TOWN OF AJAX

DESIGN CRITERIA

SECTION I

STREET LIGHTING

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I 1.0 GENERAL

Street lighting design in the Town of Ajax shall be generally based on ANSI/IESNA RP-8-00. This Design Criteria shall be used together with RP-8-00 in conjunction with the Town of Ajax requirements.

All street lighting systems in the Town of Ajax shall be 120 volt. All components of street lighting systems for roadways in the Town shall be CSA approved and shall meet the requirements of the Ontario Electrical Safety Code and the Electrical Safety Authority (ESA).

LED luminaires shall be used in all new developments and roadway installations, and use these design guidelines as a standard.

In an effort to reduce light pollution, the Town of Ajax requires that all street lighting and facility lighting be designed and constructed such that the lighting design is dark sky compliant/friendly.

An ESA certificate will be required prior to the street lighting systems being energized. The Developer's Engineer or the Consulting Engineer shall make the necessary arrangements to obtain an ESA certificate. **Street lights shall be energized prior to the first occupancy of any development**.

Electrical Consultant shall perform inspections of the streetlight system during installation and provide inspection reports documenting the inspections.

The Electrical Consultant shall provide a letter to the Town certifying that the streetlight system has been installed per their design and inspected and passed by Electrical Safety Authority. A copy of the ESA inspection report shall be included with this letter.

When the system installation is complete and has been certified by the Consultant the developer shall submit a written request to the Town to energize the lights.

Streetlights shall not be energized without written approval of the Town of Ajax.

The Developer shall arrange with the (LDC) Local Distribution Company (Veridian Connections) for the connection of all lighting systems. The Developer shall provide easements wherever they are required.

The location of street lighting poles and transformers shall be shown on the Utility Coordination Plan. For **urban** cross-sections, poles shall be located not greater than 40 metres apart. For roadways with 60 km/hr or less design speed and barrier curb, poles shall be located 2.0 metres behind the face of the curb.

For rural cross-sections, poles shall be located behind the ditch on the same side of the street, preferably at common lot lines. Due to the variability that may occur in rural subdivision design, the location of the poles may vary between developments. However, the guiding principles for the location shall be;

a) No closer than 1.0 m to the property line (frontage)

b) In a consistent offset from the property line for each street

c) A minimum of 1.0 m behind the top of the ditch

d) At a location where the luminaire height is within the manufacturers guidelines

For **rural** roadways with a design speed of 60km/hr or less the minimum pole setback shall be 3.0 m minimum subject to the guiding principles outlined above.

For all roadways with design speeds greater than 60 km/hr pole offset shall be in accordance with TAC guidelines for clear zone requirements based on roadway design speed.

Poles and base-mounted transformers shall have a minimum separation of 3.0 m.

Where super mail boxes are proposed within a plan of subdivision, street lights should be located within 10 m of the super mail boxes whenever possible.

I 2.0 LIGHTING LEVELS

I 2.1 LUMINANCE METHOD

For straight sections of roadway lighting levels shall be determined based on the luminance method. The Illumination Engineering Society (IES) defines 'luminance' as the amount of light reflected from the pavement in the direction of the driver. The average maintained luminance levels and uniformities shall comply with the values shown in the following table.

Roadway Classification	Average Luminance Lavg2 (cd/m2) (Min.)	Uniformity Ratio Lavg/Lmin (Max. Allowed)	Uniformity Ratio Lmax/Lmin (Max. Allowed)	Veiling Luminance Ratio Lvmax/Lavg (Min.)	Pedestrian Conflict Area Classification
Local	0.3	6.0	10.0	0.4	Low[1]
Collector	0.4	4.0	8.0	0.4	Low[1]
Arterial	0.6	3.5	6.0	0.4	Low[1]

Note1 – Pedestrian Conflict Area Classification as defined in ANSI/IES RP-8-00 in paragraph 2.2 on 4. The only standard exception to the low PCC used in lighting calculation in the Town is in school zones, where a medium PCC shall be used.

L = Luminance
Veiling Luminance = the veiling effect produced by bright sources or areas in the visual field that result in decreased visual performance and visibility.
cd/m2 = candela per square meter
Lavg/Lmin = average luminance / minimum luminance
Lmax/Lmin = maximum luminance / minimum luminance
Lvmax/Lavg = maximum veiling luminance / average luminance

I 2.2 ILLUMINANCE METHOD

For curved sections of roadway or where luminance cannot be calculated accurately lighting levels shall be based on illuminance. IES defines 'illuminance' as the amount of light incident on the roadway surface from the roadway lighting system. The average maintained illuminance levels and uniformities shall not be less than the values shown in the following table.

