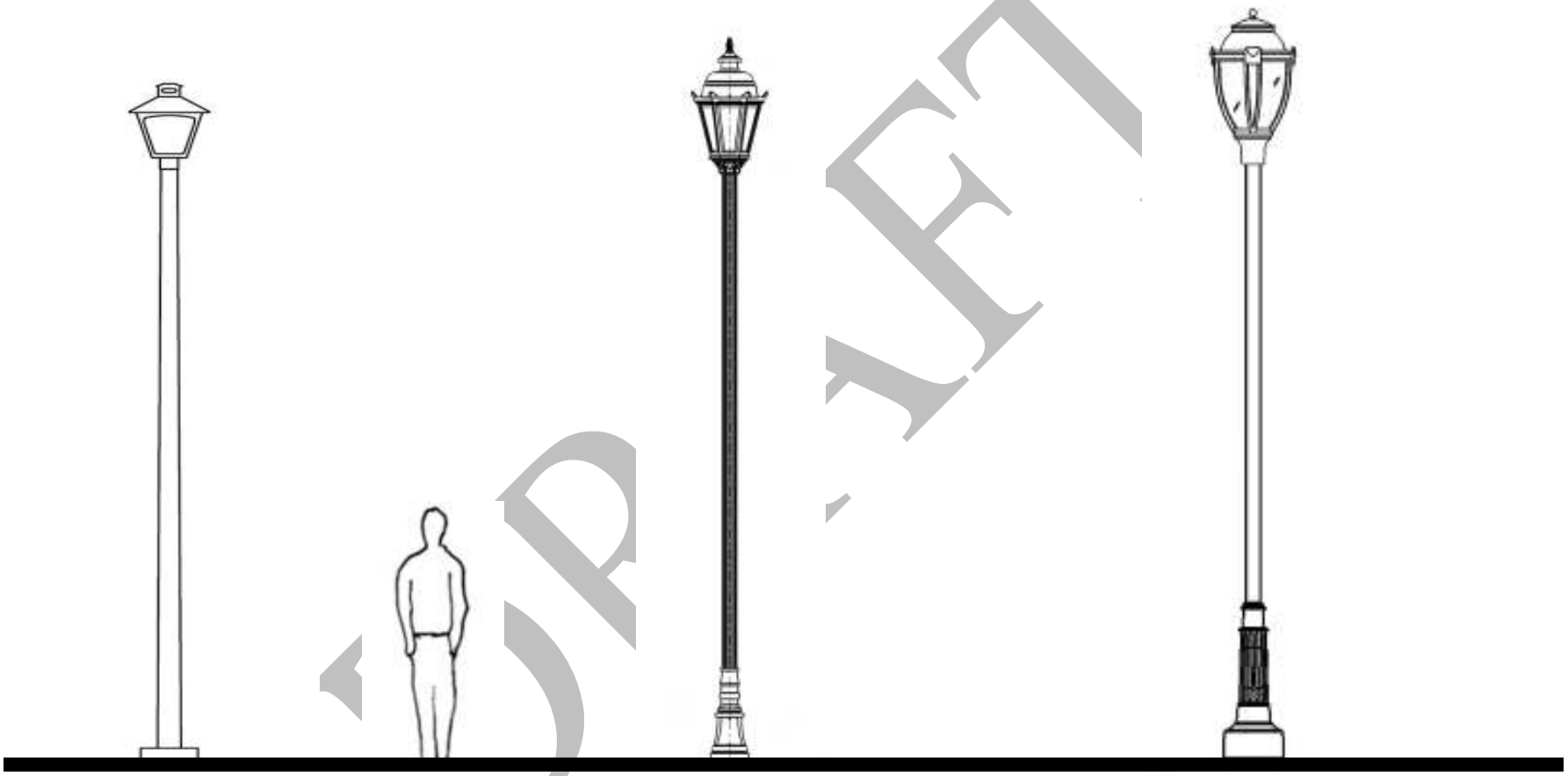
E1 – Acorn Style

E2 – Hat Style

E3 – Cage Style

Figure 5.5 Decorative Lighting Assemblies for 'Short-Height' Poles

† Refer to Table 5.1 *Roadway Lighting Equipment for "Special Areas"* for other pole options.

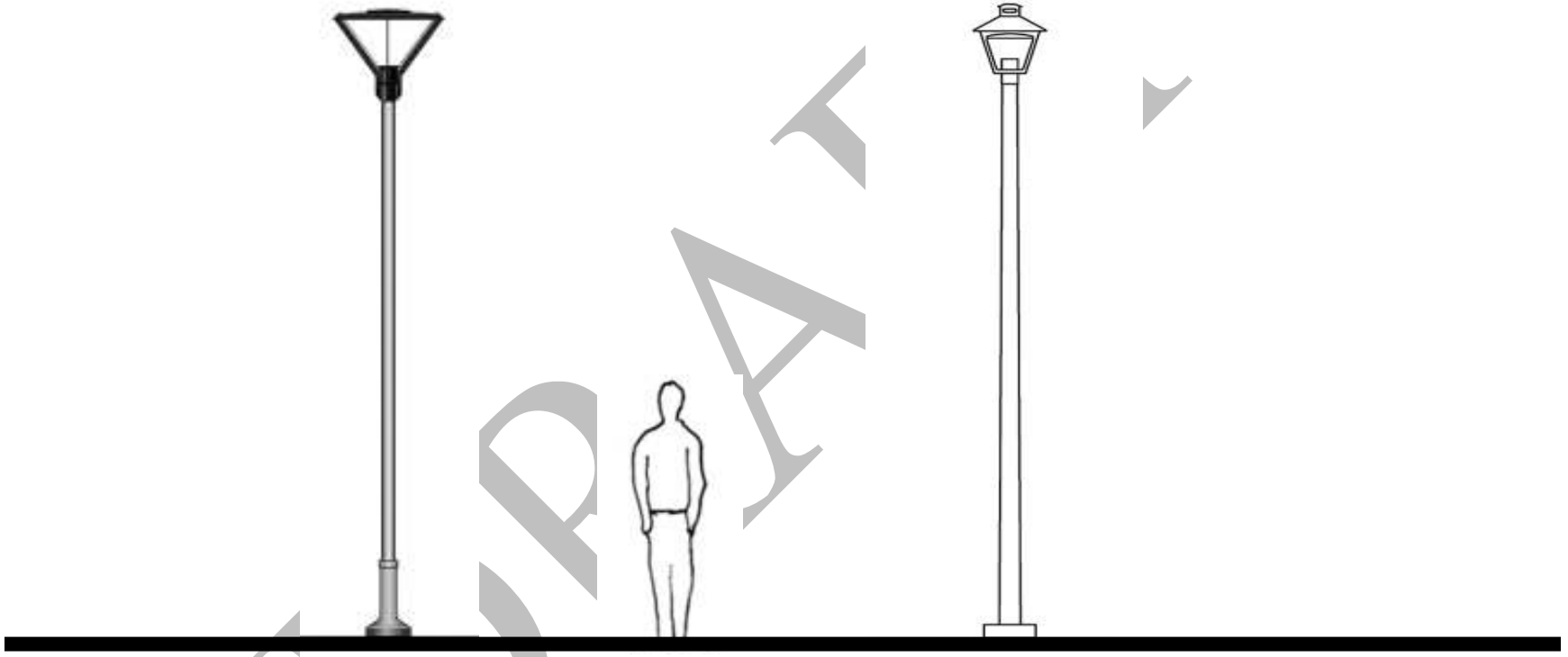


B1a – Square Lantern
Lum Cat. No. SC-24700105
Pole Cat. No. USS8050D15AB †

B1b – Hex Lantern
Lum Cat No. F146-L-FAC-70MH-120-SR3-RALXXX
Pole Cat No. P414-4FA-14-RALXXXX †

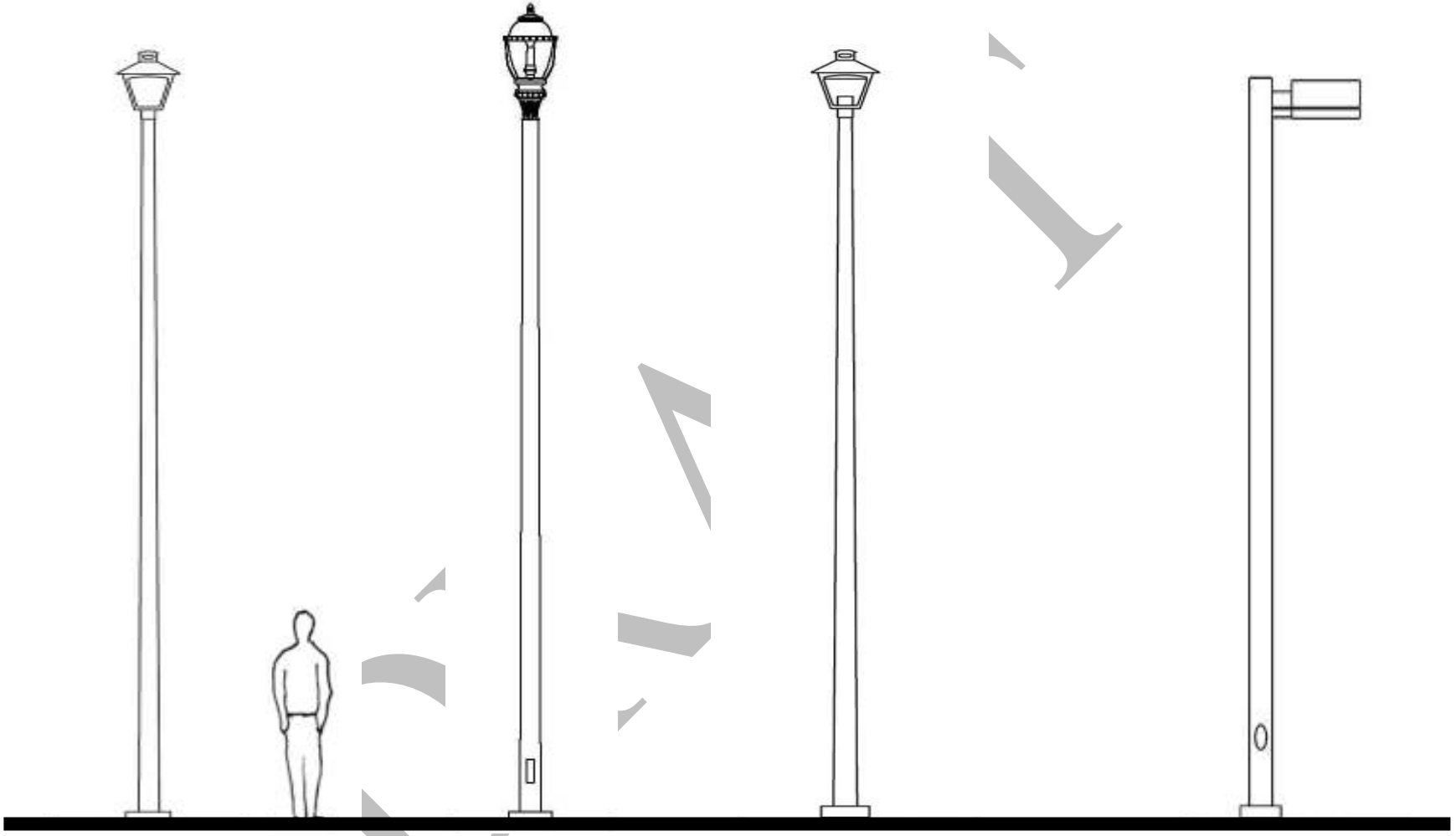
B1c – Round Lantern
Lum Cat No. L80-PCCS-70MH-SE3-120-SF80-FN4-XXXX
Pole Cat No. R80F-14-TBC1-XXXX †

Figure 5.6 Decorative Lighting Assemblies for 'Short-Height' Poles



† Refer to Table 5.1 *Roadway Lighting Equipment for "Special Areas"* for other pole options.

