

Lighting Guidelines for Lighting Plans



May 2019. Prepared for the City of Guelph by LEA Consulting

Introduction

The purpose of these guidelines is to provide a set of effective standards designed to limit the impacts of excess and unnecessary external lighting.

When is a Lighting Plan Required?

These guidelines are intended to address lighting plans that are submitted and approved as part of site plan approval. The Planning Act (Section 41(7)(a)(5)) allows for lighting studies to be requested as part of this process.

The scope of the lighting guidelines is to create a set of standards that are applicable across the City of Guelph, depending upon the particular and adjacent land use.

Specifically, these guidelines are intended to be used as part of the site plan approval process for new development as it pertains to applications for commercial, industrial, institutional, recreational, and multi residential (3 or more units) uses.

These guidelines are not intended to regulate lighting for single detached dwellings, semi-detached dwellings, and on-street street townhouse dwellings or municipal street lighting.

Who is qualified to do the study?

Applicants will be required to submit information from a qualified lighting consultant with respect to any proposed external lighting. The Lighting Plan submission shall be stamped by a Professional Engineer (P.Eng) responsible for the plan.

Background

As growth and intensification occur within the city in order to meet the future needs of residents and the Provincial Places to Grow Plan, it is important to maintain night time comfort and safe conditions, reduce **light pollution**, support dark skies and evaluate impacts of new development on surrounding areas.

The guidelines will assist in the implementation of urban design policies of the Official Plan (Sections 8.16, 8.10, 8.13, and, 8.14.1). These policies state that lighting is to:

- be compatible with the area,
- address safety,

- address pedestrian-scaled lighting,
- incorporate energy efficiencies such as sensors and timers and direct light away from the night sky (while still permitting the lighting of prominent buildings), and
- minimize the impact of lighting on adjacent uses.

Excessive and unnecessary site lighting can have a number of detrimental environmental and safety impacts. Specifically, excessive lighting can be inefficient in terms of energy consumption, as well as create glare levels that can be a detriment to drivers, pedestrians and neighbouring properties. From an environmental perspective, the over lighting of towns and cities creates a phenomenon known as Urban Sky Glow, that renders the night sky effectively unviewable to town and city dwellers. Furthermore, poor outdoor lighting design can create **light trespass** which is a nuisance that negatively affects the enjoyment of a person's property.

The uneven application of lighting standards can create issues around transition; moving from an under lit area to an over lit one. This can have a significant affect on the night vision of drivers, cyclists and pedestrians.

These guidelines are designed to mitigate these issues through introducing standards that will address concerns about direct glare and **light trespass**. In addition, these standards are designed to factor in safety issues, such as those addressed through Crime Prevention Through Environmental Design (CPTED) and in particular those safety issues that pertain to shadowing, peripheral visual detection and clarity of vision, with respect to seeing other people and objects.

Material to be submitted with a Lighting Plan

Lighting Plans will include a **luminaire** design sheets containing:

- **Lamp** (LED) types;
- Number of units or modules;
- Fixture specifications (full cut off and International Dark Sky Association (IDA) compliant fixtures will be required);
- A Lighting Plan showing photometric data (see Figure 1), containing:
 - Pole specifications such as height, spacing and placement;
 - Photometric information, showing areas of illuminance illustrated with isometric lines;