Roadway Classification	Average Illuminance Eavg2 (Lux)	Uniformity Ratio Eavg/Emin	Veiling Luminance Ratio Lvmax/Lavg	Pedestrian Conflict Area Classification
Local	4.0	6.0:1	0.4	Low[1]
Collector	6.0	4.0:1	0.4	Low[1]
Arterial	9.0	3.0:1	0.3	Low[1]

Note1 – Pedestrian Conflict Area Classification as defined in ANSI/IES RP-8-00 in paragraph 2.2 on 4. The only standard exception to the low PCC used in lighting calculation in the Town is in school zones, where a medium PCC shall be used.

E = illuminance
Veiling Luminance = the veiling effect produced by bright sources or areas in the visual field that result in decreased visual performance and visibility.
Lux = unit of illuminance (illuminance on a surface one square meter in area on which there is a uniformly distributed flux of one lumen).
Eavg/Emin = average illuminance / minimum illuminance
Lvmax/Lavg = maximum veiling luminance / average luminance

Average illuminance levels at intersections should be equal to the sum of the average levels for the two intersecting roadways. The uniformity of the intersection should be equal to the criteria of the roadway with the highest level.

For HPS conventional lighting calculations, a light loss factor (LLF) of 0.77 shall be utilized.

For LED conventional lighting calculations, a light loss factor (LLF) of 0.85 shall be utilized.

I 3.0 POLES

Street light poles shall be direct buried Ontario StressCrete or equivalent (subject to the approval of the Manager of Engineering), spun round concrete of Class B strength or better, and with Burndy ground lug in handhole. Street light poles shall be installed in accordance with the requirements of OPSD 2210.02. Poles on local or collector roads shall be 9.1 m overall (30 feet), and arterial roadway poles shall be 13.7 m (45 feet).

Approved POLES (Direct Buried) **			
Manufacturer	**Local or Collector Roads - Decorative Octagonal 7.6m (above Grade)**	**Local or Collector Roads - Round 7.6m (above Grade)**	**Arterial Roadways - Round 11.9m (above Grade)**
Utility Structures Inc (USI)	Madison MA-300-B-2-BE-60-F (1.8m Scroll Arm)	Hampton HA-300-B-1-PG-10 (1.8m Elliptical Bracket)	Hampton HA-450-B-1-PG-10 (3.0m Elliptical Bracket)

StressCrete	Octagonal Class "B" E-300-BPO-G-S11 c/w FC (Blk) (1.8m Scroll Arm)	Round Class "B" E-300-BPR-G-MOO (1.8m Elliptical Bracket)	Round Class "B" E-450-BPR-G-MOO (3.0m Elliptical Bracket)
StressCrete – Telecom Pole	Alexander KAH-25-E-11-DB (1.8m Scroll Arm)	-	-

** Note: New poles installed in the Lower Harwood Study Area (Lake Driveway to Station St) and the in Downtown Redevelopment must be Newport Series Midnight Lace (etched finish) by USI. Refer to table above for pole height by road type.

Lighting poles shall be located minimum 5.0 metres offset from large shade trees and minimum 3.0 metres offset from small ornamental flowering trees (Refer to Town of Ajax Street Tree Planting Design Criteria - Section G).

All street lighting poles shall be supplied with an above grade handhole and cover, a ground lug at the handhole, and two below grade wiring apertures. For poles with Disconnects, a second handhole shall be required. Poles shall be installed such that maintenance personnel are facing oncoming traffic while facing the handhole.

I 4.0 BRACKETS

Elliptical Brackets shall be 1.8 m long with 0.9 m rise tapered elliptical aluminum (or steel), single member type complete with pole plate Utility Supply Specialists TER-6-MA, or equivalent.

Brackets on arterial roads shall be 3 m with a 1.5 m rise.

Decorative scroll arms shall be 1.8 m long, USI Style 60, StressCrete Style 170 or approved equivalent.

Colours of decorative arms and bracket shall match pole and luminaire colours.

I 5.0 LUMINARIES

I 5.1 EXISTING/REPLACEMENT

All street lights in the Town of Ajax will eventually be converted from conventional High Pressure Sodium (HPS) to LED lights.

Luminaries for local and collector roadways shall be 100 or 150 watt High Pressure Sodium (HPS) type II or III distribution as required. Luminaries for arterials shall be 250 watt High Pressure Sodium (HPS) type II or III distribution as required.

All street lighting installations shall be energy efficient (100 watt luminaries to be used whenever possible). Wattages of all luminaries to be shown on the lighting design drawings and labelled on the luminaire as such it would be readable from the ground.

All luminaries shall have integral twist-lock photo control receptacles and individual photocell installed facing north.

Colours of luminaires shall match pole colours.

Replacement and infill of luminaires in street lighting gaps shall be assessed on a site-by-site basis.