Figure 5.7 Decorative Lighting Assemblies for 'Mid-Height' Poles



B1a – Square Lantern
Lum Cat. No. 24715SRH120R3AYAR7124
Pole Cat. No. HA-200-B-1-XX-XX-X †

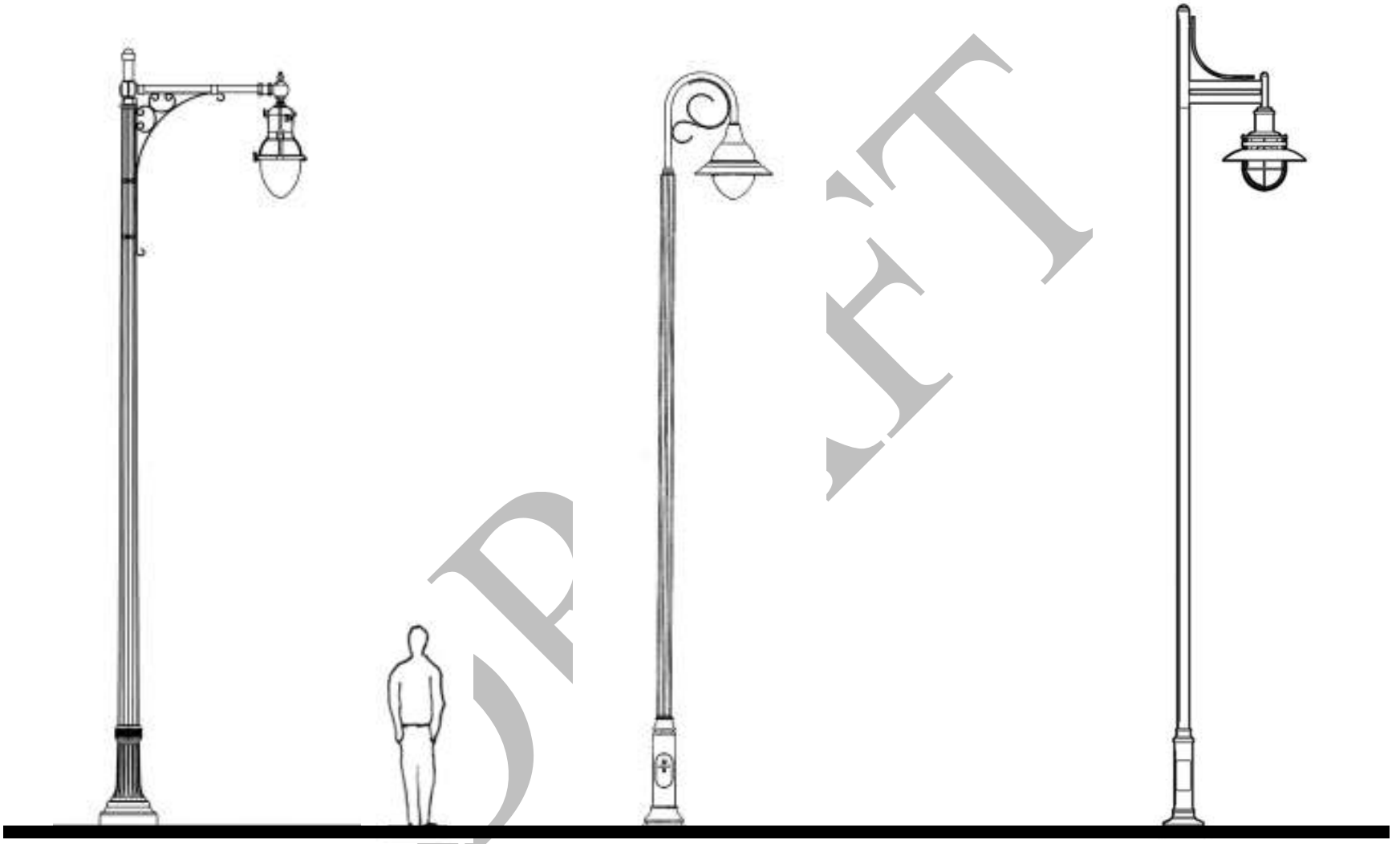
B1e – Round Lantern
Lum Cat. No. K135 SAR III 150 (MOG) MH 120 XXX
Pole Cat. No. HA-200-B-1-XX-XX-X †

B2 – Square Lantern
Lum Cat. No. 24710SRH120R2FC
Pole Cat. No. HA-200-B-1-XX-XX-X †

C – Round Cylinder
Lum Cat. No. CAS15SH22D4-CAS-OTHYD**
Pole Cat No. HA-200-B-1-XX-XX-X †

† Refer to Table 5.1 *Roadway Lighting Equipment for "Special Areas"* for other pole options.

Figure 5.8 Decorative Lighting Assemblies for 'Mid-Height' Poles

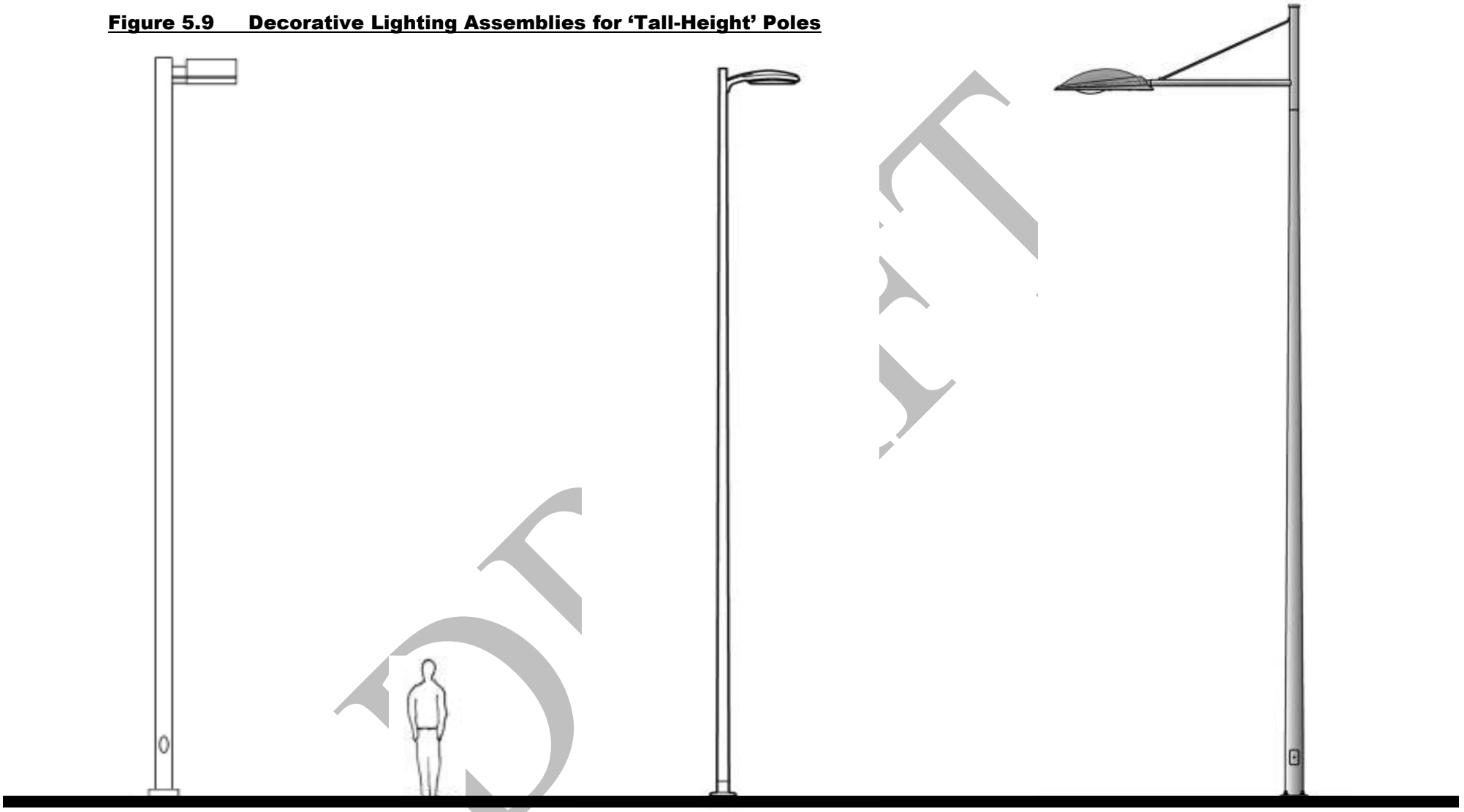


E1 – Acorn
Lum Cat. No. MPU-150MH-12-X-4
Pole Cat No. NY21/20CIS-X
Arm Cat No. CAM48/1-BHLF/200-RCA-X

E2 – Hat Style
Lum Cat. No. CPL0206-MH150-RC3-AC-120-XXX
Pole Cat No. PL85-D20-XXX
Arm Cat No. M1A-CF9PT-XXX

E3 – Cage Style
Lum Cat. No. 8222-RD3-150M-120-XXX-PC
Pole Cat No. QJ-4-AL-R-20-M-XXX
Arm Cat No. CS2-SE1-XXX

Figure 5.9 Decorative Lighting Assemblies for 'Tall-Height' Poles



C – Round Cylinder
Lum Cat. No. CAS25SW23D4CASOTHYD**
Pole Cat No. USS8050D32AB †

D1 – Wing Style
Lum Cat. No. GW13XL250HPS120CWANPPCR
Pole Cat No. USS8050D32AB †

D2 – Streamlined
Lum Cat. No. HEX250MHED28MC3120RALXXXX
Pole Cat No. ART-26-XXXX
Arm Cat No. CTP-1A-RALXXXX

† Refer to Table 5.1 *Roadway Lighting Equipment for "Special Areas"* for other pole options.