The Lighting Plan shall be in foot candle or **lux** values

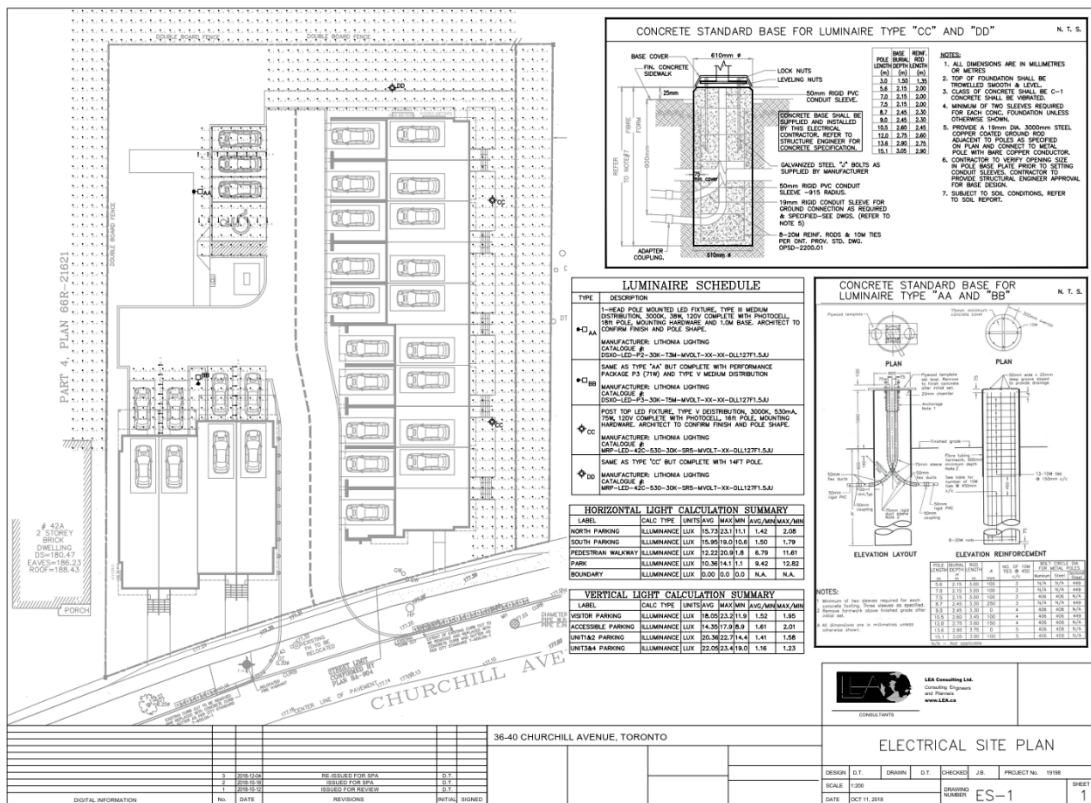


FIGURE 1: EXAMPLE OF LIGHTING PLAN

Submission Requirements and Standards

When requested, site plan applications shall be accompanied by a lighting plan and lighting fixture details that demonstrates the proposal meets the guidelines. The following submission requirements and standards will apply:

Lighting Fixtures

- Detail specifications, including **lamp** type, fixture type, **lumens** rating of **lamp**, wattage, colour temperature and drive current etc.;
- Light source shall be LED with a colour temperature (CCT) 3000 K;
- Only full cut off and International Dark Sky Association (IDA) compliant fixtures shall be accepted;
- As general principles, light fixtures should be positioned across a site so as to give a uniform distribution of light across the relevant area. This assists in the avoidance of the creation of "hot spots," being areas of over-illumination that make adjacent areas seem darker.
- Fixtures shall be positioned such that they focus light down, preventing light from emitting above the horizontal plane (90-degree position relative to the ground) and preventing **light trespass**;
- Encourage the conservation of energy;
- **Lamps** shall be located in such a way to direct light away from neighbouring properties;
- Except where lighting is strictly ornamental, photometric performance (the glare, intensity and uniformity of the light produced) will be a more important factor in assessing the suitability of proposed lighting, rather than aesthetics;

Lighting Fixture Requirements

A wide number of lighting fixture designs and **lamp** types exist today. Light sources, or **lamps**, are available in a variety of styles. Depending on what the light is intended to do will affect which **lamp** is best for the job.

Light fixture designs which cannot meet these standards, such as those with sag lenses or wall mount lights that shine horizontally, are prohibited.

Examples of full cut off and International Dark Sky Association compliant fixtures and prohibited fixtures are provided below.

Acceptable Fixtures (Full Cut Off)



FIGURE 2: FULL CUT OFF WALL MOUNT



FIGURE 3: CUT OFF LIGHT STANDARD FULL

Prohibited Fixtures



FIGURE 4: PROHIBITED SAG LENS LIGHT STANDARD



FIGURE 5: PROHIBITED WALL MOUNT

Illumination Requirements

In addition to setting standards for acceptable **lamps** and fixture types, these guidelines have established a set of maximum illumination values for different lighting zones. The illumination requirements are expressed in the form of tables pertaining to each lighting zone (see Attachment A).

The purpose of the lighting zones is to recognize the illumination needs for various land uses, while at the same time setting maximum illumination values at the property lines. This will ensure that sites are adequately illuminated as well as controlling **light trespass**.

The land uses that these guidelines will apply to are:

- Commercial uses such as Plazas, Retail Outlets, Car Dealerships, Offices, Personal Service Uses, and others;
- Employment uses such as warehousing, manufacturing, fabrication, aggregate extraction and processing uses;
- Institutional uses such as, places of worship, schools (public and private), hospitals, and government facilities;
- Residential uses (3 or more units, save and except for on-street townhouses).

