Division “E”

Utilities

Standards and Specifications Manual

Index

Section E1
Design Criteria - Utilities

.1 General

a) The developer and/or his consultants are required to submit to the City, for approval, a complete set of Utility Coordination drawings, which are to be included as a schedule to the agreement between the City and the owner.

b) At the second submission stage for the Municipal drawings, the Utility Coordination plan and all engineering drawings are to be forwarded to the participating utility companies. The utility companies will then identify whether or not any conduit and duct structures are required and, if so, indicate the location and nature of same. Upon return of the marked-up utility drawings to the consultant, the consultant shall incorporate the duct structure design on the originals.

c) The drawings are to be circulated to and approved by each right-of-way user prior to submission to the City for review. Each approval is to be indicated on a stamp that is to be included on each drawing.

d) Approved drawings to be circulated to all signing right-of-way users. Drawings are to be circulated electronically with a digital signature from all of the right-of-way users. The Utility Coordination drawing is also to be signed by the Developer's Engineer. Once the drawings have final approval, a pdf copy of each is to be provided to all right-of-way users for their use.

e) For non-typical plant locations, a standard drawing/detail section will be required on the Utility Coordination drawing indicating the location of the respective utility's plant and any potential conflicts with other plant that would typically be adjacent.

f) Utility Coordination electronic drawing file names to include the submission number (1st, 2nd, etc.) and the date of the submission.

g) All Utility Coordination drawings shall be to a scale of 1:500 minimum and include the following utilities, services and appurtenances.

.1.1 Utility Hierarchy

The following hierarchy of utilities and municipal servicing will apply when determining plant locations (in descending order):

i) Municipal watermains, sewers and appurtenances
ii) LID/Stormwater features
iii) Hydro
iv) Streetlighting
v) Telecommunications
vi) Natural Gas
vii) Postal Delivery
viii) Landscaping and street trees
ix) Other street furniture (garbage receptacles, bicycle racks etc.)

Note: Other items to consider during the design include bus stop locations, traffic controls (signage and traffic calming).

.1.2 Information Required

The following information is to be shown on the drawings:

a) Underground services:

- Valve chambers
- Water service curb stops
- Storm and Sanitary sewers
- Catchbasins including RYCB
- Natural Gas valves
- Utility route locations
- Power feed to streetlight disconnect (Alectra owned)
- Streetlight cable (City owned)
- LID and stormwater facilities
- Hydrants and water valves,
- Blowoffs, etc.
- Sewer maintenance holes
- Catchbasin leads
- Underground service connections
- All utility road crossings

b) Above-ground services:

- Hydro transformers
- Traffic signal poles
- Tele-communication pedestals
- Overhead power feed to streetlight disconnect (Alectra owned)
- Overhead streetlight cable (City owned)
- Major utility hubs/vaults
- Street name and regulatory signs
- Walkways
- Easements
- Sewer outfalls
- Fences
- Other features as may be directed
- Hydro and street light poles
- Flush to grade handwells and junction boxes
- Telecommunication pedestals
- Community mail boxes
- Streetlight disconnection boxes
- Driveway locations
- Sidewalks, paths, trails
- Bridges, culverts
- Curb and gutter
- Retaining walls

In addition to the above information, each utility coordination drawing shall have a signature block provided for approval of each of the utilities listed.

Reviewed	By	Date
Telecommunications #1		
Telecommunications #2		
Hydro		
Natural Gas		
Canada Post		

.1.3 Location Limitations

.1.3.1 Driveways

a) Clearance between driveway and lot lines to be a minimum of 1.2 m.

b) Driveways are not to encroach the projected property lines.

c) Driveways are to be differentiated as being single or double driveways. Refer to Division C for minimum driveway widths and clearances.

d) Driveways on corner lots are to be located on front lot line farthest from intersecting street.

e) Water services are not to be located within driveways.

f) Clearances to other utilities to be in accordance with the applicable utility current guidelines.

.1.3.2 Utility Hardware

a) Where possible, all hardware is to be located on opposite side of lot to driveway location. Under no circumstances is any above ground hardware or flush to grade hardware to be located within 1.0 m of any driveway. Absolute minimum of 600 mm to pedestals if the 1.0 m clearance cannot be achieved.

b) Hardware is not to be located within projected limits of easements.

c) Hardware within cul-de-sacs and 90° bends are to be avoided where possible.

.1.3.3 Road Crossings

a) Road crossing locations are to be shown on all construction drawings.

b) All ducts and spacing as per utility specifications. Ducts to have a minimum of 1.2 m cover to top of ducts for perpendicular road crossings to provide clearance to cross road subdrains.

c) Road crossings are to be placed 90 degrees to road allowance and opposite lot lines where possible.

d) A minimum of 1.0 m clearance is to be maintained between road crossings and maintenance or catchbasins.

.1.3.4 Locations of Community Mailboxes

a) Community mailboxes shall be placed according to the Canada Post Corporation requirements.

b) Design locations for mailboxes should incorporate factors such as pedestrian safety, sidewalk access, lighting, driveway locations, traffic flow, drainage and aesthetics.

c) Community mailbox locations shall be indicated on the Utility Coordination drawings and Plan & Profile drawings.

d) Where possible, a streetlight will be placed adjacent to a community mailbox location to ensure appropriate lighting levels are met.

e) The required width of the curb depressions shall be dimensioned on both the Utility Coordination drawing and the appropriate Plan & Profile drawings.

f) Additional location criteria for mailboxes is as follows:

   i. Along the flankage (side yard) of corner lots

   ii. Next to an open space or park lands

   iii. Not closer than 10 m to a fire hydrant or bus stop

   iv. Location shall not impede vehicular and/or pedestrian sight lines

.1.3.5 Public Utility Clearance Requirements

The following represents the minimum clearance separation distances for City owned utilities:

Table E-1: Minimum Clear Separation Distance for City-owned Utilities

Utility	Min Vertical Distance (meters)	Min Horizontal Distance (meters)
Sewers and Watermains	0.5	1.2
Streetlights	**	1.0
Streetlight ducts	0.5	0.6
Hydrants	0.5	1.2
City owned structures and chambers	0.5	1.2
Minimum distance Below Ditch Inverts	0.5	**

Notes:
****** Clearance above and below to be determined on a case-by-case basis.
These minimum clearances apply unless otherwise specified in other sections of this document.
Clearances to other utilities to be in accordance with the applicable utilities’ current guidelines.

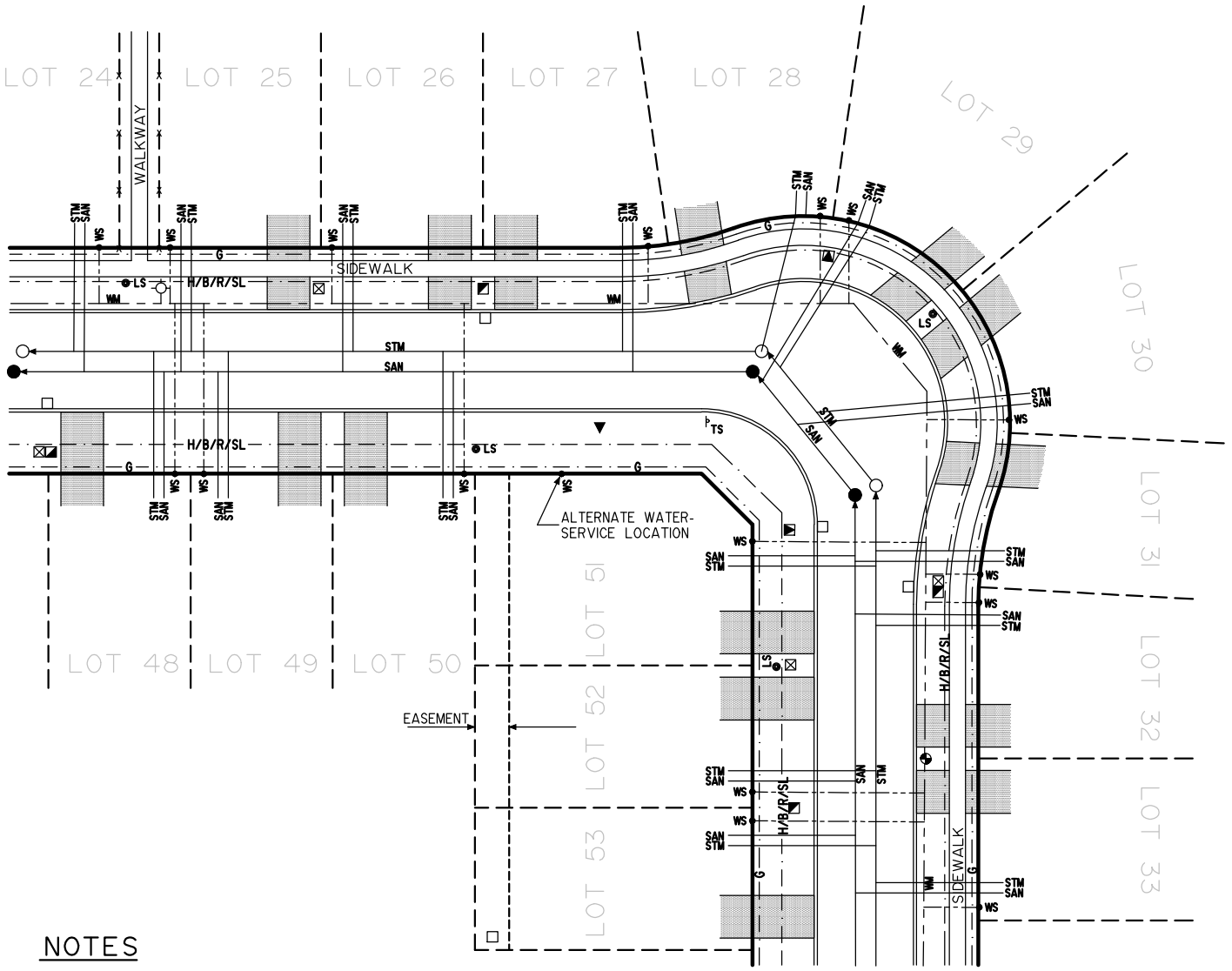
.1.3.6 Additional Utility Coordination Drawing Information

a) The Consultant shall submit an “as-constructed” version of the Utility Coordination drawing upon completion of the work within the project.

b) Typical road cross-section details should be included on a separate drawing from the Utility Coordination drawing to show the locations of above and underground utilities on each street.

c) Include the street addresses along with the lot numbers on the Utility Coordination drawing as soon as they are available.

Section E2
City of Richmond Hill Standard Drawings



NOTES

1. ALL UTILITY CO-ORDINATION DRAWINGS ARE TO BE APPROVED AND SIGNED BY ALL UTILITY COMPANIES PRIOR TO APPROVAL BY THE CITY.
2. MINIMUM 1.0m CLEARANCE BETWEEN DRIVEWAYS AND ANY ABOVE AND UNDERGROUND FIXTURES.
3. DRIVEWAYS ARE NOT TO ENCROACH PROJECTED PROPERTY LINES.
4. ABOVE GROUND FIXTURES TO BE LOCATED OPPOSITE ANY LOT LINE WHERE POSSIBLE.
5. WATERBOXES ARE NOT TO BE LOCATED WITHIN DRIVEWAYS.
6. DRIVEWAYS ON CORNER LOTS ARE TO BE LOCATED ON LOT LINE FARTHEST FROM INTERSECTING STREET.
7. ALL EASEMENTS ARE TO BE SHOWN ON UTILITY CO-ORDINATION DRAWINGS.
8. THIS DRAWING IDENTIFIES DETAIL REQUIRED FOR A TYPICAL UTILITY CO-ORDINATION PLAN BUT DOES NOT REPRESENT A STANDARD DESIGN.
9. FOR STANDARD DIMENSIONS REFER TO R.O.W. CROSS-SECTION DRAWINGS IN DIVISION "C".
10. LOCATION OF COMMUNITY MAILBOXES TO BE SHOWN.