Table 5.1 Roadway Lighting Equipment for "Special Areas" – Urban Area

ROADWAY CLASS		LUMINAIRES		WATTAGE (Note 1)			POLES (Note 1)									POLE LAYOUT		
							'Tall'			'Mid'			'Short'					
				250	150	70	10.7m Concrete	9.8m Aluminum	9.8m (Note 2)	6.1m Concrete	5.5m Aluminum	6.0m (Note 2)	4.6m Concrete	4.6m Aluminum	4.3m (Note 2)	'Tall-Height'	'Mid-Height'	'Tall-Height' and/or 'Short-Height'
URBAN AREA	ARTERIAL & MAJOR COLLECTOR & COLLECTOR	Group B	B1a		✓					✓	✓				✓		✓	
						✓							✓	✓	✓			✓
			B1b			✓							✓	✓	✓			✓
			B1c			✓							✓	✓	✓			✓
			B1d			✓							✓	✓	✓			✓
			B1e		✓					✓	✓						✓	
			B2		✓					✓	✓						✓	
						✓							✓	✓	✓			✓
		Group C	C	✓			✓	✓								✓		
					✓					✓	✓						✓	
		Group D	D1	✓			✓	✓								✓		
			D2	✓					✓							✓		
		Group E	E1		✓							✓					✓	
			E2		✓							✓					✓	
			E3		✓							✓					✓	
	LOCAL	Group B	B1a		✓					✓	✓						✓	
						✓							✓	✓				✓
			B1b			✓									✓			✓
			B1c			✓									✓			✓
			B1d			✓									✓			✓
			B1e		✓					✓	✓						✓	
			B2		✓					✓	✓						✓	
						✓							✓	✓				✓
		Group C	C		✓					✓	✓							
		Group D	D1															
			D2															
		Group E	E1		✓							✓					✓	
			E2		✓							✓					✓	
			E3		✓							✓					✓	

Notes: 1. Lamp Wattage and Pole Height may be increased for use at intersections if necessary to achieve the minimum lighting levels.

2 These poles are custom equipment and are supplied by the luminaire manufacturer. They are unique for each luminaire.

Table 5.2 Roadway Lighting Equipment for "Special Areas" – Rural Area

ROADWAY CLASS		LUMINAIRES		WATTAGE (Note 1)			POLES (Note 1)									POLE LAYOUT		
							'Tall'			'Mid'			'Short'					
				250	150	70	10.7m Concrete	9.8m Aluminum	9.8m (Note 2)	6.1m Concrete	5.5m Aluminum	6.0m (Note 2)	4.6m Concrete	4.6m Aluminum	4.3m (Note 2)	'Tall-Height'	'Mid-Height'	'Tall-Height' and/or 'Short-Height'
RURAL AREA	ARTERIAL & MAJOR COLLECTOR & COLLECTOR	Group B	B1a		✓					✓	✓				✓		✓	
						✓							✓	✓	✓			✓
			B1b			✓							✓	✓	✓			✓
			B1c			✓							✓	✓	✓			✓
			B1d			✓							✓	✓	✓			✓
			B1e		✓					✓	✓						✓	
			B2		✓					✓	✓						✓	
						✓							✓	✓	✓			✓
		Group C	C	✓			✓	✓								✓		
					✓					✓	✓						✓	
		Group D	D1	✓			✓	✓								✓		
			D2	✓					✓							✓		
		Group E	E1		✓							✓					✓	
			E2		✓							✓					✓	
			E3		✓							✓					✓	
	LOCAL	Group B	B1a		✓					✓	✓						✓	
						✓							✓	✓				✓
			B1b			✓									✓			✓
			B1c			✓									✓			✓
			B1d			✓									✓			✓
			B1e		✓					✓	✓						✓	
			B2		✓					✓	✓						✓	
						✓							✓	✓				✓
		Group C	C		✓					✓	✓							
		Group D	D1															
			D2															
		Group E	E1		✓							✓					✓	
			E2		✓							✓					✓	
			E3		✓							✓					✓	

Notes: 1. Lamp Wattage and Pole Height may be increased for use at intersections if necessary to achieve the minimum lighting levels.

2 These poles are custom equipment and are supplied by the luminaire manufacturer. They are unique for each luminaire.

5.6 "ALL OTHER AREAS"

"All Other Areas" are locations other than "Special Areas" as designated by the *City of Ottawa Official Plan Schedules A & B*. [iii] and by this Policy. The majority of the approved lighting equipment for "All Other Areas" was adopted from the *City of Ottawa Residential Street Lighting Policy 2001*. The approved lighting equipment for "All Other Areas" is listed in Appendix B *Approved Lighting Equipment*. All street lighting fixtures in "All Other Areas" meet the ANSI / IESNA RP-8-00 *Roadway Lighting* [i] definition of Semi-Cut Off or Full Cut Off.

Semi Cut-Off and Full Cut-Off luminaires were included in the approved lighting equipment list in Appendix B, to achieve a balance between being environmentally friendly and practical in terms of cost and performance. Pole spacing for Semi Cut Off fixtures is further apart compared to the Full Cut Off fixtures resulting in cost savings and maintaining improved light distribution. However, Full Cut Off fixtures produce zero 'direct up-light' and therefore are more environmentally friendly in terms of minimizing light pollution.

Full Cut-Off luminaires are mandatory for urban local roads in new residential, employment, and mixed use centre areas. In other lighting designs, full cut-off luminaires shall always be considered and shall be utilized if they are determined to be practical in terms of pole spacing and/or other site conditions. Where marker type lighting is required, Semi Cut-Off luminaires will be used due to the inherent 'beacon effect' of this fixture making the intersection more identifiable to motorists. The exception is that full cut-off luminaires shall be used for marker lights for urban and rural super mailbox locations.

5.7 LUMINAIRE GROUPING FOR "ALL OTHER AREAS"

The luminaires for "All Other Areas" were grouped together for convenience based on their general appearance and then further subdivided in subgroups (Semi Cut Off & Full Cut Off) by luminaire distribution as described by *RP-8-00 Roadway Lighting* [i]. There are four luminaire groups including; Group A *Cobra-head Style Fixtures*, Group B *Lantern Style Fixtures*, Group C *Round Style Fixtures* and Group D *'Shoe Box' Style Fixtures*.

Figure 5.8 to Figure 5.11 illustrates the different types of lighting fixtures approved for lighting installations within the City of Ottawa.

Figure 5.10 Standard Lighting Luminaires – Group A

Group A – Cobra Head Style Fixtures

Group A1 Semi Cut Off

American Electric Lighting
125 Series

Cooper Lighting
OVX Series

Group A2 Full Cut Off

American Electric Lighting
115 Series

Cooper Lighting
OVF Series

Figure 5.11 Standard Lighting Luminaires – Group B

Group B – Lantern Style Fixtures

Group B1 Semi Cut Off

American Revolution Series 247

General Electric Salem

Group B2 Full Cut Off

American Revolution Series 247

Lumec L40U

Figure 5.12 Standard Lighting Luminaires – Group C

Group C
Round Style Fixtures

Cooper Lighting Cirrus

Figure 5.13 Standard Lighting Luminaires – Group D

Group D 'Shoe Box' Style Fixtures

Cooper Lighting
UCS Concourse III

Gardco Lighting
Gullwing

American Electric Lighting
LuxMaster

5.7.1 Standard Poles for Roadway Lighting

Figure 5.14 Standard Light Poles for "All Other Areas"

Aluminum Pole

Round Concrete Pole

Tapered Concrete Pole

Octagonal Concrete Pole

5.8 ROADWAY LIGHTING EQUIPMENT CONTEXT

Table 5.2 *Roadway Lighting Equipment Context for "All Other Areas"* provides required standards for lighting equipment in various Road / Area classifications for "All Other Areas". The recommendations provide a variety of lighting options with pole heights being matched up with luminaires and lamp wattages. Table 5.2 will ensure a consistent approach to the installation of lighting poles and luminaires within the rights-of-way throughout the city.

Table 5.3 Roadway Lighting Equipment for "All Other Areas"

ROADWAY CLASS		AREA CLASS	LUMINAIRES						WATTAGE						POLES							
			Group A		Group B		Group C	Group D	400	250	200	150	100	70	Aluminum				Concrete			
			A1	A2	B1	B2									11.3 m	9.8 m	8.2 m	4.6 m	12.5 m	10.7 m	9.1 m	6.1 m
URBAN AREA	ARTERIAL	Mixed Use Centre/Central Area	NOT APPLICABLE TO "ALL OTHER AREAS"																			
		Employment/Enterprise Area	✓	✓			✓	✓	✓	✓	✓				✓	✓			✓			
		General Urban Area	✓	✓			✓	✓		✓	✓					✓				✓		
	MAJOR COLLECTOR	Mixed Use Centre																				
		Employment/Enterprise Area	✓	✓			✓	✓		✓	✓					✓				✓		
		General Urban Area	✓	✓			✓	✓				✓				✓				✓		
	COLLECTOR	Mixed Use Centre/Central Area	NOT APPLICABLE TO "ALL OTHER AREAS"																			
		Employment/Enterprise Area	✓	✓			✓	✓				✓				✓				✓		
		General Urban Area	✓	✓			✓	✓					✓			✓				✓		
					✓	✓						✓	✓	✓							✓	
	LOCAL	Mixed Use Centre/Central Area	NOT APPLICABLE TO "ALL OTHER AREAS"																			
		Employment/Enterprise Area	✓	✓									✓				✓				✓	
		General Urban Area		✓			✓	✓						✓			✓				✓	
						✓							✓	✓								✓
RURAL AREA	ARTERIAL	All Other Areas	✓	†									✓			✓				✓		
	COLLECTOR	All Other Areas	✓	†									✓			✓				✓		
	LOCAL	All Other Areas	✓										✓			✓				✓		
OTHERS-THROUGH-BLOCK PEDESTRIAN WALKWAYS								✓						✓				✓				✓

† If A2 fixtures are used for full illumination up to a boundary area from urban to rural then A2 fixtures shall be extended into the rural area as described in Section 3.3.5.1 *Full Continuous Lighting up to a Boundary Road.*

CHAPTER 6 DESIGN CONSIDERATIONS

In the design and implementation of roadway lighting, there are many things to consider, such as light pollution, transition of illumination, curvilinear road sections, etc. in order to provide a 'proper' lighting system.

6.1 LIGHT POLLUTION

Light pollution is a term used to describe the negative effects of the use of lighting such as light trespass, sky glow and glare. With the proper use of light fixtures and pole heights, light pollution can be minimized. The implementation of a maximum semi cut-off fixture (5% up-light [i]) and the use of full cut-off fixtures (0% up-light [i]) will reduce the amount of unwanted light into the environment. By also lowering the luminaire wattages in areas where darkness is preferred, such as rural and residential areas, from 150 watts to 100 watts, and also lowering the required average local roadway lighting levels in new residential, employment area and mixed use centre developments, will also contribute to minimizing light pollution.

6.2 HORIZONTAL CURVES

The illumination of horizontal curves shall be dealt with on a case-by-case basis and shall be subject to the availability of electric power and capital funding. If approved, the lighting of any horizontal curve shall be complete with semi cut-off class luminaires with maximum lamp wattage of 100 watts. The lighting equipment shall conform to Appendix B *Approved Lighting Equipment.*

6.3 STREET AND SIDEWALK LIGHTING SHADED BY TREES

The City acknowledges that seasonally, street and sidewalk lighting shaded by the foliage of trees is sometimes unavoidable. The resulting reduction in levels of roadway and sidewalk lighting is acceptable provided that the original design and installation of street lighting equipment was properly coordinated with the location of the trees. Therefore, street trees will not be trimmed to accommodate the street lighting except as may be approved in special circumstances by the Director, Traffic and Parking Operations.