All street lighting luminaries shall comply with all applicable requirements of CSA Standard C22.2

No. 9 “Electrical Lighting Fixtures”.

Cobrahead luminaires for local and collector roadways shall be high pressure sodium (HPS), IES II-M-FC c/w 120 volt outdoor ballast, glass refractor, photo electric control, and lamp as manufactured by:

a) American Electric - Series 115 Cutoff - 11510SCT120R2FG.

b) Cooper Lighting - OVH Series - OVH10SC224.

c) General Electric - M250R Series - M-250RC10S1P2GMC2.

Decorative luminaires for local or collector roadways shall be High Pressure Sodium (HPS), IES II-M-C or III-M-C c/w 120 volt outdoor ballast, photo electric control, and lamp as manufactured by:

a) Rab Design - Colonial COL-20-100HPS-HFIII-120V-BLK-PCR.

b) Lumec – L40U Series.

c) Heritage Castings - F152 Series F152-LCTG100HPS120VSR2-MPCBL1.

d) King - K601 Empress K601-S-HPC-III-100(MOG)-HPS-120-1GPE-F4-BK. Type “A” luminaires shall be suitable for mounting on a 1.8m decorative scroll arm as manufactured by USI Style 60, StressCrete Style 170 or approved equal.

Cobrahead luminaires for arterial roadways shall be High Pressure Sodium (HPS), IES II-M-FC c/w 120 volt outdoor ballast, glass refractor, photo electric control, and lamp as manufactured by:

a) American Electric - Series 125 Cutoff - 12525SCT120R2FG.

b) Cooper Lighting - OVF Series – OVF25SC224.

c) General Electric - M250R series - M-250RC25S1P2GMC2

For **LED existing luminaires**, one of the following luminaires shall be used:

a) Eaton Lighting – NVN Series

b) Cree Lighting – XSP Series

c) General Electric – Evolve ERS Series

d) Philips Lumec – RoadStar Series

I 5.2 NEW DEVELOPMENTS

All new developments shall use LED type cobrahead and decorative style luminaires.

Correlated Colour Temperature (CCT) shall be 3000K.

I 5.2.1 LOCAL AND COLLECTOR ROADWAYS

Cobrahead luminaires shall be LED type as manufactured by:

Manufacturer	Luminaire Type	Mount type
Eaton Lighting Solutions (formerly Cooper Lighting)	Archeon Small	Arm Mount

Cree Lighting	XSP Series	Arm Mount
General Electric	Evolve ERS Series	Arm Mount
Philips Lumec	RoadStar**	Arm Mount

**Note: Luminaire restricted to Lower Harwood Study Area (Lake Driveway to Station St) and the Downtown Redevelopment where the luminaire must be RoadStar by Philips Lumec (arm mounting type GPLM-0C6).

Decorative Coach style luminaires shall be LED type as manufactured by:

Manufacturer	Luminaire Type	Mount type
King Luminaire	Empress (K601)	Post-top / Arm Mount
Cooper Lighting	UTLD TRADITIONAIRE LED DOWNLIGHT	Post-top
Cooper Lighting	SDL	Arm Mount
Philips Lumec	L40U Series	Post-top / Arm Mount

I 5.2.2 ARTERIAL ROADWAYS

Street light luminaires for arterial roadways shall be LED type of luminaires manufactured by:

Manufacturer	Luminaire Type	Mount type
Eaton Lighting Solutions (formerly Cooper Lighting)	Archeon Small Archeon Medium	Arm Mount
Cree Lighting	XSP Series	Arm Mount
General Electric	Evolve ERS Series	Arm Mount
Philips Lumec	RoadStar**	Arm Mount

**Note: Luminaire restricted to Lower Harwood Study Area (Lake Driveway to Station St) and the Downtown Redevelopment where the luminaire must be RoadStar by Philips Lumec (arm mounting type GPLM-0C6).

All luminaires on Arterial Roads shall use a Correlated Colour Temperature (CCT) of 3000K.

I 6.0 PHOTOCELL CONTROL

Photocell controllers shall meet or exceed OPSS 2485.
Luminaires shall be equipped with NEMA 7 prong twist lock connector sockets with dimmable driver.

Photocells shall be north facing window, ambient light sensor type. Operating voltage shall range between 105 to 305 volts 50/60Hz. Load rating shall be 1800VA and 1000W. Capable of a continuous load current of 16 amps maximum. Power consumption less than 0.5 Watts nominal @ 230V AC. A 10 year manufacturer's warranty of the complete photocell unit shall be provided. Must meet an IP rating of 67. The photocell shall operate within specifications for an operating ambient temperature range of minus 40 degrees Celsius to 65 degrees Celsius. Photocell unit shall have a life expectance of 25 years. Photocell shall be designed to run maintenance free for a minimum of 20 years.