LEGEND

▼	COMMUNITY MAILBOX	H	U/G HYDRO
⊠	BELL PEDESTAL	B	U/G TELECOM (BELL)
⊠	BELL O.P.I.-CONC BASE	G	U/G GAS MAIN
▲	HYDRO TRANSFORMER	R	U/G TELECOM (ROGERS)
■	HYDRO SWITCH CUBICLE	HSL	HYDRO FEED TO STREET LIGHTING
⧖	GAS VALVE	SL	STREET LIGHTING CIRCUIT
◪	CABLE TV PEDESTAL	SAN	SANITARY SEWER
● LS	LIGHT STANDARD	STM	STORM SEWER
⊹	FIRE HYDRANT	WM	WATERMAIN
◔	VALVE CHAMBER	STM	STORM SERVICE
●	SANITARY MAINTENANCE HOLE	SAN	SANITARY SERVICE
○	STORM MANTENANCE HOLE	● WS	WATER SERVICE
□	CATCHBASIN		DRIVEWAY
TS	TRAFFIC SIGN		

No.	REVISIONS	DATE	APP'D

Richmond Hill

PLANNING AND INFRASTRUCTURE DEPARTMENT

UTILITY CO-ORDINATION DRAWING

—

SCALE: N.T.S.	DATE: JUL. 2022
DRAWN: P.V.G.	DWG. No. E-1

Section E3
Adopted Ontario Provincial Standard Drawings

.1 Grading Sections (OPSD Division 200)

OPSD	Date	Description	Addition or Revision
217.060	Nov. 2011	Utility Pole Setting Depth at Ditch Locations	
2245.020	Nov. 2017	Minimum Vertical Clearances for Aerial Cable Systems	

Section E4
Design Criteria - Street Lighting

.1 General Requirements

.1.1 Introduction

The purpose of these guidelines is to outline general design criteria and best practices for the design and construction of Municipal Street Lighting Systems within the City of Richmond Hill. The guidelines provide direction and outline expectations to the Design Engineers and Contractors and are based on existing and recommended practices for roadway lighting published by the Illuminating Engineering Society of North America (IESNA) and the Transportation Association of Canada (TAC). These guidelines are not to be considered absolute and following these guidelines shall not relieve the Owner/Design Engineer of the responsibility of the design, construction, and completion of the municipal street lighting system as a finished product of competent engineering design, construction, and good engineering practices. This document is not intended to be a complete instruction manual for the design of street lighting. The Design Engineers are encouraged to refer to the referenced publications for additional information.

The City of Richmond Hill reserves the right to require different lighting levels for certain areas of the City based on intended future use.

.1.2 References

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

Criterion	Description
ANSI C78.377	Specifications for the Chromaticity of Solid State Lighting Products
ANSI C136.31	Roadway and Area Lighting Equipment – Luminaire Vibration
ANSI/IEEE C62.41.2	Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
ANSI/IEEE C62.45	Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and less) AC Power Circuits
ANSI/IES LM-79	Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products
ANSI/IES LM-80	Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules
ANSI/IES LM-82	Approved Method: Characterization of Optical and Electrical Properties of Solid-State Lighting Products as a function of Temperature
ANSI/IES LP-2	Lighting Practice: Designing Quality Lighting for People in Outdoor Environments
ANSI/IES LP-11	Lighting Practice: Environmental Considerations for Outdoor Lighting
ANSI/IES RP-8	Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting

Criterion	Description
ANSI/IES TM-15	Technical Memorandum: Luminaire Classification System for Outdoor Luminaires
ANSI/IES TM-21	Technical Memorandum: Projecting Long Term Lumen, Photon, and Radiant Flux Maintenance of LED Light Sources
ASTM B117	American Society for Testing Materials: Standard Practice for Operating Salt Spray (Fog) Apparatus
City of Richmond Hill	Light Pollution By-law, as amended
CSA C22.2 No. 250.0	Luminaires
CSA C653	Photometric Performance of Roadway and Street lighting Luminaires
IEC60529	International Electrotechnical Commission: Degrees of Protection provided by Enclosures (IP Code)
IES G-1	Guide for Security Lighting for People, Property, and Critical Infrastructure
IES TM-34	Technical Memorandum: Calculation Procedures and Specifications of Criteria for Lighting Calculations
IES/IDA MLO	Model Lighting Ordinance (MLO) with User’s Guide
PTM-LIGHTING06	TAC (Transportation Association of Canada) Guide for the Design of Roadway Lighting

The Design Engineer and Contractor shall be responsible to ensure that the latest version of each standard is utilized.

.1.3 Professional Certification

Street and walkway lighting system designs shall be completed by a Professional Engineer in good standing with Professional Engineers Ontario (PEO), who is licensed to practice professional engineering in the Province of Ontario with expertise in the field of street and roadway lighting.

All drawings submitted to the City for acceptance shall be signed and sealed by a Professional Engineer of a Design Engineering Firm. The City shall be accepting the drawings as to form, in reliance upon the professional skill and ability of the Design Engineering firm, as to design and specification.

.1.4 Definitions

.1.4.1 Roadway Classifications and Definitions (per ANSI/IES RP-8)

Arterial (Major):
That part of the roadway system that serves as the principal network for through-traffic flow. The routes connect areas of principal traffic generation and important rural roadways entering and leaving the city. These routes primarily serve through traffic and secondarily provide access to abutting properties.

Collector:
Roadways servicing traffic between arterial and local streets. These are streets used

mainly for traffic movements within residential, commercial and industrial areas. They do not handle long, through trips. Collector streets may be used for truck or bus movements and give direct service to abutting properties.

Local:
Local streets are used primarily for direct access to residential, commercial, industrial, or other abutting property. They make up a large percentage of the total street system, but carry a small proportion of vehicular traffic.

Sidewalk:
A paved, concrete, or otherwise improved area for pedestrian use, located within the public street right-of-way, which also contain roadways for vehicular traffic.

Pedestrian Walkway:
A facility intended for pedestrian traffic, not within the right-of-way of a vehicular traffic roadway or detached from the roadway (distance greater than 5.0 metres). Included are skywalks (pedestrian overpasses), sub-walks (pedestrian tunnels), and walkways giving access to parks or through block interiors.

Bikeway:
Any road, street, path, or way that is specifically designated open to bicycle travel, regardless of whether such facilities are designed for the exclusive use of bicycles or are to be shared with other transportation modes. Bikeway types include the following:

- Shared Lane: A standard-width travel lane shared by motor vehicles and bicycles
- Wide outside lane: An outside travel lane with a width of at least 4.2 m
- Bike lane: A portion of the roadway designed by striping, signing, and/or pavement markings for preferential or exclusive use of bicycles
- Shoulder: A paved portion of the roadway adjacent to the edge stripe
- Separate bike path: A facility physically separated from the roadway and intended for bicycle use

Lanes:
For the purposes of this document, lanes are defined as a public road providing secondary access to a property. Public lanes are named and commonly used for vehicles to access garages located at the rear of a property.

Pedestrian Underpasses:
A facility intended for pedestrian traffic and/or cyclists, within the right-of-way of a vehicular traffic roadway.

.1.4.2 Pedestrian Conflict Area Classifications (per ANSI/IES RP-8)

The Arterial, Collector and Local Street classifications appropriately describe general conditions of vehicular traffic conflict in urban areas. A second type of conflict, which is responsible for a disproportionate number of nighttime fatalities, is the vehicle/pedestrian interaction. The magnitude of pedestrian flow is nearly always related to the abutting land use. The criteria used in selecting an appropriate amount of lighting is based on the total number of nighttime pedestrians present on both sides of the roadway in a typical block (or 200m section) over a given one-hour period (during the first hour of darkness (typically

18:00 to 19:00 hours), the actual hour considered, however, may vary). There are three classifications of pedestrian night activity levels and the types of land use with which they are typically associated:

i) **High**
Areas with significant numbers of pedestrians expected to be on the sidewalks, pedestrian walkways or crossing the streets during darkness. Examples are downtown retail areas, near theaters, concert halls, stadiums, and transit terminals.

(As a guideline the number of pedestrians expected on sidewalks or crossing the street during darkness, in a typical block or 200 meter section, for a high pedestrian conflict area is over 100 pedestrians/hour).

ii) **Medium**
Areas where lesser numbers of pedestrians utilize the streets at night. Examples are downtown office areas, blocks with libraries, apartments, neighborhood shopping, industrial parks, and streets with transit lines.

(As a guideline, the number of pedestrians expected on sidewalks or crossing the street during darkness, in a typical block or 200-meter section, for a medium pedestrian conflict area is 11 to 100 pedestrians/hour).

iii) **Low**
Areas with very low volumes of night pedestrian usage. These can occur in any of the cited roadway classifications but may be typified by suburban streets with single family dwellings, very low-density residential developments, and rural or semirural areas.

(As a guideline, the number of pedestrians expected on sidewalks or crossing the street during darkness, in a typical block or 200 meter section, for a low pedestrian conflict area is 10 or fewer pedestrians/hour).

The choice of the appropriate pedestrian activity level for a street will be determined through pedestrian forecast as determined by the design engineer subject to the City’s approval.

.2 Lighting Design

The design criteria are based on various roadway and pedestrian classification types within the City’s jurisdiction. The minimum required lighting levels are based on the IESNA and TAC recommendations for drivers’ visual needs while travelling on these various classes of roadways. The visual need or task changes with the classification of the roadway and the level of pedestrian usage - higher lighting levels required for higher classification of the roadways and/or pedestrian usage and lower lighting levels required for the lower classification of roadways and/or pedestrian usage.

Please be advised that the requirements based on IESNA and TAC recommendations are periodically revised and updated. All lighting design criteria shall be in accordance with latest American National Standards Institute/Illuminating Engineering Society standards

ANSI/IES, the latest Standard Recommended Practices for Roadway Lighting (RP-8) and TAC.

.2.1 Basic Principles of Street Lighting Design

There are five basic principles to consider when carrying out street lighting design:

a) Safety - pedestrian and driver safety. Creating sufficient lighting level, uniformity, and glare control so that drivers are aware of any pedestrians and /or objects on or near the roadway.

b) Security - providing a setting that will deter some forms of criminal activity through the use and placement of lights.

c) Limit the amount of Light Trespass - avoiding over lighting of areas such as in residential neighborhoods where the backlight may shine on houses.

d) Energy Efficiency Considerations/Environmental Responsibility - consideration shall be given to minimizing energy consumption while meeting the minimum lighting levels required by this standard. Since LED luminaires are available in many wattage variations, vendors shall base their designs on the most efficient use of power that meets the City’s lighting standards, while minimizing luminaire types and parts.

e) Provide uniformity and consistency in street lighting designs throughout the City while meeting the standards.

.2.2 Design Considerations

a) It is the responsibility of the Design Engineer preparing a street lighting design to make sure they are making reference to ANSI / IES RP-8-18 or any later edition.

b) When starting a street lighting design, attention to the surrounding area and any special requirements must be taken into consideration (i.e., schools, shopping districts, or community centers).

c) It is important to note that only the Luminance design method may be used for calculating the roadway lighting levels within the City. Exceptions allow for the use of the Illuminance design method for curved road sections, sidewalks, cul-de-sacs and intersections. These methods are fully explained in ANSI / IES RP-8, American National Standard Practice for Roadway Lighting.

.2.3 Pavement Classification

Pavement classification is described by the type of pavement surface. Reflectivity (R) tables are listed in ANSI/IES RP-8 and are a measure of the reflectivity characteristics of the roadway surface. A typical City of Richmond Hill roadway is represented by an R3 pavement.

.3 Street Lighting Design Criteria and Recommended Values

.3.1 Straight Roadways, Streets and Sidewalks

Luminance is the recommended method for roadway lighting calculations. The luminance levels, uniformity and veiling luminance ratios to be used are provided in Table E-2 below. Illuminance is the recommended method for sidewalk lighting calculations. The illuminance levels to be used are also provided in Table E-2 below.