CHAPTER 7 STREET LIGHTING WARRANTS

7.1 PRIORITIZATION OF LIGHTING

Capital funding for street lighting on unlit and underlit roadways, including its installation, operation and maintenance, is limited, and must be allocated on a priority basis to projects that will yield the greatest cost benefit ratio. Therefore, the City has applied a Weighting Scheme to various roadway factors such as site conditions (including, for example, the presence of schools, parks, community centres), road class, area class, bus routes and traffic volumes, to name a few. Each candidate roadway is scored based on the sum of the weights for the various factors applicable to the respective roadway. The scores for each roadway are then sorted numerically with the highest scoring roadway being given the highest priority to receive a lighting upgrade. Although a roadway may be high in the priority list, it is also subject to a lighting warrant analysis to meet specific lighting warrants before capital funding is allocated to construct the new lighting.

7.1.1 Roadway Lighting Prioritization Database

The Roadway Lighting Prioritization Database (RLPD) is a separate document used to assist in the implementation of this Policy. The RLPD was extracted and developed using the City of Ottawa *GIS Maintenance Database* and Hydro Ottawa *Existing Lighting Conditions Mapping*. The RLPD will be updated as required over time by the City to reflect new installations of street lighting, the addition of new roadways, and revisions to road and area classifications as per the *City of Ottawa Official Plan Schedule Maps* since the amalgamation of the City of Ottawa.

7.2 ROADWAY LIGHTING WARRANTS

Although a roadway may have high priority for street lighting it may not necessarily require the lighting. The use of roadway lighting warrants will assist the City in establishing a consistent method of evaluating the need for right-of-way lighting. The warrants provide conditions that must be satisfied to justify the installation of lighting. Warrants give conditions that should be satisfied to justify the installation of lighting, however, meeting warranting conditions does not obligate the City of Ottawa to provide lighting or contribute to its cost.

Roadway Lighting Warrants shall be undertaken as described by the *Guide to the Design of Roadway Lighting* [ii].

APPENDIX A GLOSSARY

A.1 ABBREVIATIONS

ANSI – American National Standards Institute,

CSA – Canadian Standard Association,

ESA – Electrical Safety Authority,

IEEE – Institute of Electrical and Electronics Engineers,

IESNA – Illuminating Engineering Society of North America,

TAC – Transportation Association of Canada,

MTO – Ministry of Transportation Ontario

A.2 DEFINITIONS

Average Illuminance: Average Illuminance, generally referred to as 'E_{avg}.' and measured in 'Lux', is the arithmetical average of individual illuminance values calculated at predetermined points within an area. For example, Average Illuminance on a section of roadway can be determined by overlaying an imaginary grid on that section of the roadway, calculating illuminance values at each grid point and then taking an average of all the values.

Average Luminance: Average Luminance or Average Pavement Luminance for a surface, generally referred to as 'LP_{avg}.' and measured in 'Candelas per square metre (cd/m^2), is the arithmetical average of individual Luminance values calculated at predetermined points on the surface. Similar to calculating Average Illuminance, Average Pavement Luminance for a section of roadway can be determined by overlaying an imaginary grid on that section of the roadway, calculating Luminance values at each grid point and then taking an average of all the values.

Candela (cd): The unit of luminous intensity formerly termed "candle". One candela equals one lumen per steradian.

Coefficient of Utilization (CU): A design factor that represents the percentage of bare lamp lumens that are utilized to light the pavement surface. This factor is based on the luminaire position relative to the lit area.

Footcandle (fc): The English unit of Illuminance; illuminance on a surface one square foot in area on which there is uniformly distributed a light flux of one lumen. One footcandle equals 10.76 lux.

Glare: The sensation produced by the luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort or loss in visibility or visual performance.

Illuminance (E): Illuminance is a measure of the "amount" of light a light source projects on to a surface. More precisely, it is the density of luminous flux (Lumens) falling on a surface and decreases with distance of the surface from the source (Inverse Square Law). The metric units for measurement of illuminance are "Lux", which is equal to 1 Lumen/m^2 area.

Initial Lamp Lumens (LL): Initial bare bulb lumen output of a light source.

Light: Radiant energy that is capable of being perceived by the eye and producing a visual sensation. The visible portion of the electromagnetic spectrum extends from approximately 380 to 770 nanometers.

Lumen (lm): defined as:

A unit of measure of the quantity of light. One lumen is the amount of light which falls on an area of one square foot, every point of which is one foot from the source of one candela. A light source of one candela emits a total of 12.57 lumens; or

A measure of luminous flux emitted by a source. The output of a lamp is expressed by the manufacturers in Lumens (e.g. 400 watt high pressure sodium lamp produces 50000 initial lumens).

Luminaire: A complete unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply.

Luminance: Luminance of a roadway surface, simply explained, is the intensity of reflected light per unit area of the surface in the direction of the viewer. Luminance indicates the "brightness" of the roadway surface ahead of the observer when viewed from a given location in a given direction. Luminance at any location (point) on the roadway surface varies with the incident angles of light from various light sources on to the surface, the reflectance properties of the pavement, and the viewing angle of the stationary observer at the point.

Lux (lx): The SI unit of illuminance; defined as the amount of light on a surface of one square metre, all points of which are one metre from a uniform source of one candela. One lux equals 0.0929 footcandle.

Maintained Average Illuminance/Luminance: Light output of a roadway lighting system deteriorates over time due to many factors. Though many of these factors are complex in nature to quantify, two major factors are depreciation of lamp lumen output due to its age (referred to as Lamp Lumen Depreciation or 'LLD'), and accumulation of dirt inside the luminaire as well as on the outside of the glassware (referred to as Luminaire Dirt Depreciation or 'LDD'). The product of these two factors is referred to as Light Loss Factor or 'LLF'.

Nuisance Light: Nuisance light can be defined as the presence of a bright source within the observer's field of view, which the observer finds objectionable and/or intrusive. This adverse effect includes the increase in brightness of the night sky (Sky Glow) and glare experienced by people in the vicinity of luminaires.

Q Factor: A measure to overall "lightness" of the surface

Sky Glow: The term used to describe the added sky brightness caused by the scattering of extraneous light reflecting from the dust particles in the atmosphere.

Spill Light: Spill light can be defined as illumination of an area beyond the primary area that the light source is intended to illuminate.

Steradian: A solid angle subtending an area on the surface of a sphere equal to the square of the sphere radius.

Uniformity: Uniformity of lighting refers to "Quality" of lighting. The lighting must be uniformly spread over an area for good visibility since the human eye requires a finite amount of time to adapt to changes in light levels. The uniformity of lighting for an area, for both Illuminance and Luminance

method, is determined by calculating the ratio of Average Illuminance/Luminance to Minimum Illuminance/Luminance within the area.

Veiling Luminance: Also known as Disability Glare, it is the direct luminance superimposed on the retina by external light sources, which causes a "veil" of light and reduces the contrast of an image. The veiling luminance can be produced by a roadway luminaire, headlights of an oncoming vehicle, advertising signs along the roadway, and stray commercial/residential lighting adjacent to the roadway. Veiling luminance produced by only roadway luminaires is considered in the lighting calculations.

Visibility: The quality or state of being perceivable by the eye. In roadway lighting it is usually defined in terms of the distance at which an object can just be perceived.

Warrant: The justification for the installation of roadway lighting based on several factors as defined in the Transportation Association of Canada "Guide for the Design of Roadway Lighting"

A.3 REFERENCES

The following published documents have been used as the basis for establishing lighting design criteria:

Canadian Standard Association:

CSA C22.2 No. 211.2-M1984 (R2003) - Rigid PVC, Unplasticized Conduit

CSA C22.2 No. 227.1-97 (R2002) - Electrical Non-metallic Tubing (Bi-national standard, with UL 1653)

Illuminating Engineering Society of North America:

IESNA DG-5-94 - Recommended Lighting for Walkways and Class 1 Bikeways

IESNA LM-67- 94 - Calculation Procedures and Specifications of Criteria for Lighting Calculations

IESNA RP-8-00 - Roadway Lighting ANSI Approved

IESNA RP-22-96 - Recommended Practice for Tunnel Lighting

IESNA TM-3-95 - A Discussion of Appendix E – "Classification of Luminaire Light Distributions"

IESNA TM-10-00 - Addressing Obtrusive Light (Urban Sky Glow and Light Trespass) in Conjunction with Roadway Lighting

IESNA TM-11-00 - Light Trespass; Research, Results and Recommendations

Transportation Association of Canada (TAC):

Guide for the Design of Roadway Lighting

Ministry of Transportation, Ontario (MTO):

Roadside Safety Manual

APPENDIX B APPROVED LIGHTING EQUIPMENT

B.1 "SPECIAL AREAS"

Table 7.1 Luminaires For "Special Areas"

Group	Description	Manufacturer	Lamp Wattage	Distribution Type	Luminaire Catalogue # XXX = Colour Place Holder	Photometric Curve	Ballast Factor
B1a	Square Lantern	American Electric & General Electric	REFER TO SECTION B.2 OF APPENDIX B				
B1b	Hex Lantern	Heritage Casting & Ironworks	70	III	F146-L-FAC-70MH-120-SR3-RALXXXX	9730	95%
B1c	Round Lantern	Lumec	70	III	L80-PCCS- 70MH-SE3-120-SF80-FN4-XXX	LU200035	90%
B1d	Cone Style	Se'lux	70	V	QD1-MC-1-H070-XX-120-PX	QD1-MC-H10	90%
B1e	Round Lantern	King Luminaire	150	III	K135 SAR III 150 (MOG) MH 120 XXX	ITL50542P	90%
B2	Square Lantern	American Electric & Lumec	REFER TO SECTION B.2 OF APPENDIX B				
C	Round Cylinder	Cooper Lighting	REFER TO SECTION B.2 OF APPENDIX B				
D1	Wing Style	Gardco	REFER TO SECTION B.2 OF APPENDIX B				
D2	Streamlined Style	Schreder	250	III-MSCO	HEX-250MH-ED28-MC3-120-RALXXXX	210696	100%
E1	Acorn Style	Holophane	150	III	MPU-150MH-12-X-4	47268	100%
E2	Hat Style	Lumca	150	III-MSCO	CPL0206-MH150-RC3-AC-120-XXX	50201182	90%
E3	Cage Style	SDL	150	III	8222-RD3-150M-120-XXX-PC	X8200-ORD2-100S-02	90%

Table 7.2 Poles & Luminaire Bracket Arms For "Special Areas"