Photocell shall have contacts normally closed at nighttime and under failure conditions. Photocell shall be factory preset at 16 lux switch-on light level and 50 lux switch-off light level in accordance with OPSS 2485.

The photocell 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 of disassembly. The photocell unit shall have visible identification which shall contain the manufacturer serial number and date of manufacture in a location which can be viewed when accessing. Photocells shall be safety certified to standards or have an equivalent listing from a recognized testing laboratory for the approved sale and use in Canada. Photocell 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.

I 7.0 CONTROL AND SUPPLY

Street lighting systems shall be controlled by a 'Service Entrance 'rated disconnect to comply with the current Electrical Safety Authority (ESA) requirements. The disconnect shall be Square D Model CQO112M100C60 or approved equal. The branch breakers shall be 20 A Square D Model QO140HID or approved equal. Handhole breakers shall be used and placed in a separate hand hole.

Final connection to secondary supply is to be completed by local hydro authority at transformer or secondary supply pole.

The Developer shall be responsible for the payment of all fees and costs to be paid to local utility for the energizing of the street lighting system until "Formal Acceptance" of the subdivision.

I 8.0 CABLE

Low voltage single conductor cables for roadway lighting shall be stranded copper conductors with RWU90 cross linked polyethylene insulation rated for 600 volt according to CSA C22.2 No. 38. Insulation colour of "Line" conductors shall be RED and BLACK for a120/240 V, 1-phase, 3-wire system and RED for 120 V, 1-phase, 2-wire system. Insulation colour of Neutral conductor shall be WHITE. Wire sizes allowed shall be #6 and #4 (#2 AWG may be used if approved by the Town). Wire shall be sized so as to satisfy Ontario Electrical Safety Code maximum voltage drop requirements.

Splices shall be made only in the pole handholes with CSA approved Burndy compression connectors and electrical insulating tape. Electrical insulating tape shall be rated for 600 V and -

10°C to 90°C working temperature and shall be according to CSA C22.2 No. 197.

Riser wires in lighting poles shall be #12 AWG, stranded copper, type TW90 insulation. Riser wires shall be connected to the lighting circuit wiring in the pole handhole with an in-line fuse holder rated 600 V complete with protective boot and 10 A type KTK fuse.

I 9.0 DUCT

Lighting conductors and ground wires shall be installed in 50 mm rigid duct suitable for direct buried. For under pavement crossing, install 100 mm rigid PVC duct encased in 20 MPa concrete. Cover over direct buried duct and under pavement crossing shall not be less than 0.75 m.

I 10.0 GROUNDING

The separate system ground wire shall be #6 stranded copper, insulation colour green RWU90 cross linked polyethylene, 600 volt according to CSA C22-2 No. 38. The system ground shall be connected to the ground lug in each pole handhole and to the main ground bus at the supply disconnect.

The power supply shall be grounded with two (2) ground rods by means of 2-#6 RWU90 (green) running from the supply to an approved ground rods. The disconnect shall be grounded using two (2) ground rods.

A ground rod shall also be installed at a minimum of every 5th lighting pole in each circuit as well as at the last lighting pole in each circuit.
Ground rods to be steel, 19 mm diameter, 3.0 m long, copper clad for full length and shall be according to CSA. C22.2 No. 41. Ground rods shall be driven to a depth of 300 mm below finished grade.

I 11.0 POLE NUMBERING

The Town of Ajax will assign the pole numbers. The developer shall supply and install the pole number tags in accordance with OS-401 and OS-402.

I 12.0 PHOTOMETRICS

I 12.1 QUALIFIED DESIGNERS

A photometric plan for exterior lighting shall be prepared by a licensed electrical lighting specialist competent in lighting and photometrics or a licensed professional electrical engineer and submitted to the Town of Ajax for review. The plan must be legible and have sufficient information to show light levels throughout the site and in particular at all property lines.

I 12.2 DESIGN PARAMETERS – LIGHT TRESPASS

In general, Town of Ajax's policy is that the exterior lighting system shall be designed to ensure readings of 0.0 Lux at all property lines within the municipal right-of-way.

I 12.3 DRAWINGS

In addition to the Photometric Plan an Underground Electrical/Schematic Plan and a Detail Plan shall be prepared by a licensed electrical lighting specialist or a licensed professional electrical engineer and submitted to the Town of Ajax for review.

As built drawings shall be provided to the Town upon energizing the system.

I 13.0 ASSUMPTION OF SUBDIVISION

Prior to the assumption of a subdivision, the developer shall ensure all poles are installed correctly and in the proper location as per the approved drawings. All luminaires are to be cleaned and re-lamped in the case of HPS.

All LED lamps are to be cleaned according to manufactures recommendations.