Table E-2: Lighting Levels

Roadway Classifi-cation	Pedestrian Conflict	Avg. Luminance (Lavg cd/m^2)	Avg. Uniformity Ratio (Lavg/Lmin)	Max. Uniformity Ratio (Lmax/Lmin)	Max. Veiling Luminance Ratio (Lvmax/Lavg)	Sidewalk Average Illuminance Eavg (lux)
Local	Low	0.3	6.0	10.0	0.4	3.0
	Medium	0.5	6.0	10.0	0.4	5.0
	High	0.6	6.0	10.0	0.4	10.0
Collector	Low	0.4	4.0	8.0	0.4	3.0
	Medium	0.6	3.5	6.0	0.4	5.0
	High	0.8	3.0	5.0	0.4	10.0
Arterial	Low	0.6	3.5	6.0	0.3	3.0
	Medium	0.9	3.0	5.0	0.3	5.0
	High	1.2	3.0	5.0	0.3	10.0

Note: This table is extracted from IESNA RP-8

Where:
Lavg - minimum maintained average pavement luminance
Lmin - minimum pavement luminance
LVmax - maximum veiling luminance (a measure of the glare produced by the lighting system)
Sidewalk Average Illuminance - minimum maintained average horizontal illuminance (lux)

Notwithstanding the requirements of Table E-2, please note that when the City is converting its outdoor lights from HPS to LED, without adding or moving poles, the minimum light level on sidewalks shall be 2.0 lux average maintained illuminance. This is only applicable in circumstances where the light levels listed in Table E-2 cannot be achieved due to existing pole layout/orientation.

For certain areas, the City may require dedicated sidewalk/walkway/bikeway lighting. For these areas, the use of both horizontal and vertical illuminances or the use of horizontal illuminances at grade and at 1.5m above grade is recommended for design as specified in RP-8 or G-1, respectively. Refer to Table E-4.

.3.2 Intersections

The primary method of design for intersections is illuminance. The values included in Table E-3 are the recommended minimum average maintained illuminance levels for fully lighted intersections based on road classification and pedestrian volumes. The values for

full intersection lighting represent the sum of the recommended values for the intersecting streets.

Table E-3: Minimum Average Maintained Illuminance Levels at Fully-Lighted Intersections

Street Functional Classification	Average Maintained Illumination at Pavement by Pedestrian Area Classification in [Lux/FC]			Uniformity Ratio Eavg/Emin
	High	Medium	Low	
Arterial/Arterial	34/3.2	26/2.4	18/1.7	3.0
Arterial/Collector	29/2.7	22/2.0	15/1.4	3.0
Arterial/Local	26/2.4	20/1.9	13/1.2	3.0
Collector/Collector	24/2.2	18/1.7	12/1.1	4.0
Collector/Local	21/2.0	16/1.5	10/0.9	4.0
Local/Local	18/1.7	14/1.3	8.0/0.7	6.0

Note: This table is extracted from IESNA RP-8

Depending on context the City may request that photometric analyses include vertical illuminances at 1.5m above grade for crosswalks/crossrides at intersections, mid-block crossings and roundabouts as per RP-8.

.3.3 Curves and Cul-de-Sacs

.3.3.1 Cul-de-sac (Dead-end Street)

Due to the irregular shape and terminal nature of cul-de-sacs, it is impractical to apply the luminance design method to those roadway areas. Illuminance is; therefore, the required method of design for a cul-de-sac. The area of a cul-de-sac begins at the start of the cul-de-sac curb return radius. The requirements for cul-de-sac lighting are determined by targeting the illuminance values for the approach roadway. Where the approach street has been designed using the luminance method, the equivalent illuminance can be calculated using the ratio of 1 cd/m² = 15 lux for an R3 pavement or 1 cd/m² = 10 lux for an R1 pavement.

.3.3.2 Curves

Lighting systems along streets with gradual curves (radius greater than or equal to 600m) shall be designed using the luminance method and shall have luminaires positioned so that they are aimed 90 degrees to the tangent of the curve. This assures a balanced light distribution on the pavement. Luminaires may require closer spacing in order to achieve the required lighting levels/uniformities. The design criteria shall be according to the road classification and pedestrian conflict level.

In cases where there are sharp curves (radius less than 600m), the designer shall provide an analysis of the lighting and assess the site conditions. The design shall be based on the illuminance method. The equivalent average maintained illuminance level requirement can be calculated using the ratio of 1 cd/m² = 15 lux for an R3 pavement or 1 cd/m² = 10 lux for an R1 pavement.

.3.4 Pedestrian Walkways and Bikeways

The primary method of design for lighting of Pedestrian Walkways and Bikeways is illuminance.

Note: For pedestrian walkways and bikeways within municipal parks, please refer to Section E6 for "Design Criteria for Municipal Parks and Sport Facilities Lighting".

Table E-4: Illumination Levels for Pedestrian Walkways and Bikeways

Pedestrian Area Classification	Sub-Category	Horizonal Illuminance			Vertical Illuminance
		Eavg @ grade [Lux/FC]	Eavg @ 1.5m above grade (*) [Lux/FC]	Eavg/ Emin	EVmin [Lux/FC]
Facilities within R.O.W. (right-of-way)					
High	Mixed Vehicle and Pedestrian	20/1.9	20/1.9	4.0	10/0.9
	Pedestrian only	10/0.9	10/0.9	4.0	5/0.5
Medium	Pedestrian only	5/0.5	5/0.5	4.0	2/0.2
Low	Rural/Semi-Rural Areas	2/0.2	2/0.2	10.0	1/0.1
	Low Density Residential (2 or fewer dwelling units per acre)	3/0.3	3/0.3	6.0	1/0.1
	Medium Density Residential (2.1 to 6.0 dwelling units per acre)	4/0.4	4/0.4	4.0	1/0.1
Facilities outside R.O.W. (right-of-way)					
N/A	N/A	6/0.6	6/0.6	4.0 (**)	N/A

Note: This table is based on IESNA RP-8 and IESNA G-1

Where:
Rural/Semi-Rural - Areas with very low residential density away from urban areas; cities or large towns or areas that are partly rural; between rural and urban.
Eavg - minimum maintained average horizontal illuminance at pavement
Emin - minimum horizontal illuminance at pavement
EVmin - minimum vertical illuminance at 1.5m above pavement
(*) – Eavg at 1.5m above grade target can be used as an alternative to the minimum vertical illuminance target, subject to approval by the City.
(**) – Eavg/Emin uniformity target for facilities outside of R.O.W. also applies to areas adjacent to walkways/bikeways out to a distance of 9.1m on either side of the walkway/bikeway, subject to absence of light trespass restrictions.

Notwithstanding the requirements of Table E-4, where security of pedestrians and cyclists may be of concern, illumination levels should be at least 10.0 Lux (1.0 FC) at ground level, with an average-to-minimum uniformity ratio no greater than 4 to 1.

.3.5 Pedestrian/Vehicular Underpass Areas

Lighting design criteria for pedestrian/vehicular underpass areas shall be as per Table E-5 below.

Table E-5: Lighting Design Criteria for Pedestrian/Vehicular Underpass Areas

Description	Eavg [Lux/FC]	EVmin [Lux/FC]	Eavg/Emin *
Daytime	100.0/10.0	50.0/5.0	3.0
Night time	40.0/4.0	20.0/2.0	3.0

Note: This table is extracted from IESNA RP-8

Where:
Eavg - minimum maintained average horizontal illuminance at pavement
Emin - minimum horizontal illuminance at pavement
EVmin - minimum vertical illuminance at 1.5m above pavement
*Horizontal illuminance only

.4 Material Specifications

.4.1 Source Type

All light sources shall be of the Light Emitting Diode (LED) type.

.4.2 LED Luminaires

.4.2.1 General Requirements

Wattages of LED luminaires will be selected based on lighting design criteria and site conditions. LED luminaires shall have a minimum service life of 100,000 hours (including the driver and light source life). The LED luminaire should have the following general specifications:

- 0-10 Volt DC Dimming LED Driver
- Operating voltages as a minimum 120V or 347 VAC +/- 10 percent, 60 Hz.
- Equipped with Surge protective device (SPD) in case of lightning or electrical storms. The SPD for luminaires wired at 120V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C High operation and ANSI/IEEE C62.45. The SPD for luminaires wired at 347V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C Low operation and ANSI/IEEE C62.45.
- The housing shall be painted with a durable polyester powder coat. Castings shall be pre-treated using a five-stage iron phosphate system to assure adhesion.
- Tool-less entry feature for quick and easy maintenance.
- 7-PIN NEMA twist lock photo control receptacle.
- Correlated Colour Temperature (CCT): 3000K ± 200K.
- Colour Rendering Index (CRI): 70 or greater.
- Operate at an ambient temperature range of - 40 °C to + 40 °C.

- Approved by CSA or ULC

The detailed mechanical, photometric and electrical specifications for LED luminaires are provided in Appendix A, B and C. These specifications are used by the City for approving the LED luminaires for outdoor lights. The current, City approved LED luminaires can be found under Section E7.1.

.4.2.2 Manufacturers’ Warranty

- Provide a 10-year manufacturer’s warranty certificate, in the City’s name, for LED luminaires and components confirming that the luminaire housing and all of its internal components, including but not limited to LED drivers and light engines shall be covered against defective workmanship, material, and premature light source failures.
- Warranty period shall begin on date of receipt of material from the supplier. The supplier/manufacturer shall provide the City with appropriate warranty certificates and shipping documents as proof of date of shipment.
- Provide a manufacturer’s certificate indicating that the service life of the LED luminaires is 100,000 hours of operation or greater.

.5 Standard Design - Roads

.5.1 Local & Collector Road

.5.1.1 Luminaire

a) Shall be of the "Cobra Head" type.

b) Colour shall be grey, polyester powder coat compatible with pole.

c) Luminaire Mounting Height: 9.14m minimum

.5.1.2 Mast Arm

a) 1.8m (6ft) tapered elliptical aluminum with a rise of 0.9m (3ft). Mast Arms shall be bolted directly to the pole with 16 mm galvanized steel through bolts, nuts, and 50 x 50 mm square washers (banding is prohibited). Mast Arm lengths shall be as required to position the luminaire within ± 0.6m beyond the near edge of the traveled portion of the road.

b) Mast arm shall be manufactured to ANSI C136.13 and shall be in general conformity to OPSD 2420.010.

.5.1.3 Pole

a) Shall be 9.9m (32.5ft) direct bury, Class “B” spun concrete. Hand-hole cover plates shall have tamper proof screws and be affixed with a warning label. Pole shall be affixed with an identification plate containing manufacturer's name, class, pole height, date of manufacturer and a C.S.A. stamp.

b) Cross Section: Tapered round

c) Finish: Smooth Mold

d) Colour: Natural concrete grey

.5.2 Lanes

.5.2.1 Luminaire

a) Shall be of the "Cobra Head" type

b) Colour shall be grey, polyester powder coat compatible with pole.

c) Luminaire Mounting Height: 5.8m minimum

.5.2.2 Pole

a) Shall be 7.6m (25 Ft.) direct buried Class “B” spun concrete. Hand-hole cover plates shall have tamper proof screws and be affixed with a warning label. Pole shall be affixed with an identification plate containing manufacturer's name, class, pole height, date of manufacturer and a C.S.A.

b) Cross Section: Tapered round

c) Finish: Smooth Mold

d) Colour: Natural concrete grey

.5.3 Arterial Road

.5.3.1 Luminaire

a) Shall be of the "Cobra Head" type.

b) Colour shall be grey, polyester powder coat compatible with pole.

c) Luminaire Mounting Height: 11m minimum

.5.3.2 Mast Arm

a) 3.7m (12ft) tapered elliptical aluminum with a rise of 1.5m (5ft). Mast Arms shall be bolted directly to the pole with 16 mm galvanized steel through bolts, nuts and 50 x 50mm square washers (banding is prohibited).

b) Mast arm shall be manufactured to ANS1 C136.13, and shall be in general conformity to OPSD 2420.010.