Group	Description	Pole Catalogue #	Luminaire Arm Catalogue #	Banner Arm (Integral/Extra)	Manufacturer's Colour Code				
					Natural	Black	Grey	Dark Bronze	Dark Green
B1a	Square Lantern	REFER TO SECTION B.2 OF APPENDIX B							
B1b	Hex Lantern	P414-4FA-14-RALXXXX	N/A	INTEGRAL	▲	9011	7012	8019	6005
B1c	Round Lantern	R80F-14-TBC1-XXXX	N/A	INTTEGRAL	NP	BKTX	GY3TX	▲	GN8TX
B1d	Cone Style	A35-BC1-14-XX	N/A	EXTRA	SV	BK	▲	BZ	▲
B1e	Round Lantern	REFER TO SECTION B.2 OF APPENDIX B							
B2	Square Lantern	REFER TO SECTION B.2 OF APPENDIX B							
C	Round Cylinder	REFER TO SECTION B.2 OF APPENDIX B							
D1	Wing Style	REFER TO SECTION B.2 OF APPENDIX B							
D2	Streamlined Style	ATR-26-RALXXXX	CTP-1A-RALXXXX	EXTRA	9006	9011	9007	8019	▲
E1	Acorn Style	NY21/20CIS-X	CAM48/1-BHLF/200-RCA-X	INTEGRAL	▲	B	▲	Z	D
E2	Hat Style	PL85-D20 XXX	M1A-CF9PT-XXX	INTEGRAL	AG	BK	▲	BE	GN
E3	Cage Style	QJ-4-AL-R-20-M-XXX	CS2-S1E-XXX	INTEGRAL	E10	A11	▲	B11	K31

Notes:

* Colour and Voltage to be included in catalogue # at time of order

** IES file provides appropriate photometric data, in most cases lumen package must be modified to account for specified lamp as manufacturers do not provide photometrics for all available lamp types

▲ Custom colour to be specified when ordering fixture

B.2 "ALL OTHER AREAS"

Table 7.3 Group A1 – Semi Cut Off Cobra Head Style Fixtures

Manufacturer	Series	Lamp Wattage (HPS)	Distribution Type	Socket Position	Ballast Type	Luminaire Catalogue #	Photometric Curve
American Electric Lighting	115	70	II-MSCO	C-2	Reactor HPF	SC-11300431-1	AE2035
	115	100	II-MSCO	C-2	Reactor HPF	SC-11300106-2	AE2035
	115	150	II-MSCO	C-2	Reactor HPF	SC-11301130	AE2035
	125	200	II-MCO	A-1	CWA	SC-12500432 **	AE3851
	125	250	III-MCO	D-1	CWA	SC-12500434-1 **	AE3853
	125	400	III-MCO	D-1	CWA	SC-12500436-3 **	AE3853
Cooper Lighting	OVZ	70	II MSCO	-	Reactor HPF	OVZ70SH22E4-OTHYD	ovz1s2eg
	OVZ	100	II MSCO	-	Reactor HPF	OVZ10SH22E4-OTHYD	ovz1s2eg
	OVZ	150	II MSCO	-	Reactor HPF	OVZ15SH22E4-OTHYD	ovz1s2eg
	OVX	200	II MSCO	-	CWI/CWA	OVX20SW(C)22E4-OTHYD	ovx2s2e
	OVX	250	III MSCO	-	CWI/CWA	OVX25SW(C)23E4-OTHYD	ovx2s3eg
	OVX	400	III MSCO	-	CWI/CWA	OVX40SW(C)23E4-OTHYD	ovx4s3eg

Notes:
** For CWI ballast option add '-CT' to catalogue #

Table 7.4 Group A2 – Full Cut Off Style Cobra Head Style Fixtures

Manufacturer	Series	Lamp Wattage (HPS)	Distribution Type	Socket Position	Ballast Type	Luminaire Catalogue #	Photometric Curve
American Electric Lighting	115	70	II MFCO	A-1.5	Reactor HPF	SC-11301172-HP	AE4551
	115	100	II MFCO	A-1.5	Reactor HPF	SC-11301100-HP	AE4551
	115	150	II MFCO	A-1.5	Reactor HPF	SC-11301173-HP	AE4551
	125	200	II MFCO	2 (St. Side)	CWA/CWI	SC-12500437-1 **	S0103222
	125	250	III MFCO	B-4	CWA/CWI	SC-12500264-1 **	AE5743
	125	400	III MFCO	B-4	CWA/CWI	SC-12500438 **	AE5743
Cooper Lighting	OVH	70	II MCO	-	Reactor HPF	OVH70SH22D4-OTHYD	ovh1s2d
	OVH	100	II MCO	-	Reactor HPF	OVH10SH22D4-OTHYD	ovh1s2d
	OVH	150	II MCO	-	Reactor HPF	OVH15SH22D4-OTHYD	ovh1s2d
	OVF	200	II MCO	-	CWA/CWI	OVF20SW(C)22D4-OTHYD	ovf4s2d
	OVF	250	III MCO	-	CWA/CWI	OVF25SW(C)23D4-OTHYD	ovf4s3d
	OVF	400	III MCO	-	CWA/CWI	OVF40SW(C)23D4-OTHYD	ovf4s3d

Notes:
** For CWI ballast option add '-CT' to catalogue #

Table 7.5 Group B1 – Semi Cut Off Lantern Style Fixtures

Manufacturer	Series	Lamp Wattage (HPS)	Distribution Type	Socket Position	Ballast Type	Luminaire Catalogue #	Photometric Curve
American Electric Lighting	247	70	II MSCO	Fixed	Reactor HPF	SC-24700105	AE2026
	247	100	II MSCO	Fixed	Reactor HPF	SC-247AR3640	AE2026
	247	150	II MSCO	Fixed	Reactor HPF	247 15S RH 120 R3 AY AR7124	AE2026
General Electric	Salem	70	II MSCO	-	Reactor HPF	SEMT07S1N1TAMS2BL	177678
	Salem	100	II MSCO	-	Reactor HPF	SEMT10S1N1TAMS2BL	177678
	Salem	150	II MSCO	-	Reactor HPF	SEMT15S1N1TAMS2BL	177678

Table 7.6 Group A2 – Full Cut Off Lantern Style Fixtures

Manufacturer	Series	Lamp Wattage (HPS)	Distribution Type	Socket Position	Ballast Type	Luminaire Catalogue #	Photometric Curve
American Electric Lighting	247	70	II MFCO	-	Reactor HPF	247 05S RH 120 R2 FC	LTL11941
	247	100	II MFCO	-	Reactor HPF	247 07S RH 120 R2 FC	LTL11941
	247	150	II MFCO	-	Reactor HPF	247 10S RH 120 R2 FC	LTL11941
LUMEC (Side Mount)	L40U	70	III MSCO	Fixed	Reactor HPF	L40U-STM-70HPS-RACE3D-120-PH8-BKTX	S0701291
	L40U	100	III MSCO	Fixed	Reactor HPF	L40U-STM-100HPS-RACE3D-120-PH8-BKTX	S0701291
	L40U	150	III MSCO	Fixed	Reactor HPF	L40U-STM-150HPS-RACE3D-120-PH8-BKTX	S0701261
LUMEC (Post Top)	L40U	70	III MSCO	Fixed	Reactor HPF	L40U-SFR-70HPS-RACE3D-120-PH8-BKTX	LU200064
	L40U	100	III MSCO	Fixed	Reactor HPF	L40U-SFR-100HPS-RACE3D-120-PH8-BKTX	LU200064
	L40U	150	III MSCO	Fixed	Reactor HPF	L40U-SFR-150HPS-RACE3D-120-PH8-BKTX	LU200064

Table 7.7 Group C – Round Style Fixxtures

Manufacturer	Series	Lamp Wattage (HPS)	Distribution Type	Ballast Type	Luminaire Catalogue #	Photometric Curve
Cooper Lighting	Cirrus	70	II MCO	Reactor HPF	CAS70SH22D4-**CAS-OTHYD	Z1232
	Cirrus	100	II MCO	Reactor HPF	CAS10SH22D4-**CAS-OTHYD	Z1232
	Cirrus	150	II MCO	Reactor HPF	CAS15SH22D4-**CAS-OTHYD	Z1232
	Cirrus	250	III MCO	CWA	CAS25SW23D4-**CAS-OTHYD	Z1253
	Cirrus	400	III MCO	CWA	CAS40SW23D4-**CAS-OTHYD	Z2263

Notes:
** Optional colours only – natural (bronze), white, black, grey and green

Table 7.8 Group D – 'Shoe Box' Style Fixtures

Manufacturer	Series	Lamp Wattage (HPS)	Distribution Type	Ballast Type	Luminaire Catalogue #	Photometric Curve
Cooper Lighting	Concourse III	70	II MCO	Reactor HPF	UCS70SH22D4-*CA50-OTHYD	CS7232-2
	Concourse III	100	II MCO	Reactor HPF	UCS10SH22D4-*CA50-OTHYD	CS7232-2
	Concourse III	150	II MCO	Reactor HPF	UCS15SH22D4-*CA50-OTHYD	CS7232-2
	Concourse III	250	III MCO	CWA/CWI	UCS25SW(C)23D4-*CA50-OTHYD	CS7252-3
	Concourse III	400	III MCO	CWA/CWI	UCS40SW(C)23D4-*CA50-OTHYD	CS7262-2
Gardco Lighting	Gullwing G13	70	II MCO	Reactor HPF	G13-1-2XL-100HPS-120-NP-PCR C/W ADAPTER	G32X1H
	Gullwing G13	100	II MCO	Reactor HPF	G13-1-2XL-100HPS-120-NP- PCR C/W ADAPTER	G32X1H
	Gullwing G18	150	II MCO	CWA/CWI	G18-1-2XL-150HPS-[(120/CWA) or (120/CWI)]-NP-PCR	GW2X15H
	Gullwing G18	250	III MCO	CWA	GW-1-3XL-250HPS-120/CWA-NP-PCR	GW3X25H
	Gullwing G18	400	III MCO	CWA	GW-1-3XL-400HPS-120/CWA-NP-PCR	GW3X4H
American Electric Lighting	LuxMaster Series 53	70	II MCO	Reactor HPF	53 07S RH 120 R2 FG M2 EC NL CS *	AE3832
	LuxMaster Series 53	100	II MCO	Reactor HPF	53 10S RH 120 R2 FG M2 EC NL CS *	AE3832
	LuxMaster Series 53	150	II MCO	Reactor HPF	53 15S RH 120 R2 FG M2 EC NL CS *	AE3832
	LuxMaster Series 153	200	III MCO	CWA/CWI	153 20S CA (CT) 120 R3 FG M2 EC NL CS *	AE3819
	LuxMaster Series 153	250	III MCO	CWA/CWI	153 25S CA (CT) 120 R3 FG M2 EC NL CS *	AE3819
	LuxMaster Series 153	400	III MCO	CWA/CWI	153 40S CA (CT) 120 R3 FG M2 EC NL CS *	AE3819

Notes :
* Optional colours only – natural (bronze), white, black and grey

Table 7.9 Underpass Luminaires

Manufacturer	Luminaire Series	Lamp Wattage	Luminaire Catalogue #	Photometric Curve
Holophane	Wallpack IV	70	W4-070HP-12-U-G-†	LTL16010
Holophane	Wallpack IV	70	W4-70DMH-12-U-G-†	LTL16006