Glare

Glare is the sensation produced by a light source within the visual field that is sufficiently greater than the background brightness to which the eye is adapted to cause discomfort, annoyance or loss in visibility.

The control of glare is primarily a function of the light distribution characteristics of the luminaire and to some extent the brightness of the surroundings.

For outdoor lighting applications the impact of glare can be contained by limiting the Glare Index as outlined in the IES TM15-07 (Luminaire classification system for outdoor luminaires).

The glare rating for outdoor applications should be limited to G0 to G1 (see Attachment A).

Lighting Plan

- The illumination levels expressed in **foot candles** or **lux** values and in the form of Isolux curves showing the predicted lighting levels at the property line and throughout the development site;
- Lighting analysis shall be carried out with independent software (e.g. AGI 32);
- Pole specification such as height, spacing, foundation details, and placement;
- The lot boundaries;
- The location of all structures;
- Location and height of all proposed luminaires, including wattage, and **lamp** type;
- The illumination levels at all property lines should follow the levels outlined in Attachment A. However, the design should strive to achieve '0' **Lux (0 foot candles)**;
- A photometric diagram showing the predicted lighting levels from each of the proposed light sources;
- The lighting plan is to be signed by a Professional Engineer responsible for the plan;
- Five (5) copies of the lighting plan and fixture details are to be included in the submission.

Post Installation Investigation

After the installation of any new lighting subject to municipal review and approval, the applicant's lighting consultant shall provide a written signoff confirming that the lighting has been installed as per the approved plans. This will be confirmed as part of the site plan inspection.

For more information

City of Guelph
Planning Services
519-822-1260 extension 5616
TTY 519-826-9771
planning@guelph.ca

Alternate formats are available as per the Accessibility for Ontarians with Disabilities Act

Attachment A

Lighting Design Criteria for Outdoor Applications

Parking Lots and Loading Areas

	Basic (Lux)	Enhanced Security ¹ (Lux)
Minimum Horizontal Illuminance	20 (2.0 f.c.)	50 (5.0 f.c)
Uniformity Ratio (Max:Min)	20:1	15:1
Average Vertical Illuminance ²	10 (1.0 f.c)	25 (2.5 f.c)
Glare Rating	G1	

Note: During periods of non-use, the **illuminance** of certain parking facilities may be turned off or reduced to conserve energy. If reduced lighting is to be used for the purpose of security, the minimum value should not be less than 1.0. Reductions should not be applied to facilities subject to intermittent night use, such as apartments, hospitals and transport terminals. If there are a number of handicap parking spaces, enhanced lighting levels may be used

Car Dealerships

Business Districts	Max Illuminance Horizontal Lux	Uniformity (Max:Min)
Adjacent to roadway	200	5:1
Other areas	100	10:1
Entrances	100	5:1
Driveways	30	10:1
Glare rating	G2	

Private Roads and Driveways

Area Description	Avg. Horizontal Lux	Minimum Lux
Commercial/Industrial Driveways	6.0 (0.6 f.c)	2.0 (0.2 f.c.)
Residential/ Institutional Driveways	4.5 (0.4 f.c.)	1.5 (0.15 f.c.)
Glare Rating	G0	

¹ Enhanced security applied to lots where night staff may be using the facility (e.g. Hospitals)

² The calculation of vertical illuminance is outlined in IES RP-8 and RP-20.

Service Stations

Area Description	Average Illuminance Lux
Approach	20
Driveway	20
Pump island	200
Building facades	30
Service areas	30
Landscape highlights	20
Glare rating	G1

Floodlighting Buildings and Monuments

Area Description ³	Average Target Illuminance (Vertical) Lux
Bright surroundings and light surfaces	50
Bright surroundings and medium light surfaces	70
Bright surroundings and dark surfaces	100
Dark surroundings and light surfaces	20
Dark surroundings and medium light surfaces	30
Dark surroundings and dark surfaces	50

³ The surrounding brightness values are related to if the subject is in an urban setting (bright) or rural setting