.5.3.3 Pole

a) Shall be 12.2m (40 ft.) direct bury, C.S.A. Class "B" spun concrete. Hand-hole cover plates shall have tamper proof screws and be affixed with a warning label. Pole shall be affixed with an identification plate containing manufacturer's name, class, pole height, date of manufacturer and a C.S.A. stamp.

b) Cross Section: Tapered round

c) Finish: Smooth Mold

d) Colour: Natural Concrete grey

.6 Decorative Design – Roads

.6.1 Traditional

.6.1.1 Luminaire

a) Shall be of the '"Traditional Lantern" Type, side mounted.

b) Colour shall be black polyester powder coat, compatible with pole

c) Luminaire Mounting Height: 8.25m minimum

.6.1.2 Mast Arm

a) 1.8m (6ft) single bend aluminum decorative scroll arm with a rise of 0.45m (1.5ft). Mast Arms shall be bolted directly to the pole with 16 mm galvanized steel through bolts, nuts and 50 x 50mm square washers and painted black to match the luminaire (banding is prohibited).

b) Colour shall be black polyester powder coat, compatible with pole

c) Mast arm shall be manufactured to ANSI C136.13.

.6.1.3 Pole

a) Shall be 9.9m (32.5ft) direct bury, Class “B” tapered, octagonal spun concrete pole with a 4-fin cap painted black to match. Hand-hole cover plates shall have tamper proof screws and be affixed with a warning label. Pole shall be affixed with an identification plate containing manufacturer's name, class, pole height, date of manufacturer and a C.S.A. stamp.

b) Cross Section: Tapered octagonal

c) Finish: Etched

d) Colour: Eclipse

.7 Pedestrian Walkways, Sidewalks and Bikeways Design

.7.1 Luminaire

a) Shall be of the Contemporary "Shoe Box" type using a 15cm (6in) arm

b) Colour shall be bronze polyester powder coat compatible with pole.

c) Luminaire Mounting Height: 4.6m minimum

.7.2 Concrete Pole

a) Shall be 6.4m (21 Ft.) direct buried decorative, tapered, octagonal, spun concrete pole. Hand-hole cover plates shall have tamper proof screws and be affixed with a warning label. Pole shall be affixed with an identification plate containing manufacturer's name, class, pole length, date of manufacture and a C.S.A. stamp.

b) Cross Section: Tapered octagonal

c) Finish: Etched

d) Colour: Bronze or Black

.7.3 Metal Pole

Metal poles are intended for parks only and their use shall be subject to City's approval.

a) Shall be 4.9m (16 Ft.) base mounted round tapered aluminum pole, with 0.156” wall thickness and 5” shaft diameter at base, and with 2.38” OD. 4” high tenon, and complete with nut covers. Hand-hole cover plates shall have tamper proof screws and be affixed with a warning label. Pole shall be affixed with an identification label containing manufacturer's name, pole specifications, date of manufacture and a C.S.A. stamp.

b) Cross Section: Round tapered

c) Finish: Polyester powder coated

d) The illumination design drawings shall include a structural pole base design for any proposed base mounted poles. Structural design shall be sealed by a structural engineer

.8 Pole Locations

Both one-sided and staggered pole arrangements will be permitted. At locations with wider pavement widths, especially at intersections, opposite arrangements will be permitted to achieve the luminance/Illuminance design levels. Poles shall be installed as per City of Richmond Hill Standard Cross-Section Drawings. Refer to Division C. For the erection of poles, construction shall be as per OPSS.MUNI 615 - unless otherwise specified in the contract, concrete encasement is not a requirement. Pole hand hole locations as per OPSD 2220.01.

On roadways with residential frontages, poles are to be placed at lot lines and at ends of walkways where possible. A minimum separation of 1.2 m (from centre line of pole) shall be required from driveways and municipal services. Other minimum clearances shall be as per Table E-1.

.8.1 Pole Numbering

All poles will be given unique asset ID number by the City. The City will then physically tag the poles.

.9 Underground Services

All wiring to be underground, the lighting completed and energized prior to Occupancy.

All electrical Contractors/Subcontractors must meet Electrical Safety Authority and local electricity utility company requirements and are subject to their approval.

For electrical work in general, construction shall be as per OPSS.MUNI 106. For the installation of ducts, construction shall be as per OPSS.MUNI 603. For the installation of cable, construction shall be as per OPSS.MUNI 604.

For the installation of a grounding system, construction shall be as per OPSS.MUNI 609. For the removal of electrical equipment, construction shall be as per OPSS.MUNI 610. For the installation of roadway luminaires, construction shall be as per OPSS.MUNI 617.

All trench backfill shall be compacted to a minimum of 100% standard proctor density and is subject to the approval of the City.

Contractor shall construct a complete circuit to include all electrical connections in accordance with local electricity utility company, O.P.S.S., C.S.A. and Ontario Electrical Safety Code requirements to the supply points.

Service Cables from transformer to pedestal (loadcentre) shall be 3 # 2 Copper RWU-90 [Note: jacket colours shall be Black (Line), Red (Line) and White (Neutral)]. Service cables from transformer to in-pole disconnect shall be 2 # 6 Copper RWU-90 [Note: for 120V systems, jacket colours shall be Black or Red (Line) and White (Neutral); for 240V systems, jacket colours shall be Black (Line) and Red(Line)]. Any cables exposed to sunlight shall be RWU-90 SR rated type.

Streetlight Cables from Pedestal or disconnect to hand hole in pole shall be 2 # 6 Copper RWU-90 complete with 1 # 6 stranded copper green jacketed ground wire [NOTE: Jacket colours shall be Black (Line), White (Neutral), and Green (Ground)].

All service and streetlight cables to be installed in 50mm Rigid PVC Conduit (CSA 22.2#211.2) with solvent weld fittings or 50mm HDPE (CSA C22.2 #327) smooth wall interior conduit with mechanical (Shur-Lock or Push Lock Couplers), or solvent weld CSA listed fittings, or fittings approved by the HDPE manufacturer. The direct buried conduit system shall be as per OPSD 2101.01 at 900mm (minimum) below finished grade and protected by red plastic warning tape buried at 300mm below finished grade.

Streetlight Cables from hand hole in pole to fixture shall be 2 # 12 Copper RWU-90 complete with 1 # 12 stranded copper green jacketed ground wire [NOTE: Jacket colours shall be Black (Line), White (Neutral), and Green (Ground)] such that the entire circuit has an acceptable voltage drop. Compression type connectors shall be used throughout. All wiring connections shall be made in the hand holes of streetlight poles. A waterproof C.S.A. fused connector kit complete with a 10 Amp ceramic midget fuse shall separate the line end from the load end.

Road crossings must not terminate under driveways and shall be installed at right angles with respect to the boulevard. A minimum clearance of 1m shall be maintained from the edge of driveway to the road crossing. The location of the road crossings with reference to a fixed point (e.g. Property line, transformer etc.) must be indicated on construction drawings.

Contractor is required to provide adequate surplus cable to allow the local electrical utility company to make connections to the existing supply. All other connections are to be complete.

Final Installation shall be inspected by and subject to Electrical Safety Authority and City of Richmond Hill approval.

.9.1 Fusing

Each fixture shall be protected through the use of in-line fuses. The line side of the streetlight circuit shall be individually fused utilizing 10 Amp KTK fuse(s) complete with in-line breakaway fuse holder: P/N HEB-AW-RYC for 120 V installations and P/N HEX-AW-DRYC for 240 V installations. The requirement for fusing is covered under previous section.

.10 Means of Disconnect

All disconnects shall be service entrance rated and grounded with a ground electrode as per Code requirements.

.10.1 In-pole Breakers

In-pole breakers for 120V and for 240V installations shall be single-pole 120V, 15A, 22kAIR and double-pole 240V, 15A, 22kAIR, respectively.

In-pole breakers shall be Eaton Cutler-Hammer catalogue # 1SL150PCO (for 120V systems) and # 2SL150PCO (for 240V systems), or approved equals.

.10.2 Loadcentre Pedestals

Loadcentre pedestals shall be comprised of base mounted metal enclosure housing a 120/240V 100A breaker panel complete with 2-pole 60A 240V 22kAIR main breaker and six (6) 1-pole 30A 120V loadside breakers. The enclosure shall be rated for outdoor use and manufactured from galvanized sheet metal in green powder coat finish.

.11 Smart Lighting Control System

The City has converted its outdoor lighting network to LED technology and installed a state-of-the-art smart lighting control and monitoring (SLCM) system. The SLCM system, produced by Itron Inc., is a proprietary communication network formed by SELC External CMS Modules (Nodes) installed on each light, which communicate wirelessly to the central management server via Access Points (Gateways). It is the intent of the City to continue to utilize the latest Itron Inc. technology for any new outdoor municipal lights installed in the City of Richmond Hill as described below. The Design Engineer shall consult with the appropriate City staff to confirm the equipment to be deployed for a specific geographical location.

.11.1 Access Points (Gateways)

The existing Itron Inc’s SLCM utilizes Generation 5.0 Access Points to connect the radio frequency (RF) mesh formed by the SELC External CMS Modules (Nodes) installed on each light. The nodes report the status of the lights and allow for remote control dimming and scheduling from the central management server. Six Access Points have been installed throughout the City as part of the City’s ‘Conversion of Outdoor Lighting Network to LED Project’.

For new developments, the Developer shall install new Access Points at their own cost, if the City deems it necessary to ensure adequate connectivity and response time. The Access Point shall be mounted on the roof or wall of the City facility or on streetlight poles. The City shall determine the appropriate location of any new Access Points.

.11.2 Smart Control Nodes

All new municipal light fixtures installed shall be equipped with GPS enabled Nodes mounted on the fixture’s 7-pin NEMA twist lock receptacle. Black Nodes shall be used for all 120 Volts luminaires including both cobra head style and decorative style luminaires (i.e. Coach/Lantern and Square pack/Shoebox). Please refer to Section E7, “Table E-13: Nodes Approved by the City per Luminaire Type” for further details.

For new developments, the Developer shall purchase and install the Nodes at their own cost. The Node shall be purchased from Fairway Electrical Services Inc. using the contact information below:

Fairway Electrical Services
1104 Fiddler’s Green Rd
Ancaster, ON L9G 3L1

Email: smartcity@fairwayelectrical.com
Office Number 905-304-1133 x7001
Mobile Number 905-746-2435
Fax number 905-304-0698

Each node will be initialized into the central management system by the City during the assumption process. If needed, the City will provide a list of locations that are reporting fixture or node faults to the Design Engineer/Developer/Contractor. All faults/malfunctions shall be addressed before the City assumes responsibilities for new lights.

.11.3 Procedure for Installing Nodes on Luminaires

a) The Node shall be mounted on each LED luminaire. Once installed, the Node will act as a regular photocell until initialized by the City.

b) To properly initialize the nodes, the City needs to know which node was installed at each location. To assist with this, each node is labeled with a unique QR Code sticker which includes the Node’s Serial number and unique MAC ID. The Node also comes with a detachable QR Code Sticker. During field installation, the installer shall paste the detachable QR Code sticker on the Smart Control Nodes Installation Form below and

record the corresponding Pole Coordinates and Pole Number (from the installation drawings):

Table E-6: Smart Control Nodes Installation Form

Pole #	Pole Coordinates*		Node Sticker (Paste here)
	X	Y	

*The permissible level of accuracy for the Pole Coordinates is ± 3m.

c) Once completed the design engineer shall submit this information to the City, including the chart above, and design/installation drawings that indicate the pole numbers and locations. The City's staff will remotely initialize the node using this information. The developer/contractor shall inform the City representative as soon as the lights are energized.