† Replace with 'G' for optional wire guard

Table 7.10 Luminaire Bracket Arms

Manufacturer	Series	Pole Height	Color	Manufacturer's Catalog #
USS	TER	1.8m (6')	Natural	TER6MA
USS	TER	2.4m (8')	Natural	TER8MA
USS	TER	3.0m (10')	Natural	TER10MA
USS	TER	3.6m (12')	Natural	TER12MA
USS	TER	4.6m (15')	Natural	TER15MA

Table 7.11 Aluminum Poles

Manufacturer	Series	Pole Height	Color	Manufacturer's Catalog #
USS	TER	4.6m (15')	Natural	USS8050D15AB-OTT
USS	TER	6.1m (20')	Natural	USS8050D20AB-OTT
USS	TER	8.2m (27')	Natural	USS8050D27AB-OTT
USS	TER	9.8m (32')	Natural	USS8050D32AB-OTT
USS	TER	11.3m (37')	Natural	USS8050D37AB-OTT

Table 7.12 Concrete Poles

Manufacturer	Pole Series	Pole Length	Pole Height above Grade	Pole Colour				
				NATURAL	BLACK	BROWN	MIDNIGHT LACE	GREEN
USI	Hampton	20 Foot	15 Foot	HA-200-B-1-PG-30-X-OTT	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL
USI	Hampton	20 Foot	15 Foot	HA-200-B-1-PG-10-X-OTT	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL
USI	Hampton	30 Foot	25 Foot	HA-300-B-1-PG-30-X-OTT	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL
USI	Hampton	30 Foot	25 Foot	HA-300-B-1-PG-10-X-OTT	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL
USI	Newport	35 Foot	30 Foot	NE-350-B-1-PG-10-X-OTT	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL
USI	Newport	41 Foot	35 Foot	NE-410-D-1-PG-10-X-OTT	OPTIONAL	OPTIONAL	OPTIONAL	OPTIONAL
USI	Madison	20 Foot	15 Foot	OPTIONAL	MA-200-A-2-BE-10-F-OTT	MA-200-A-2-DB-10-F-OTT	MA-200-A-2-ML-10-F-OTT	MA-200-A-2-AJ-10-F-OTT
USI	Madison	25 Foot	20 Foot	OPTIONAL	MA-250-B-2-BE-60-F-OTT	MA-250-B-2-DB-60-F-OTT	MA-250-B-2-ML-60-F-OTT	MA-250-B-2-AJ-60-F-OTT
USI	Madison	30 Foot	25 Foot	OPTIONAL	MA-300-B-2-BE-60-F-OTT	MA-300-B-2-DB-60-F-OTT	MA-300-B-2-ML-60-F-OTT	MA-300-B-2-AJ-60-F-OTT
USI	Madison	35 Foot	30 Foot	OPTIONAL	MA-350-B-2-BE-60-F-OTT	MA-350-B-2-DB-60-F-OTT	MA-350-B-2-ML-60-F-OTT	MA-350-B-2-AJ-60-F-OTT
USI	Cambridge	25 Foot	20 Foot	OPTIONAL	CA-270-A-2-BE-60-F-OTT	CA-270-A-2-DB-60-F-OTT	CA-270-A-2-ML-60-F-OTT	CA-270-A-2-AJ-60-F-OTT
USI	Cambridge	*27 Foot	22 Foot	OPTIONAL	CA-270-A-2-BE-60-F-OTT	CA-270-A-2-DB-60-F-OTT	CA-270-A-2-ML-60-F-OTT	CA-270-A-2-AJ-60-F-OTT
USI	Cambridge	30 Foot	25 Foot	OPTIONAL	CA-300-A-2-BE-60-F-OTT	CA-300-A-2-DB-60-F-OTT	CA-300-A-2-ML-60-F-OTT	CA-300-A-2-AJ-60-F-OTT

* 27' Cambridge for Solera Subdivision only.

APPENDIX C *MAINSTREET* ROADS

C.1 BUSINESS IMPROVEMENT AREAS

Business Improvement Areas in Table 7.1 are listed only by street or area name. Refer to section D.1 *Business Improvement Areas* of Appendix D *Map Schedules* for the boundaries of each BIA.

Table 7.13 Business Improvement Area Existing *Mainstreet* Roads

BIA DISTRICT		*MAINSTREET* ROADS WITH EXISTING DECORATIVE LIGHTING*	NOTES
1.	Bank Street	Bank Street	Under construction
2.	Byward	Dalhousie, ByWard Market, Sussex, McKenzie, Murray Street, Clarence Street, York Street, George Street.	Only a short section of Murray west of Parent has decorative lights.
3.	Preston Street	Preston Street	Under construction
4.	Rideau Street "1" and "2"	Rideau Street, Sussex, Colonel By.	
5.	Somerset Heights	Somerset Street	
6.	Somerset Village	Somerset Street	Under construction
7.	Sparks Street	Sparks Street	In pedestrian mall
8.	Vanier	Beechwood Ave., Montreal Road	
9.	Westboro Village	Richmond Road	
10.	Barrhaven	(None)	

BIA DISTRICT		*MAINSTREET* ROADS WITH EXISTING DECORATIVE LIGHTING*	NOTES
11.	Carp	Carp Road, Donald B. Munro Drive.	
12.	Manotick	Manotick Main Street, Bridge Street, Tighe Street, Mill Street.	
13.	Orleans	(None)	

* These roads are not necessarily designated in the *City of Ottawa Official Plan* schedule maps as *mainstreet* roads but do have existing decorative (full / partial) lighting.

C.2 RURAL AREA VILLAGES

Table 7.2 *Suggested Rural Area Village Mainstreets* provides suggested *mainstreets* for each of the respective rural area Villages as identified in *City of Ottawa Official Plan Schedule G – Rural Road Network*.

Table 7.14 Suggested Rural Area Village *Mainstreets*

VILLAGE		*MAINSTREET* ROADS	NOTES
1.	Galetta	Galetta Side Road**, Mohr's Road**.	Aprox. 1270m standard lighting.
2.	Kinburn	Kinburn Side Road**, Loggers Way**.	Aprox. 1260m standard lighting.
3.	Fitzroy Harbour	Fitzroy Street**, Harbour Street**.	Aprox. 1400m standard lighting.
4.	Constance Bay	Constance Bay Road**.	Aprox. 460m standard lighting.
5.	Dunrobin	Dunrobin Road**	Aprox. 300m standard lighting.

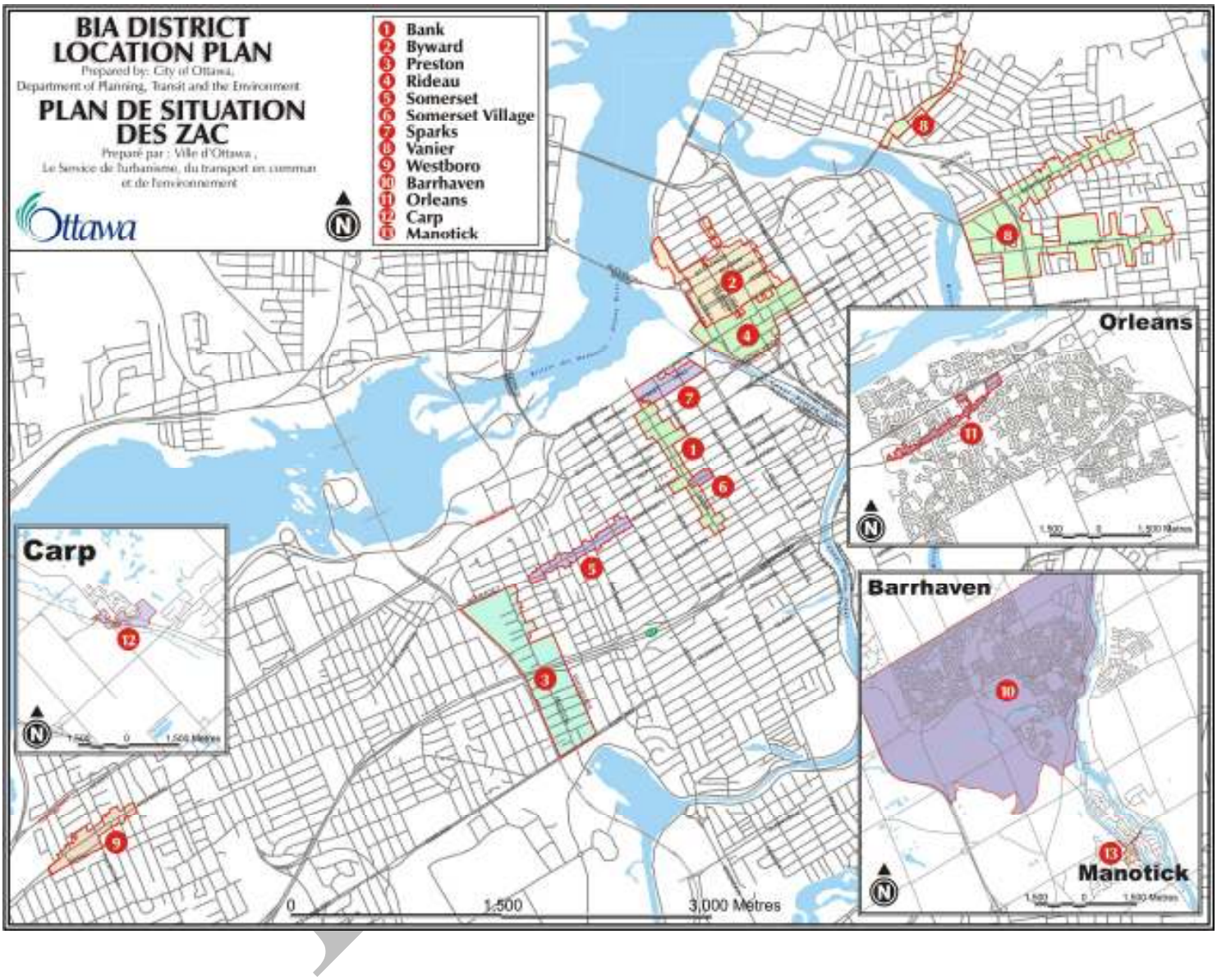
VILLAGE		*MAINSTREET* ROADS	NOTES
6.	Carp	Carp Road*, Donald B. Munro Drive.*	Aprox. 2190m standard lighting & 470m of decorative lighting.
7.	Ashton	Ashton Station Road.***	Marker only
8.	Munster	Munster Side Road, Bleeks Road.***	Marker only
9.	Richmond	Perth Street*, McBean Street**.	Aprox. 3980m standard lighting & 380m of decorative lighting.
10.	Fallowfield	Steeple Hill Crescent.	No existing lighting.
11.	Manotick	Manotick Main Street*, Bridge Street*, Maple Avenue**, Scharfield Road**, Ann Street**, Beaverwood Road**, Tighe Street*, Mill Street*, Currier Street (west).	Aprox. 2870m standard lighting & 960m of decorative lighting.
12.	North Gower	Roger Stevens Drive**, Fourth Line Road**, Church Street**, Prince of Wales Drive**.	Aprox. 2700m standard lighting.
13.	Kars	Rideau Valley Drive**, Old Wellington Street*, Washington Street*, Kars Rectory Street*, Lord Nelson Street, Waterloo Street*.	Aprox. 1030m standard lighting & 750m of decorative lighting. *(note that most of these are local back streets and may not be included as mainstreets for decorative lighting)*
14.	Osgoode	Osgoode Main Street**.	Aprox. 2400m standard lighting.
15.	Greely	Parkway Road**, Meadow Drive**, Ellesworth Lane.	Aprox. 2200m standard lighting.
16.	Metcalfe	8th Line Road**, Victoria Street**.	Aprox. 3000m standard lighting.
17.	Kenmore	Yorks Corners Road.***	Marker only