Attachment B

Lighting Zones, Spill Light Limitations and Maximum Pole Heights

Lighting Zones, Spill Light Limitations and Maximum Pole Heights					
Lighting Zone	Ambient Brightness	Locations	Zoning Category	Lighting levels Lux Level at Property Lines ⁴	Maximum Pole Height (metres)
LZ1	Dark	Natural Heritage System	Natural Heritage System identified in the Official Plan ⁵ ; Wetland Zone (WL); Conservation Land (P.1)	0 (0 f.c.) at the limit of the Natural Heritage System	4.5
LZ2	Low	Open Space	Urban Reserve (UR)	2 (0.2 f.c.)	4.5
LZ3	Medium	Low/medium density Residential or Institutional	Residential Zones (R.1, R.2, R.3); Institutional (I) Zones; Office Residential (OR); Commercial Residential (CR); Park Zones (P.2, P.3, P.4, P.5)	5 (0.5 f.c.)	6.0
LZ4	High	Dense Urban with Mixed Commercial and Industrial	Downtown Zones (D.1, D.2, D.3, D.3a); Residential Apartment (R.4); Convenience Commercial (C.1); Commercial Shopping Center Zones (CC); Service Commercial (SC); Industrial (B) Zones	7.5 (0.75f.c.)	6.0 ⁶

⁴ Where a property is adjacent to another zone the more restrictive illuminance level shall apply at the property line. Where multiple zones exist on the same lot, the zone line shall be treated as property line for the purposes of the lighting plan.

⁵ The full Natural Heritage System is not identified in the Zoning By-law however where the Natural Heritage System is within the property line (as identified through an EIS or other document) the **lux** level will be required to be met at the limit of Natural Heritage System and/or the property line whatever is greater.

⁶ For industrial sites or large commercial sites (i.e. 2000 square metres or greater) the maximum pole height may be increased to 7.3 metres. However with the Hanlon Creek Business Park use a pole height of 4.6m as shown in the Hanlon Creek Business Park Urban Design Guidelines.

Attachment C

Lighting Site Plan Approval Checklist

City of Guelph Lighting Site Plan Approval Checklist

#	Task	Complies? (Yes or No)	N/A	Notes
1	Site Plan Ref. Number _____			
2	Lighting Zone and Adjacent Lighting Zone Noted (Attachment B)			
3	Lighting Pole Type and Mounting Height Maximum Pole Height (Attachment B): _____			
4	Light Source to be LED			
5	Colour Temperature (3000k or less)			
6	Drive Current Specified			
7	Luminaires that are full cut off and International Dark Sky Association (IDA) compliant specified			
8	Manufacturer Catalogue Number Specified			
9	Photometric Data with IES I file Number Specified			
10	Applicable Lighting Design Criteria (check all that apply): <input type="checkbox"/> Parking Lot/Loading Area <input type="checkbox"/> Private Driveway or Road <input type="checkbox"/> Car Dealership <input type="checkbox"/> Service Station			
11	Glare Rating Specified (see Attachment A)			
12	Independent Lighting Software Specified			
13	Illuminance and Luminance Grid Pattern as specified in IES RP-8 and RP-20			

14	Vertical Illuminance Level at Property Limit (See Attachment A)			
15	Horizontal Illuminance Level at Property Limit (See Attachment B) Lighting Zoning: _____ Illuminance Level at Property Line: _____			
16	Summary Tabulation of Photometric Analysis Submitted			
17	Lighting Controls and Energy Saving Measures Specified			
18	Submission Stamped by P.Eng			

Attachment D

Definitions

Candelas: related to luminous flux is luminous intensity. Candelas are the intensity of a light source in a particular direction. One Lumen = one Candela emitted within a solid angle known as a steradian. (There are 4π , or 12.57 steradians in a sphere).

Foot candles: Lumens per square foot.

Illuminance: is the amount of light that actually falls on an object. It is the density of light on a particular surface – measured in **lux** or lumens per square foot (foot candles – fc).

Lamp: refers to a bulb or other light producing source.

Light Pollution: the overall impact that the lighting of cities and towns has on the night sky.

Light Trespass: the projection of light from one site onto another.

Lumens: measurement of total amount of light emitted by a bulb, known as luminous flux. A 100-watt incandescent bulb will put out roughly 1,800 lumens, while a high-pressure sodium street lamp of the same wattage will emit about 8,550 lumens.

Luminaire: lighting fixture itself. It is a combination of the bulb, socket, reflectors or lenses, ballast, and housing.

Luminance: is the light that the eye sees – i.e., light that has been reflected by a surface. It is measured in Candelas per square foot or metre.

Lux: is the measure of illuminance, expressed in units of Lumens per square metre.

Pole Height: Height of a light standard, measured from grade to top tenon cap.

Qualified Lighting Design Professional: Registered Professional Engineer (P.Eng).

Uniformity: Defines the uniformity of light distribution. Measured as maximum: minimum and average: minimum.