.12 Standard Drawings

Refer to Standard Drawings Section in Division "E" and Division "C".

.13 Submission Requirements

.13.1 Street Lighting Design Submission Requirements

Street lighting design submissions to the City shall include two hard copies and one electronic copy of the following:

a) A Design Engineer Certification Letter confirming that the Streetlight design has been completed in accordance with ANSI/ IESNA Recommended Practice RP-8, TAC: Guide for the Design of Roadway Lighting – 2006, and the Electrical Safety Authority (ESA) requirements.

b) Lighting plans, including the following:

   i. Planview layout of all equipment, including wiring details, and load summaries. Note: pole spacing shall not exceed 95% of maximum optimizer spacing

   ii. Details sheets including:

   - Spec sheets for poles, arms, smart controls and luminaires (showing wattage, drive current, distribution type, CCT)
   - R.O.W. cross-sections identifying pole and trench offsets

c) Photometric plans, including the following:

   i. Luminaire schedule identifying LLF, IES files and other luminaire parameters

   ii. Optimizer results for each R.O.W. type

   iii. AGI32 photometric simulation grids for the proposed pole layout:

- taking into account existing boundary conditions, where applicable
- including property boundary and trespass areas (for walkway lighting)

iv. Identification of luminaire mounting heights

v. Summary of results vs City’s design targets

d) Additional technical information that should be made available at City’s request, including:

i. TM-21 data files for each luminaire type

ii. IES files (electronic version) for each luminaire type

iii. Optimizer files

iv. AGI32 file

.13.2 Certification and Documentation Requirements

The following documents shall be submitted to the City at various stages:

.13.2.1 Stage 1: Building Permit/Occupancy Stage

The following documents shall be submitted to the City at the Building Permit/Occupancy Stage:

a) The Design Engineer Certification Letter confirming that:

i. The street lighting system has been installed in accordance with the approved street lighting drawings, specifications, and the City Standards, Electrical Safety Authority (ESA) requirements and all applicable electrical code

ii. All street lighting poles have the appropriate buried depth.

iii. All streetlights are functional and operational on all streets, lanes, and walkways.

b) If the actual pole location deviates more than two (2) meters from the proposed design location, the Design Engineer shall carry out the photometric analysis again to confirm that the required lighting levels are met as per ANSI/IES RP-8 Standards latest version.

c) The Smart Control Nodes Installation Form that includes the Global Position System (GPS) X, Y Co-ordinates of newly installed poles and the QR Code stickers for the SLCM nodes. This information will be used by the City to initialize the nodes and connect them to the SLCM system.

Upon receiving Smart Control Nodes Installation Form, City staff will remotely initialize the nodes and connect them to the SLCM system. The developer/contractor shall be responsible for correcting any deficiencies associated with the pole, lights and SLCM nodes.

.13.2.2 Stage 2: Assumption (Start of Maintenance) Stage

The following documents shall be submitted to the City at the Assumption (start of maintenance) Stage:

a) As-Constructed drawings - 1 hard copy + electronic files in AUTOCAD and PDF format:
   i. As-Constructed drawings shall be in accordance with the City’s Design Criteria
   ii. Global Position System (GPS) X, Y Co-ordinates of newly installed poles in a tabular format. The permissible level of accuracy for the pole coordinates is ± 3m.
   iii. Include offsets, if streetlight cables are not installed in joint utility trench
b) The Design Engineer Certification Letter confirming that:
   i. All lights are functional and operational on all streets, lanes, and walkways
   ii. All light poles are plumb / straight
   iii. All street lighting luminaries are washed and provision of date of wash
   iv. All pedestals have been locked
   v. Grades around poles and pedestals have not settled
   vi. All hand hole cover plates are secured
   vii. All poles, mounting hardware, and streetlights are visually inspected
   viii. All deficiencies are corrected

.13.2.3 Stage 3: End of Maintenance Stage

The following documents shall be submitted to the City at the End of Maintenance Stage:

a) A Design Engineer Certification Letter certifying the following:
   i. The street lighting system is in accordance with City’s Standards, Electrical Safety Authority (ESA) requirements and all applicable electrical code
   ii. All lights are functional and operational on all streets, lanes, and walkways
   iii. All light poles are plumb / straight
   iv. All pedestals have been locked
   v. Grades around poles and pedestals have not settled
   vi. All hand hole cover plates are secured
   vii. All poles, mounting hardware, and streetlights are visually inspected
   viii. All deficiencies are corrected

Section E5
Design Criteria - Municipal Parking Lot Lighting

.1 General Requirements

.1.1 Introduction

The purpose of these guidelines is to outline general design criteria and best practices for design, construction, and inspection of Municipal Parking Lot Lighting Systems within the City of Richmond Hill. The guidelines provide direction and outline expectations to the Design Engineers and Contractors and are based on existing and recommended practices for parking lot lighting published by the Illuminating Engineering Society of North America (IESNA). These guidelines are not to be considered absolute and following these guidelines shall not relieve the Owner/Design Engineer of the responsibility of the design, construction, and completion of the municipal parking lot lighting system as a finished product of competent engineering design, construction, and good engineering practices.

This document is not intended to be a complete instruction manual for the design of lighting. The Design Engineers are encouraged to refer to the referenced publications for additional information.

The City of Richmond Hill reserves the right to require different lighting levels for certain areas of the City based on intended future use.

.1.2 References

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

Criterion	Description
ANSI/IES LM-79	Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products
ANSI/IES LM-80	Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules
ANSI/IES LM-82	Approved Method: Characterization of Optical and Electrical Properties of Solid-State Lighting Products as a function of Temperature
ANSI/IES LP-2	Lighting Practice: Designing Quality Lighting for People in Outdoor Environments
ANSI/IES LP-11	Lighting Practice: Environmental Considerations for Outdoor Lighting
ANSI/IES RP-8	Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting
ANSI/IES TM-15	Technical Memorandum: Luminaire Classification System for Outdoor Luminaires
ANSI/IES TM-21	Technical Memorandum: Projecting Long Term Lumen, Photon, and Radiant Flux Maintenance of LED Light Sources
City of Richmond Hill	Light Pollution By-law, as amended

Criterion	Description
IES G-1	Guide for Security Lighting for People, Property, and Critical Infrastructure
IES/IDA MLO	Model Lighting Ordinance (MLO) with User’s Guide
PTM-LIGHTING06	TAC (Transportation Association of Canada) Guide for the Design of Roadway Lighting

The Design Engineer and Contractor shall be responsible to ensure that latest version of each standard is utilized.

.1.3 Professional Certification

Municipal parking lot lighting system designs shall be completed by a Professional Engineer in good standing with Professional Engineers Ontario (PEO) who is licensed to practice electrical engineering in the Province of Ontario with expertise in this field.

All drawings submitted to the City for acceptance shall be signed and sealed by a Professional Engineer of a Design Engineering Firm. The City shall be accepting the drawings as to form in reliance upon the professional skill and ability of the Design Engineering firm, as to design and specification.

.2 Material Specifications

.2.1 Source Type

All light sources shall be of the Light Emitting Diode (LED) type.

.2.2 LED Luminaires

Wattages of LED luminaires will be selected based on lighting design criteria and site conditions (this to be confirmed after the implementation phase of the project). LED luminaires shall have a minimum service life of 100,000 hours (including the driver and light source life). In addition, the LED Luminaire should have the following specification:

- 0-10Volt Dimming LED Driver
- Operating voltages as a minimum 120V, 347 VAC +/- 10 percent, 60 Hz.
- Equipped with Surge protective device (SPD) in case of lightning or electrical storms. Surge protective devices shall be in compliance with the applicable ANSI standard.
- Durable finish and IP66 rated protection gasket against water and dust particles.
- Tool-less entry feature for quick and easy maintenance.
- 7-PIN NEMA twist lock photo control receptacle.
- For custom luminaires (if required), drawings shall be stamped by a Professional Engineer and approved by ESA.
- Correlated Colour Temperature (CCT): 3000K ± 200K.
- Colour Rendering Index (CRI): 70 or greater.

- Operate at an ambient temperature range of – 40 °C to + 40 °C.
- Approved by an ESA-approved certified organization, such as CSA or ULC as per ESA Technical Guidelines Document.

.2.3 Selection of LED Luminaires

BUG ratings (Backlight, Up light & Glare) must be addressed during the selection of luminaires. Ensure that up light from luminaires is zero (U=0), backlight (B) and glare light (G) shall be reviewed and selected in accordance with design criteria and site conditions.

Where parking lots and pedestrian ways are to be adjacent, the parking lot lighting and the pedestrian way lighting may be achieved by a single lighting system or multiple systems.

Ensure compliance with all City's applicable By-Laws; especially Light Pollution By-law.

.2.4 Manufacturers' Product Warranty

Provide a 10-year manufacturer's warranty certificate, in the City's name, for LED luminaires and components confirming that the luminaire housing and all of its internal components, including but not limited to LED drivers and light engines shall be covered against defective workmanship, material, and premature light source failures.

Warranty period shall begin on date of receipt of material from the supplier. The supplier/manufacturer shall provide the City with appropriate warranty certificates and shipping documents as proof of date of shipment.

Provide a manufacturer's certificate indicating that the service life of the LED luminaires is 100,000 hours of operation or greater.

.3 Lighting Design

Lighting design criteria for municipal parking lots shall be as per Table E-7 below. Please be advised that the requirements based on IESNA recommendations are periodically revised and updated. All lighting design criteria shall be in accordance with latest American National Standards Institute/Illuminating Engineering Society standards ANSI/IES, the latest Standard Recommended Practices (RP-8).

Table E-7: Lighting Design Criteria for Municipal Parking Lots

Application Task / Area	Time	Recommended Min. maintained Illuminance [LUX]		Horizontal Illuminance Max:Min Ratio (Max.)	Vertical Illuminance Max:Min Ratio (Max.)
		Horizontal Eh (at grade)	Vertical Ev (at 1.5m above grade)		
Drive Aisles / Parking Areas (see Note 1)		2	1	20:1	20:1
	Pre-closing time	10	5	15:1	15:1

Application Task / Area	Time	Recommended Min. maintained Illuminance [LUX]		Horizontal Illuminance Max:Min Ratio (Max.)	Vertical Illuminance Max:Min Ratio (Max.)
		Horizontal Eh (at grade)	Vertical Ev (at 1.5m above grade)		
General Transaction Areas	Post-closing time	2	1	15:1	15:1
Transaction Machines	Pre-closing time	n/a	30 @ task surface	n/a	n/a
	Post-closing time	n/a	15 @ task surface	n/a	n/a

Note: This table is based on IESNA RP-8

Where:

- Pre-closing time: Is from dusk until ‘closing time’ (time to be determined by the City), when the area being illuminated is more likely to be in use.
- Post-closing time: Is from ‘closing time’ (time to be determined by the City) to dawn.
- NOTE 1: Where security is an overriding concern, IES G-1 recommends a maintained horizontal illuminance of 32 lx on the pavement and to a height of 1.5m. The consultant will have to balance illuminance requirements with security lighting recommendations when preparing lighting design case-by-case, on a contextual basis and in consultation with the City of Richmond Hill.

.4 Pole Locations

Luminaires to be distributed to achieve the illumination design levels.

.5 Pole Numbering and Tagging

All poles will be given unique asset ID number by the City. The City will then physically tag the poles.

.6 Underground Services

All electrical Contractors/Subcontractors must meet Electrical Safety Authority, local electricity distribution utility company and City of Richmond Hill requirements and are subject to their approval. All wiring to be underground. All underground power cables must be placed in a minimum 50mm PVC or HDPE duct. Primary and secondary power cables must be installed in separate ducts. The ducts should be sized so the power cables do not exceed forty percent (40%) of the cross-sectional area of the duct. The ducts must only be used for underground power cables.