VILLAGE		*MAINSTREET* ROADS	NOTES
18.	Vernon	Bank Street**, Lawrence Street**.	Aprox. 2480m standard lighting.
19.	Marionville	Marionville Road**, Gregoire Road**.	Aprox. 830m standard lighting.
20.	Vars	Buckland Road*, Farwell Street*.	Aprox. 1080m standard lighting & 540m of decorative lighting.
21.	Carlsbad Springs	Russell Road.***	Marker only
22.	Navan	Trim Road**, Meteor Road** and Colonial Road**.	Aprox. 2750m standard lighting.
23.	Notre-Dame-des Champs	Navan Road, Mer Bleue Road.***	Marker only
24.	Sarsfield	Colonial Road**, Sarsfield Road**.	Aprox. 1480m standard lighting.
25.	Cumberland	Old Montreal Road*, Cameron Street*, Dunning Road**.	Aprox. 1610m standard lighting & 650m of decorative lighting.
26.	Burritt's Rapids	Burritt's Rapids Drive.***	Marker only

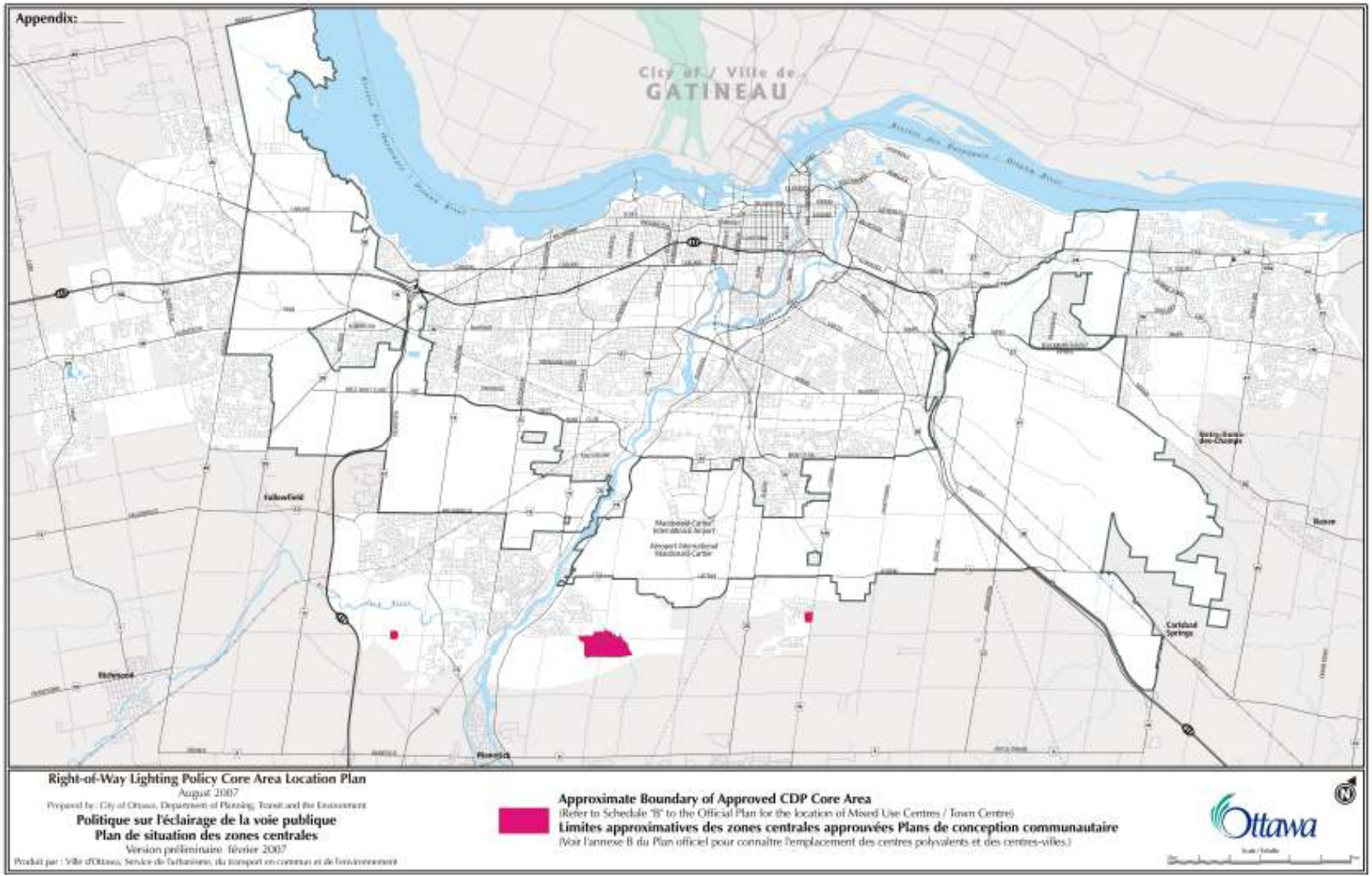
* Existing decorative / standard (continuous) lighting.
** Existing standard (continuous) lighting.
*** Existing marker ("crossroads") lighting.

APPENDIX D MAP SCHEDULES

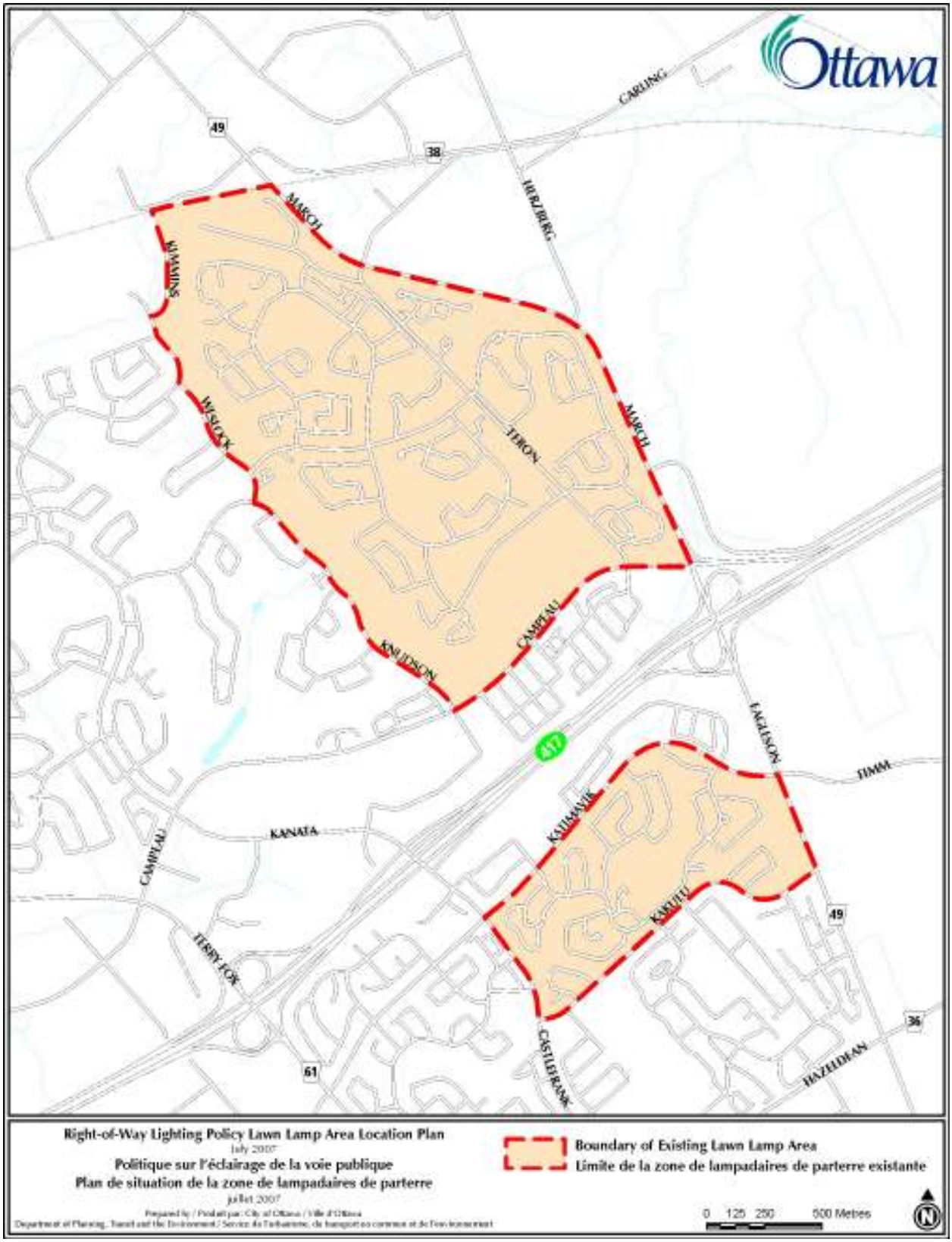
D.1 BUSINESS IMPROVEMENT AREAS



D.2 CDP CORE AREAS



D.3 EXISTING LAWN LAMPS



APPENDIX E LIGHTING STYLES IN EXISTING HERITAGE CONSERVATION DISTRICTS

1.

Location:
Lowertown West

2.

Location:
Lowertown West
Byward Market
Somerset Street

3.

Location:
Sparks Street

4.

Location:
Lowertown West
Byward Market
Confederation Blvd.

5.

Location:
Sandy Hill

6.

Location:
Minto Bridges
Fleet Street

7.

Location:
Lowertown West

APPENDIX F LUMINANCE VERSUS ILLUMINANCE

Right-of-way lighting designs are to be undertaken using the Luminance criteria for all tangent roadway sections as opposed to the Illuminance method. Luminance has become the preferred criteria for roadway lighting because it defines what the eye sees (meaning the light that is reflected from the roadway surface to the observer who is located 83m upstream from the calculation point and is looking downward at an angle of 1 degree). To perform this calculation, reflectance tables for the roadway surface are required. *IESNA RP-8* defines these reflectance values for four types of roadway surfaces, R1 to R4, where R1 is a concrete road surface and R2 to R4 are asphalt road surfaces of varying aggregate sizes/textures. Due to the requirements of the Luminance criteria (including the calculation method with the observer 83m upstream from the point of interest looking 1 degree downward and the reflectance tables), it will not be suitable for designing roadway lighting of curved roadway sections, intersections and sidewalks.