.6.1 Fusing

Fusing shall be done in accordance with the latest requirements from the Electrical Safety Authority (ESA) and/or any other applicable regulations.

.7 Standard Design

.7.1 Area Lighting Luminaires

The following types of parking lot luminaire designs may be considered:

- Architectural/Decorative: A wide variety of architectural luminaires are available and because it is desirable to obscure the light source in normal applications, architectural luminaires may provide light distribution through optical systems. Efficiencies of this luminaire type can be comparable to other types.
- Post top or side mounted luminaires: They have many similarities to Architectural luminaires. Usually, to be located within the parking area (away from the perimeter). Mounting heights for direct type are recommended to be 8 meters (26ft) or less. Side mounting may be used as an alternate mounting method to match the appearance of arm-mounted luminaires.
- Wall mounted (wall pack) luminaires: Narrow parking areas (that are between or adjacent to buildings) may be lighted by wall mounted luminaires. Mounting heights 8 meters (26ft) or less are recommended.

.7.2 Pole Bases

The parking lot illumination design drawings shall include a structural pole base design for any proposed base mounted poles. Structural design shall be sealed by a structural engineer.

.8 Lighting Controls

The City has converted its outdoor lighting network to LED technology and installed a smart lighting control and monitoring (SLCM) system. All new, outdoor municipal lights installed in Richmond Hill shall be equipped with Smart Control Nodes as per the requirements contained in the Street Lighting Standards in Section E4.

.9 Submission Requirements

An Exterior Lighting Plan shall be provided for all parking lot lighting projects as defined in the City of Richmond Hill Light Pollution By-law. The Exterior Lighting Plan must be certified by an Electrical Engineer confirming that the design has been completed in accordance with ANSI/IESNA Recommended Practices RP-20 and Electrical Safety Authority (ESA) requirements. All exterior lighting shall be designed in accordance with and in compliance with the City of Richmond Hill Light Pollution By-law and this Standard.

Section E6
Design Criteria - Municipal Parks and Sport Facilities Lighting

.1 General Requirements

.1.1 Introduction

The purpose of these guidelines is to outline general design criteria and best practices for design, construction, and inspection of Municipal Parks and Sport Facilities Lighting Systems within the City of Richmond Hill. The guidelines provide direction and outline expectations to the Design Engineers and Contractors and are based on existing and recommended practices for parks and sports lighting published by the Illuminating Engineering Society of North America (IESNA). These guidelines are not to be considered absolute and following these guidelines shall not relieve the Owner/Design Engineer of the responsibility of the design, construction, and completion of the municipal parks and sports lighting system as a finished product of competent engineering design, construction, and good engineering practices.

This document is not intended to be a complete instruction manual for the design of lighting. The Design Engineers are encouraged to refer to the referenced publications for additional information.

The City of Richmond Hill reserves the right to require different lighting levels for certain areas of the City based on intended future use.

.1.2 References

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

Criterion	Description
ANSI/IES LM-79	Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products
ANSI/IES LM-80	Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules
ANSI/IES LM-82	Approved Method: Characterization of Optical and Electrical Properties of Solid-State Lighting Products as a function of Temperature
ANSI/IES LP-2	Lighting Practice: Designing Quality Lighting for People in Outdoor Environments
ANSI/IES LP-11	Lighting Practice: Environmental Considerations for Outdoor Lighting
ANSI/IES RP-6	Recommended Practice for Sports and Recreational Area Lighting
ANSI/IES RP-8	Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting
ANSI/IES TM-15	Technical Memorandum: Luminaire Classification System for Outdoor Luminaires
ANSI/IES TM-21	Technical Memorandum: Projecting Long Term Lumen, Photon, and Radiant Flux Maintenance of LED Light Sources

Criterion	Description
City of Richmond Hill	Light Pollution By-law, as amended
IES G-1	Guide for Security Lighting for People, Property, and Critical Infrastructure
IES/IDA MLO	Model Lighting Ordinance (MLO) with User’s Guide
PTM-LIGHTING06	TAC (Transportation Association of Canada) Guide for the Design of Roadway Lighting

Contractor shall be responsible to ensure that latest version of each standard is utilized.

.1.3 Professional Certification

Municipal park and sport facility lighting system designs shall be completed by a Professional Engineer in good standing with Professional Engineers Ontario (PEO) who is licensed to practice professional engineering in the Province of Ontario with expertise in this field.

All drawings submitted to the City for acceptance shall be signed and sealed by a Professional Engineer of a Design Engineering Firm. The City shall be accepting the drawings as to form in reliance upon the professional skill and ability of the Design Engineering firm, as to design and specification.

.2 Material Specifications

.2.1 Source Type

.2.1.1 Parks

All light sources shall be of the Light Emitting Diode (LED) type.

.2.1.2 Sport Facilities

Light sources could be of Light Emitting Diode (LED) or High Pressure Sodium (HPS) to match existing.

.2.2 LED Luminaires

- Wattages of LED luminaires will be selected based on lighting design criteria and site conditions (this to be confirmed after the implementation phase of the project). LED luminaires shall have a minimum services life of 100,000 hours (for the driver and light source life). In addition, the LED Luminaire should have the following specification:
- 0-10 Volt Dimming LED Driver.
- Operating voltages as a minimum 120V, 240V or 347VAC +/- 10 percent, 60 Hz.
- Equipped with Surge protective device (SPD) in case of lightning or electrical storms. Surge protective devices shall be in compliance with the applicable ANSI standard.
- Durable finish and IP66 rated protection gasket against water and dust particles.
- Tool-less entry feature for quick and easy maintenance.

- 7-PIN NEMA twist lock photo control receptacle (not applicable to sports lighting).
- Correlated Colour Temperature (CCT): 3000K ± 200K (if not available, 4000K shall be acceptable).
- Colour Rendering Index (CRI): 70 or greater.
- Sports lighting luminaires shall be equipped with a laser aiming device.
- Operate at an ambient temperature range of - 40 °C to + 40 °C.
- Approved by an ESA-approved certified organization, such as CSA or ULC as per ESA Technical Guidelines Document.

.2.3 Selection of Luminaires

LED luminaires to be selected to meet lighting design criteria.

BUG ratings (Backlight, Up light & Glare) must be addressed during the selection of luminaires. Ensure that up light from luminaires is zero (U=0), backlight (B) and glare light (G) shall be reviewed and selected in accordance with design criteria and site conditions. BUG rating system does not apply to sport facilities lighting.

Ensure compliance with all City’s applicable By-Laws; especially Light Pollution By-law.

.2.4 Manufacturers’ Product Warranty

Provide a 10-year manufacturer’s warranty certificate, in the City’s name, for LED luminaires and components confirming that the luminaire housing and all of its internal components, including but not limited to LED drivers and light engines shall be covered against defective workmanship, material, and premature light source failures.

Warranty period shall begin on date of receipt of material from the supplier. The supplier/manufacturer shall provide the City with appropriate warranty certificates and shipping documents as proof of date of shipment.

Provide a manufacturer’s certificate indicating that the service life of the LED luminaires is 100,000 hours of operation or greater.

.3 Lighting Design

.3.1 Parks Lighting

Lighting design level for Parks: Per IESNA G-1 (Guideline for security lighting for people, properties and public spaces)

- Locations where security concerns may exist should be illuminated to a level of at least 11 lux (1.0 fc) horizontal at ground level and at 1.5 m above ground, with an average-to-minimum uniformity ratio not greater than 4:1.
- When lighting park trails and walkways, they should be illuminated to at least 6 lux (0.6 fc) horizontal at ground level and at 1.5 m above ground. The average-to-minimum uniformity ratio should be 4:1.

For parking lot lighting requirements within parks, refer to Section E5 Design Criteria for Parking Lots.

The lighting systems for parks should be reviewed and approved by the City on a case-by-case basis and in accordance with site conditions.

.3.2 Sport Facilities Lighting

The table below (Table E-8) illustrates the recommended maintained illuminance targets for various outdoor sports and recreational areas (after RP-6-20).

Table E-8: Illuminance Targets for Various Outdoor Sports and Recreational Areas

Sport	Class of Play	Target Eh @ height above grade Lux @ m	Uniformity Ratios	
			Max CV	Max:Min
Baseball / Softball				
Infield	I	1,500 @ 0.91	0.07	1.3:1
Outfield	I	1,000 @ 0.91	0.13	1.7:1
Infield	II	1,000 @ 0.91	0.10	1.5:1
Outfield	II	750 @ 0.91	0.17	2:1
Infield	III	500 @ 0.91	0.17	2:1
Outfield	III	300 @ 0.91	0.21	2.5:1
Infield	IV	300 @ 0.91	0.21	2.5:1
Outfield	IV	200 @ 0.91	0.25	3:1
Bocce				
	n/a	50 @ 0.91	0.25	3:1
Soccer				
	I	750 @ 0.91	0.13	1.7:1
	II	500 @ 0.91	0.17	2:1
	III	300 @ 0.91	0.21	2.5:1
	IV	200 @ 0.91	0.25	3:1
Tennis				
	I	1,500 @ 0.91	0.10	1.5:1
	II	750 @ 0.91	0.13	1.7:1
	III	500 @ 0.91	0.17	2:1
	IV	300 @ 0.91	0.21	2.5:1

.4 Pole Locations

Luminaires to be distributed to achieve the illumination design levels.

.4.1 Pole Numbering and Tagging

All poles will be given unique asset ID number by the City. The City will then physically tag the poles.

.5 Underground Services

All electrical Contractors/Subcontractors must meet Electrical Safety Authority and local electricity distribution utility company requirements, and City of Richmond Hill requirements and are subject to their approval. All underground power cables must be placed in a minimum 50mm PVC or HDPE duct. Primary and secondary power cables must be installed in separate ducts. The ducts should be sized so the power cables do not exceed forty percent (40%) of the cross-sectional area of the duct. The ducts must only be used for underground power cables.

.5.1 Fusing

Fusing shall be done in accordance with the latest requirements from the Electrical Safety Authority (ESA) and/or any other applicable regulations.

.6 Pole Design

The lighting poles will be of metal or concrete. Their design should match with the style of the project. They should be reviewed and approved by the City on a case-by-case basis.

All sports lighting installations shall require a pole foundation design to be prepared by a structural engineer.

.7 Lighting Controls

.7.1 Parks

The City has converted its outdoor lighting network to LED technology and installed a smart lighting control and monitoring (SLCM) system. All new, outdoor municipal lights installed in Richmond Hill shall be equipped with Smart Control Nodes as per the requirements contained in the Street Lighting Standards in Section E4.

.7.2 Sports Facilities

For sports lighting systems, a single master Smart Control Node shall be utilized, complete with a custom lighting loadcentre controls design.

.8 Submission Requirements

The City requires the submission of an Exterior Lighting Plan for park lights. The Exterior Lighting Plan must be certified by an Electrical Engineer confirming that the park lights design has been completed in accordance with the requirements of this standard and the Electrical Safety Authority (ESA). All exterior lighting shall be designed in accordance with and in compliance with

the City of Richmond Hill Light Pollution By-law. The Exterior Lighting Plan and associated documents will be reviewed and approved by the City on a case by-case basis.

Section E7
Approved Manufacturers and Products

.1 City-Approved LED Roadway and Pedestrian Luminaires

Table E-9 lists the City-approved cobra head and traditional styled LED luminaires that meet the City's lighting standards and shall be used for the City's streetlights. The requirements illustrated in Appendix E-1, E-2 and E-3 are used in approving these LED luminaires.

Table E-9: City-Approved LED Roadway Luminaires

Manufacturer	Style	Base Part Number
LRL	Cobra Head	NXT-XXS-X-7-XXX-X-GY-4-UL-X-2H
LRL	Cobra Head	NXT-XXM-X-7-XXX-X-GY-4-UL-X-2H
GE Lighting	Cobra Head	ERL1 X XX XX 30 A GRAY ILT
GE Lighting	Cobra Head	ERLH X XX XX 30 A GRAY ILT
GE Lighting	Cobra Head	ERL2 X XX XX 30 A GRAY ILT
Acuity AEL	Cobra Head	ATB0 XXBLEDEXX XXX RX 3K 20 NL P7
Acuity AEL	Cobra Head	ATB2 XXBLEDEXX XXX RX 3K 20 NL P7
King Luminaire	Traditional Lantern	K601D-S-P4-NL-X-X-SSL-120V-X-3K-BK-F4-PR7
Amerlux	Traditional Lantern	CSL-A-XM-3K-TX-7P-BLK

Table E-10: City-Approved LED Pedestrian Luminaires

Manufacturer	Style	Base Part Number
King Luminaire	Pedestrian Post-Top Traditional Lantern	K601D-T-P4-NL-X-X-SSL-120V-X-3K-BK-F4-PR7
Amerlux	Pedestrian Post-Top Traditional Lantern	CSL-P-XM-30-TX-TBK-7P
Cooper Lighting	Pedestrian shoebox	RDG-XXX-LED-D-U-XX-??-4N7-U-7030-SA1182-?? Black : ??=BK, Bronze : ??=BZ
Cooper Lighting	Pedestrian shoebox	LD-RV-XX-XXX-E-DIM-PER7-7030-??-MA1182-?? Black : ??=BK, Bronze : ??=BZ

Table E-11: City-Approved Roadway Lighting Poles and Arms

Location	Manufacturer	Model Number
Poles		
Local & Collector Road	StressCrete or USI or Approved Equal	E325-BPR-G-M00 S/F 120 C/W Capseal or HA-325-B-1-PG-10-X or Approved Equal
Lanes	StressCrete or USI or Approved Equal	E250-BPR-G-M00 S/F 120 C/W Capseal or HA-250-B-1-PG-10-X or Approved Equal
Arterial Road	StressCrete or USI or Approved Equal	E400-BPR-G-M00 S/F 120 C/W Capseal or HA-400-B-1-PG-10-X or Approved Equal
Decorative Road (Traditional)	StressCrete or USI or Approved Equal	E325-BPO-G-E11 S/F KA176-S C/W FC or MA-325-B-3-BE-60-F or Approved Equal

Location	Manufacturer	Model Number
Arms		
Tapered Elliptical Arms	USS Manufacturing or Aluminous or Thomas & Betts or approved equal	TER-XX-MA or ALS-RE-XX-M or RE-XX-M
Decorative Road (Traditional)	StressCrete or Approved Equal	KA170 series or Approved Equal

Table E-12: City-Approved Pedestrian Lighting Poles

Location	Manufacturer	Model Number
Walkways, Sidewalks & Bikeways	StressCrete or USI or Approved Equal	Saluki Bronze: #E210-APO-G-E90 C/W 140-25/35 or MA-210-A-3-SB-30 or Approved Equal Black Eclipse: E210-APO-G-E11 C/W 140-25/35 or MA-210-A-3-BE-30 or Approved Equal

Refer to Section E7.5 for luminaires and poles approved for use within Parks.

.2 City-Approved Loadcentre Pedestals

The loadcentre shall be Pedestal Solutions Inc. catalogue # SLS1-6-30 or approved equal.

The pre-cast foundation for the pedestal loadcentre shall be Utilicon catalogue # UP1420 or approved equal.

.3 City-Approved Smart Control System Components

The specification for the Nodes approved by the City and corresponding luminaire type can be found in the chart below:

Table E-13: Nodes Approved by the City per Luminaire Type

Manufacturer /Part Number	Part Description	Luminaire Type
SELC/ 8S57137-004002-3-RCH	120-277 Volt SELC RF Photocell 5 PIN 0-10V, Black ROTA V2 GPS	LED Cobra Head LED Traditional Lantern LED Contemporary / Pedestrian Shoebox
Acuity Brand / DTL (Dark to Light) DSN 127 BK 0 G USM5 DSTY RCH	120-277 Volt Control Node 0-10 V, Black	LED Cobra Head LED Traditional Lantern LED Contemporary / Pedestrian Shoebox
Acuity Brand / DTL (Dark to Light) DSN 347 GN 0 G USM5 DSTY RCH	347 Volt Control Node 0-10 V, Green	Any 347V LED Luminaire

.4 City-Approved LED Municipal Parking Lot Luminaires

Table E-14 lists the City-approved LED luminaires that meet the City's lighting standards, to be used for the City's municipal parking lot lights.

Table E-14: Approved LED Luminaires - Municipal Parking Lots

Manufacturer	Base Part Number
GE Lighting	EANB-0-XX-7-30-A-X-XXXX

.5 City-Approved LED Park Luminaires & Poles

Table E-15 and Table E-16 list the City-approved LED luminaires and poles that meet the City's lighting standards, to be used for the City's park lights.

Table E-17 lists City-approved LED luminaire models to be used for outdoor sports facilities.

Table E-15: Approved LED Luminaires – Municipal Park Lights

Manufacturer	Style	Base Part Number
King Luminaire	Pedestrian Post-Top Traditional Lantern	K601D-T-P4-NL-X-X-SSL-120V-X-3K-BK-F4-PR7
Amerlux	Pedestrian Post-Top Traditional Lantern	CSL-P-XM-30-TX-TBK-7P
Acuity AEL	Pedestrian Post-Top Traditional Lantern	GRPCL-X-MVOLT-3K-X-P7-PCLL-NL
Cooper Lighting	Pedestrian shoebox	LDRV-XX-XXX-E-DIM-PER7-7030-XX
Cooper Lighting	Pedestrian shoebox	RDG-XXX-LED-D-U-XX-??-4N7-U-7030-SA1182-?? Black : ??=BK, Bronze : ??=BZ

Table E-16: Approved Poles – Municipal Park Lights

Manufacturer	Style	Model Number
StressCrete or USI or Approved Equal	Concrete	Saluki Bronze: #E210-APO-G-E90 C/W 140-25/35 or MA-210-A-3-SB-30 or Approved Equal Black Eclipse: E210-APO-G-E11 C/W 140-25/35 or MA-210-A-3-BE-30 or Approved Equal
Valmont or Aluminous	Metal	R150830505T4-P2 dark bronze or black or RTAP16-535B-AB-PF

Table E-17: Approved LED Luminaires - Outdoor Sports Facilities

Manufacturer	Base Part Number
Cooper Lighting	Ephesus All Field AF series
Hubbell Outdoor Lighting	Intercept VFS series
Musco Lighting (Note 1)	TLC series

Note 1 – Musco Lighting systems may be considered for professional play facilities.

Appendix E-1
Materials Specifications:
Cobra Head Style LED Luminaires

.1 Mechanical

- The luminaire housing shall be of rugged, highly corrosion resistant, light weight die cast low copper aluminum alloy.
- The housing shall be painted with a durable polyester powder coat. Castings shall be pre-treated using a five-stage iron phosphate system to assure adhesion. Colour shall be Grey.
- Luminaire components and applied finishes shall pass the 1,000 hour salt test per ASTM B117 standard.
- Luminaires shall be horizontal mast arm mountable
- Luminaires shall be designed to mount on matching pole davit arms.
- Where small metal machine screw fastening hardware is utilized in the luminaire assembly it shall be of a material that is corrosion resistant and compatible with the housing material. The hardware will have a Robertson or hex-head drive. Slot or Phillips head drives are not acceptable. All externally exposed hardware shall be painted to match the exterior or the luminaire.
- Access to the electrical compartment shall be made without the use of tools. Internal system components, clamping assembly and terminal blocks shall be accessible without the use of tools. Drivers and LED array modules must be mounted internally and be easily accessible for replacement.
- The luminaire shall be CSA or cUL listed for wet locations. The LED optical module shall be sealed and tested to IEC spec 529 to meet a rating of IP66 for particulate and moisture ingress. Power supply/driver unit shall also be rated IEC IP66.
- The luminaire and all subcomponents are to be free of designated hazardous substances that would otherwise prevent it from being disposed of in a normal regulated Ontario landfill site or recycled without any special type of treatment or disassembly.
- The luminaire shall operate within specifications in an ambient temperature range of -40 degree Celsius to + 40 degree Celsius.
- Luminaire shall be safety certified to CSA C22.2 # 250.0-08 or have an equivalent listing from a recognized testing laboratory for the approved sale and use in Canada. Applicable labels shall be applied inside each unit.
- Each luminaire shall have a label permanently fixed inside the unit that identifies the manufacturer’s essential product information including, date of manufacture, electrical schematic diagram, and operating specifications.

.2 Photometric Performance

- Wattages of LED luminaires will be selected based on lighting design criteria and site conditions.
- The luminaire LED light source shall emit white to cool white light with a nominal CCT in the range of 3,000°K ± 200°K. Colour variation from the nominal luminaire rating over the operating life is to observe tolerance ranges consistent with ANSI standard C78.377- 2008 “Specifications for the Chromaticity of Solid State Lighting”.

- Ensure compliance with the City’s Light Pollution Bylaw. BUG ratings (Backlight, Up-light & Glare) must be addressed during the selection of luminaires. Ensure that up-light from cobra head style luminaires is zero (U=0), backlight (B) and glare (G) shall be reviewed and selected in accordance with design criteria and site conditions.
- Colour Rendering Index (CRI) shall be ≥ 70.
- The luminaire shall be tested for photometric and electrical performance in accordance with the IES LM-79 “Approved Method for the Electrical and Photometric Measurements of Solid State Lighting Products”. The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure.
- A copy of the manufacturer’s LM-79 photometric report shall be submitted for review.
- The luminaire shall maintain a minimum of 85 percent of initial lumen output (L85) at 90,000 hours when operated within specified operating parameters at an ambient temperature of 25° Celsius. The manufacturer shall indicate the actual lamp lumen depreciation (LLD) at 90,000 hours and at an ambient temperature of 25° Celsius as calculated using procedures outlined in IES TM-21 (Projecting Long Term Lumen Maintenance of LED Light Sources). The manufacturer shall provide a total assembled luminaire system (LED package, housing, optical and electrical components) lumen depreciation curve for each separate wattage, drive current and distribution type proposed.
- The LED chip manufacturer shall have tested the lumen maintenance characteristics of the LED chip in accordance with the guidelines of IES LM-80 “Approved Method for Lumen Maintenance Testing of LED Light Sources”. A copy of the manufacturer’s LM – 80 reports shall be submitted for review.

.3 Electrical

- The Luminaire shall contain a surge protection device (SPD) to protect all electrical and electronic components from harmful line transient voltage surges as a result of utility line switching, lightning strikes, or other electrical supply system disturbances. The SPD for luminaires wired at 120V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C High operation and ANSI/IEEE C62.45. The SPD for luminaires wired at 347V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C Low operation and ANSI/IEEE C62.45. SPDs shall be designed to fail in the off position so as to help identify failed units and to continue to protect LED drivers and light
- Utility supply wiring to the luminaire shall terminate in a barrier-type terminal block secured to the housing. The terminal block shall have wire grips suitable for # 14 AWG to # 6 AWG wire sizes. All internal wiring shall be copper, 600V rated.
- The Luminaire shall be provided with a NEMA photoelectric control receptacle. The receptacle shall be a seven-prong twist lock type conforming to ANSI standard C136.41 and capable of being adjustable directionally such that any photoelectric control device may be pointed to the north.
- The nominal operating voltage shall be 120 or 347 VAC +/- 10 percent, 60 Hz.
- The LED driver shall be designed to operate maintenance-free for a minimum of 100,000 hours at 25 degree Celsius ambient. Provide a manufacturer’s certificate indicating that the service life of the LED luminaires is 100,000 hours of operation or greater.

- The LED driver shall have a power factor ≥ 0.90.
- The THD (current and voltage) induced into the AC supply line shall not exceed 20 percent.
- Luminaire driver electrical/electronic component devices shall comply with Industry Canada ICES Interference Causing Equipment Standards for RF emissions.
- Drivers shall be provided with 0 – 10VDC dimmable drive current operation over the 20-year expected life of the luminaires.