For curved roadway sections the observer is typically looking along the curve less than 83m ahead making it impractical to apply the Luminance criteria. For intersections, the light levels are typically increased due to the concentration of vehicular and pedestrian activity. This increase in light levels affects the Veiling Luminance calculations for glare which uses average Luminance to determine the glare ratio. Consequently, in order to correctly assess the Veiling Luminance of a roadway lighting design, Luminance calculations must be done in advance of or ahead of the intersection. For sidewalks, there is usually two components to the lighting design as recommended by the *IESNA RP-8*; horizontal or sidewalk surface (for detecting obstacles in the pedestrian's path) and vertical or pedestrian surface (for facial recognition). Although one can dispute that we could define Luminance criteria for the horizontal sidewalk surface using R1 reflectance values, *IESNA RP-8* does not currently have recommended levels. Furthermore, it is not possible to perform Luminance calculations on a vertical plane since neither reflectance values for a surface that simulates a pedestrian nor calculation methods are available for performing such a calculation. Therefore Luminance cannot be used for sidewalk lighting.

Subsequently, the Illuminance criteria will still be used to design roadway lighting of curvilinear roadway sections, intersections and sidewalks. Illuminance is suitable in these instances as it is a measure of the amount of light that strikes a surface independent of an observer and reflectance properties of the surface and it can also be calculated on both a horizontal (roadway/sidewalk) and vertical (pedestrian) surface. Illuminance criteria will also be used as a verification tool for field measurements of designed lighting levels to actual light levels achieved on the roadway/sidewalk

Luminance and Illuminance should not be used in conjunction with each other in designing roadway lighting as it has a significant impact on the lighting installation in terms of higher initial capital construction cost, increase maintenance and operation costs, increased energy consumption and increase light pollution. The following sample calculation demonstrates the impact of utilizing both criteria for roadway lighting designs:

Design Criteria for a Typical Arterial Roadway in an Employment Enterprise Area

A. Roadway Lighting Levels as indicated in Table 2.1 *Required Average Roadway Lighting Levels*:

1. Average Luminance = 0.9 Cd/m^2
2. Average to Minimum Uniformity = 3:1
3. Veiling Luminance (Glare Ratio) = 0.3

} Luminance Criteria

4. Average Illuminance = 13 Lux
5. Average to Minimum Uniformity = 3:1

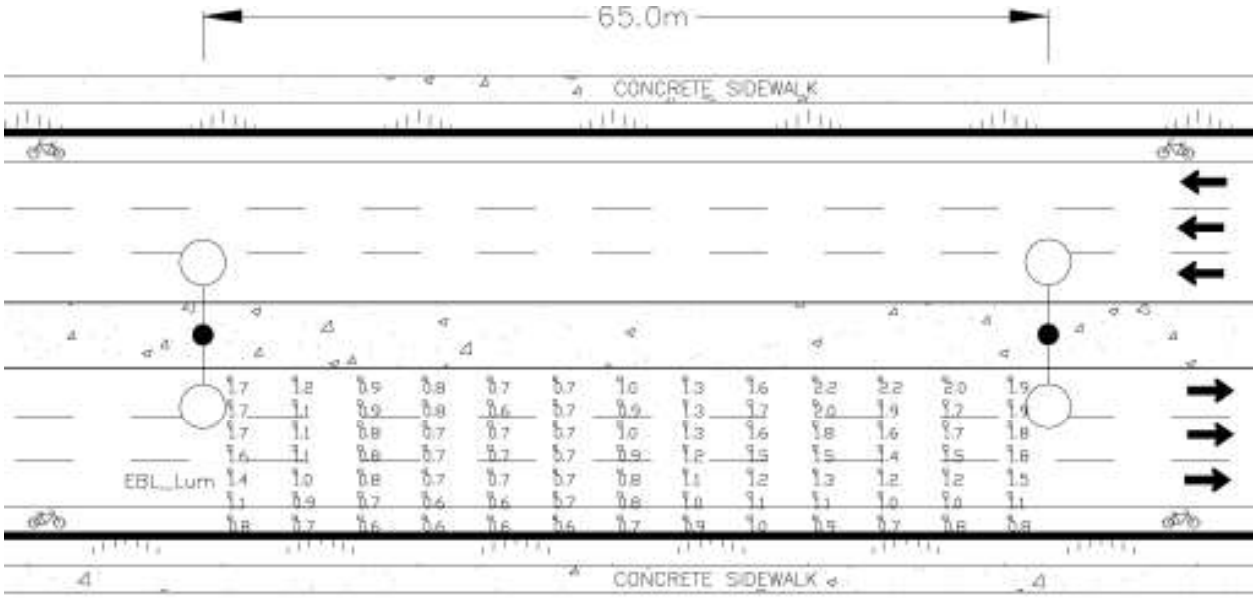
} Illuminance Criteria

B. Lighting Equipment selected from Appendix B *Approved Lighting Equipment* including:

1. 400 Watt HPS by American Electric Lighting, Photometric Curve # AE3853 (Table 7.3 *Group A1 – Semi Cut Off Cobra Head Style Fixtures)*,
2. 2.4m Luminaire Bracket (Table 7.10 *Luminaire Bracket Arms*), and
3. 11.3m Aluminum pole (Table 7.11 *Aluminum Poles)*.

Figure 7.1 *Roadway Lighting Design Using Luminance,* illustrates a lighting design of a typical arterial roadway section using the Luminance criteria. The design resulted in a lighting layout with about 16 light poles per kilometer with pole spacing of 65m. The designed average Luminance achieved was 25% higher than the required average. The increased lighting is inherent in any lighting design in attempting to satisfy all the lighting criteria (in this case; Average, Uniformity & Glare). 'Over Lighting' should be minimized as much as possible as discussed in Section 2.1 *Lighting Design Calculations*.

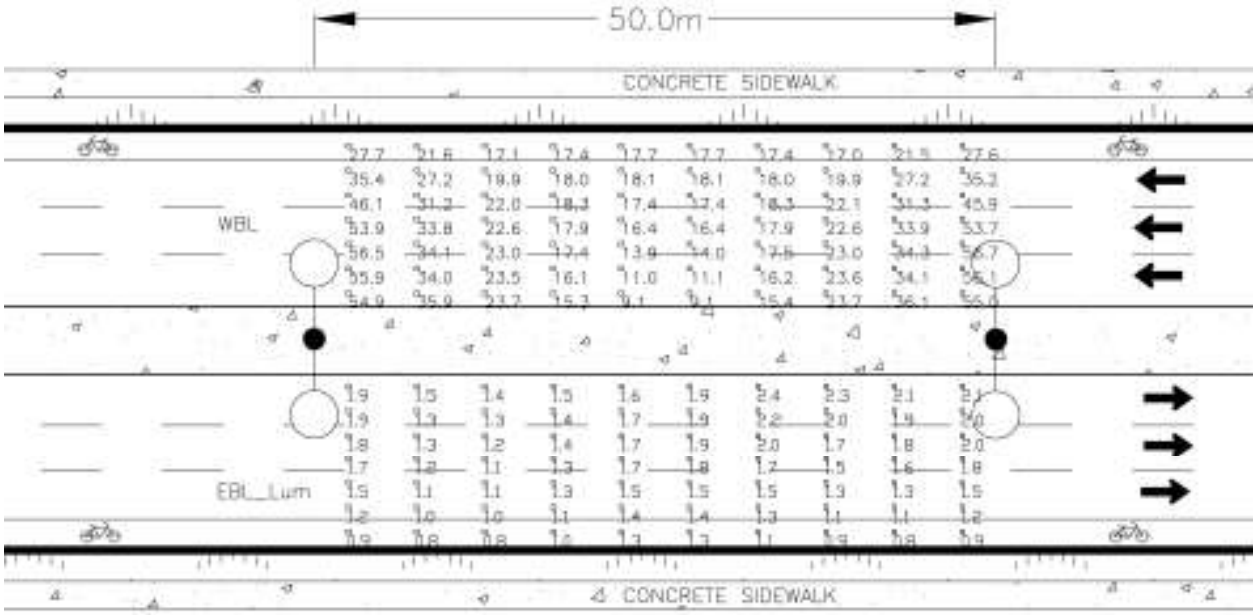
Figure 7.1 Roadway Lighting Design Using Luminance



Numeric Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	LVRatio
EBL_Lum	Luminance	Cd/Sq.M.	1.12	2.2	0.6	1.87	0.00
EBL_Lv	VLuminance	Cd/Sq.M.	0.16	0.32	0.05	3.20	0.28

Figure 7.2 *Roadway Lighting Design Using Luminance & Illuminance*, illustrates a lighting design for the same arterial roadway section using both Luminance and Illuminance criteria. This design resulted in a lighting layout with 20 Poles per kilometer with pole spacing of 50m. In attempting to achieve both criteria the designed average levels for Luminance was 65% higher than needed and for Illuminance it was 103% higher than actually required. The 'over lighting' again is a direct result of trying to achieve all the criteria for both Luminance and Illuminance (i.e. Average Luminance & Illuminance, Glare for Luminance and Uniformity for Luminance and Illuminance).

Figure 7.2 Roadway Lighting Design Using Luminance & Illuminance



Numeric Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	LVRatio
WBL	Illuminance	Lux	26.41	56.7	9.1	2.90	N.A.
EBL_Lum	Luminance	Cd/Sq.M.	1.48	2.4	0.8	1.84	0.00
EBL_Lv	VLuminance	Cd/Sq.M.	0.22	0.38	0.08	2.75	0.26

In summary, using both Luminance and Illuminance methods produced a lighting design layout requiring an additional 4 poles per kilometer. The additional lighting poles resulted in significantly higher lighting levels than required; for both criteria Luminance average was 65% higher than required whereas with Luminance criteria only it was 25% higher. The higher lighting levels will result in increased energy consumption and light pollution. The sample calculation illustrates the advantages of using the Luminance criteria only for roadway lighting design such as reduced 'over lighting' in designed levels, increased poles spacing resulting in cost savings in the initial construction costs and ongoing operational and maintenance costs. For this reason Luminance shall always take precedence over Illuminance except for lighting designs where Luminance is not practical (e.g. curvilinear roadway sections, intersections and sidewalks).

APPENDIX G FOOTNOTES

[i] American National Standard Institute / Illuminating Engineering Society of North America (ANSI / IESNA)

[ii] Transportation Association Canada (TAC)

[iii] Available at http://www.ottawa.ca/city_hall/ottawa2020/official_plan/vol_1/schedules/index_en.html

[iv] Ministry of Transportation Ontario, Roadside Safety Manual

[v] Electricity Act 1998

[vi] Official Plan Schedule B available at
http://www.ottawa.ca/city_hall/ottawa2020/official_plan/vol_1/schedules/index_en.html

[vii] Official Plan Schedule G available at
http://www.ottawa.ca/city_hall/ottawa2020/official_plan/vol_1/schedules/index_en.html

[viii] Official Plan Schedule E available at
http://www.ottawa.ca/city_hall/ottawa2020/official_plan/vol_1/schedules/index_en.html