Appendix E-2
Materials Specifications: Traditional (Coach/Lantern) Style LED Luminaires

.1 Mechanical

- The upper housing and lower cage shall be of rugged, highly corrosion resistant, light weight die cast low copper aluminum alloy.
- The upper housing and lower cage shall be painted with a durable polyester powder coat. Castings shall be pre-treated using a 5-stage iron phosphate system to assure adhesion. Colour shall be semi-gloss black, or some other colour which may from time to time be specified by the City.
- Luminaire components and applied finishes shall pass the 1,000-hour salt test per ASTM B117 standard.
- The bottom section of the housing shall be hinged to the top section and allow access to the electrical compartment without the use of tools.
- Luminaires shall be either horizontal mast arm mountable or post-top mountable
- Post-top mounted luminaires shall be designed to mount on existing pole tenons.
- Where small metal machine screw fastening hardware is utilized in the luminaire assembly it shall be of a material that is corrosion resistant and compatible with the housing material. The hardware will have a Robertson or hex head drive. Slot or Phillips head drives are not acceptable. All externally exposed hardware shall be painted to match the exterior or the luminaire except for any quarter-turn fasteners.
- Internal system components, clamping assembly and terminal blocks shall be accessible without the use of tools. Drivers and LED array modules must be mounted internally and be easily accessible for replacement.
- The luminaire shall be CSA or cUL listed for wet locations. The LED optical module shall be sealed and tested to IEC spec 529 to meet a rating of IP66 for particulate and moisture ingress. Power supply/driver unit shall also be rated IEC IP66. The upper housing shall contain measures that prevent the entry of birds and insects.
- Outer side and bottom lenses are not required by the City. If supplied and required for the correct optical performance of the luminaire, they shall be made of impact resistant glass and attached to the frame with reinforcing channels and sealed to prevent ingress of dirt or moisture.
- The luminaire and all subcomponents are to be free of designated hazardous substances that would otherwise prevent it from being disposed of in a normal regulated Ontario landfill site or recycled without any special type of treatment or disassembly.
- The luminaire shall operate within specifications in an ambient temperature range of -40 degree Celsius to + 40 degree Celsius.
- Luminaire shall meet ANSI C136.31 (current version) for 3.0 G vibration for use on normal roadways and bridges.
- Luminaire shall be safety certified to CSA C22.2 # 250.0-08 or have an equivalent listing from a recognized testing laboratory for the approved sale and use in Canada. Applicable labels shall be applied inside each unit.

- Each luminaire shall have a label permanently fixed inside the unit that identifies the manufacturer’s essential product information including, date of manufacture, electrical schematic diagram, and operating specifications.

.2 Photometric Performance

- Wattages of LED luminaires will be selected based on lighting design criteria and site conditions.
- The luminaire LED light source shall emit warm white light with a nominal CCT in the range of 3,000°K ± 200°K. Colour variation from the nominal luminaire rating over the operating life is to observe tolerance ranges consistent with ANSI standard C78.377- 2008 “Specifications for the Chromaticity of Solid State Lighting”.
- Ensure compliance with the City’s Light Pollution Bylaw. BUG ratings (Backlight, Up-light & Glare) must be addressed during the selection of luminaires. The luminaire zonal lumen distribution above 90° vertical shall comply with the “U” rating for the geographical and land usage zones as defined by IES technical memorandum TM-15, "Luminaire Classification System (LCS) for Outdoor Luminaires". Backlight (B) and glare (G) shall be reviewed and selected in accordance with design criteria and site conditions.
- Colour Rendering Index (CRI) shall be ≥ 70.
- The luminaire shall be tested for photometric and electrical performance in accordance with the IES LM-79 “Approved Method for the Electrical and Photometric Measurements of Solid State Lighting Products”. The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure.
- A copy of the manufacturer’s LM-79 photometric report shall be submitted for review.
- The luminaire shall maintain a minimum of 85 percent of initial lumen output (L85) at 90,000 hours when operated within specified operating parameters at an ambient temperature of 25° Celsius. The manufacturer shall indicate the actual lamp lumen depreciation (LLD) at 90,000 hours and at an ambient temperature of 25° Celsius as calculated using procedures outlined in IES TM-21 (Projecting Long Term Lumen Maintenance of LED Light Sources). The manufacturer shall provide a total assembled luminaire system (LED package, housing, optical and electrical components) lumen depreciation curve for each separate wattage, drive current and distribution type proposed.
- The LED chip manufacturer shall have tested the lumen maintenance characteristics of the LED chip in accordance with the guidelines of IES LM-80 “Approved Method for Lumen Maintenance Testing of LED Light Sources”. A copy of the manufacturer’s LM – 80 reports shall be submitted for review.

.3 Electrical

- The Luminaire shall contain a surge protection device (SPD) to protect all electrical and electronic components from harmful line transient voltage surges as a result of utility line switching, lightning strikes, or other electrical supply system disturbances. The SPD for luminaires wired at 120V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C High operation and ANSI/IEEE C62.45. The SPD for luminaires wired at 347V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for

Category C Low operation and ANSI/IEEE C62.45. SPDs shall be designed to fail in the off position so as to help identify failed units and to continue to protect LED drivers and light

- Utility supply wiring to the luminaire shall terminate in a barrier-type terminal block secured to the housing. The terminal block shall have wire grips suitable for # 14 AWG to # 6 AWG wire sizes. All internal wiring shall be copper, 600V rated.
- The Luminaire shall be provided with a NEMA photoelectric control receptacle. The receptacle shall be a seven-prong twist lock type conforming to ANSI standard C136.41 and capable of being adjustable directionally such that any photoelectric control device may be pointed to the north.
- The nominal operating voltage shall be 120 VAC or 347 VAC +/- 10 percent, 60 Hz.
- The LED driver shall be designed to operate maintenance-free for a minimum of 100,000 hours at 25 degree Celsius ambient. Provide a manufacturer’s certificate indicating that the service life of the LED luminaires is 100,000 hours of operation or greater.
- The LED driver shall have a power factor ≥ 0.90.
- The THD (current and voltage) induced into the AC supply line shall not exceed 20 percent.
- Luminaire driver electrical/electronic component devices shall comply with Industry Canada ICES Interference Causing Equipment Standards for RF emissions.
- Drivers shall be provided with 0 – 10VDC dimmable drive current operation over the 20 year expected life of the luminaires.

Appendix E-3
Materials Specifications: Contemporary Style (Shoe Box) LED Luminaires

.1 Mechanical

- The luminaire housing shall be of the Contemporary (Shoe Box) type, and shall be manufactured using rugged, highly corrosion resistant, light weight die cast low copper aluminum alloy.
- The luminaire shall be side mounted using a 15cm (6in) arm.
- The housing shall be painted with a durable polyester powder coat. Castings shall be pre-treated using a five-stage iron phosphate system to assure adhesion. Colour shall be bronze, compatible with pole.
- Luminaire components and applied finishes shall pass the 1,000-hour salt test per ASTM B117 standard.
- Access to the electrical compartment shall be made without the use of tools.
- Where small metal machine screw fastening hardware is utilized in the luminaire assembly it shall be of a material that is corrosion resistant and compatible with the housing material. The hardware will have a Robertson or hex-head drive. Slot or Phillips head drives are not acceptable. All externally exposed hardware shall be painted to match the exterior or the luminaire.
- Internal system components, clamping assembly and terminal blocks shall be accessible without the use of tools. Drivers and LED array modules must be mounted internally and be easily accessible for replacement.
- The luminaire shall be CSA or cUL listed for wet locations. The LED optical module shall be sealed and tested to IEC spec 529 to meet a rating of IP66 for particulate and moisture ingress. Power supply/driver unit shall also be rated IEC IP66.
- The luminaire and all subcomponents are to be free of designated hazardous substances that would otherwise prevent it from being disposed of in a normal regulated Ontario landfill site or recycled without any special type of treatment or disassembly.
- The luminaire shall operate within specifications in an ambient temperature range of -40 degree Celsius to + 40 degree Celsius.
- Luminaire shall be safety certified to CSA C22.2 # 250.0-08 or have an equivalent listing from a recognized testing laboratory for the approved sale and use in Canada. Applicable labels shall be applied inside each unit.
- Each luminaire shall have a label permanently fixed inside the unit that identifies the manufacturer’s essential product information including, date of manufacture, electrical schematic diagram, and operating specifications.

.2 Photometric Performance

- Wattages of LED luminaires will be selected based on lighting design criteria and site conditions.
- The luminaire LED light source shall be warm white with a nominal CCT in the range of 3,000°K ± 200°K. Colour variation from the nominal luminaire rating over the operating life is to observe tolerance ranges consistent with ANSI standard C78.377- 2008 “Specifications for the Chromaticity of Solid State Lighting”.

- Ensure compliance with the City’s Light Pollution Bylaw.
- Colour Rendering Index (CRI) shall be ≥ 70.
- The luminaire shall be tested for photometric and electrical performance in accordance with the IES LM-79 “Approved Method for the Electrical and Photometric Measurements of Solid State Lighting Products”. The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure.
- A copy of the manufacturer’s LM-79 photometric report shall be submitted for review.
- The luminaire shall maintain a minimum of 85 percent of initial lumen output (L85) at 90,000 hours when operated within specified operating parameters at an ambient temperature of 25° Celsius. The manufacturer shall indicate the actual lamp lumen depreciation (LLD) at 90,000 hours and at an ambient temperature of 25° Celsius as calculated using procedures outlined in IES TM-21 (Projecting Long Term Lumen Maintenance of LED Light Sources). The manufacturer shall provide a total assembled luminaire system (LED package, housing, optical and electrical components) lumen depreciation curve for each separate wattage, drive current and distribution type proposed.
- The LED chip manufacturer shall have tested the lumen maintenance characteristics of the LED chip in accordance with the guidelines of IES LM-80 “Approved Method for Lumen Maintenance Testing of LED Light Sources”. A copy of the manufacturer’s LM – 80 reports shall be submitted for review.

.3 Electrical

- The Luminaire shall contain a surge protection device (SPD) to protect all electrical and electronic components from harmful line transient voltage surges as a result of utility line switching, lightning strikes, or other electrical supply system disturbances. The SPD for luminaires wired at 120V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C High operation and ANSI/IEEE C62.45. The SPD for luminaires wired at 347V shall meet application and testing requirements per ANSI/IEEE C.62.41.2 for Category C Low operation and ANSI/IEEE C62.45.SPDs shall be designed to fail in the off position so as to help identify failed units and to continue to protect LED drivers and light
- Utility supply wiring to the luminaire shall terminate in a barrier-type terminal block secured to the housing. The terminal block shall have wire grips suitable for # 14 AWG to # 6 AWG wire sizes. All internal wiring shall be copper, 600V rated.
- The Luminaire shall be provided with a NEMA photoelectric control receptacle. The receptacle shall be a seven-prong twist lock type conforming to ANSI standard C136.41 and capable of being adjustable directionally such that any photoelectric control device may be pointed to the north.
- The nominal operating voltage shall be 120 VAC or 347 VAC +/- 10 percent, 60 Hz.
- The LED driver shall be designed to operate maintenance-free for a minimum of 100,000 hours at 25 degree Celsius ambient. Provide a manufacturer’s certificate indicating that the service life of the LED luminaires is 100,000 hours of operation or greater.
- The LED driver shall have a power factor ≥ 0.90.
- The THD (current and voltage) induced into the AC supply line shall not exceed 20 percent.

- Luminaire driver electrical/electronic component devices shall comply with Industry Canada ICES Interference Causing Equipment Standards for RF emissions.
- Drivers shall be provided with 0 – 10VDC dimmable drive current operation over the 20-year expected life of the luminaires.