



# CITY PROCEDURE

POLICY NUMBER: C576

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AUTHORITY: City Manager

EFFECTIVE DATE: August 21, 2013

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TITLE: **Light Efficient Community Policy**

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## 1 DEFINITIONS

- Adaptive Lighting – Varying light levels in off peak periods
- ANSI – American national Standards Institute
- ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
- BUG – Back-Up-light-Glare rating system used to classify luminaires
- Candela (cd) – A measure of intensity of light
- CSA – Canadian Standards Association
- IESNA – Illuminating Engineering Society of North America
- LEED - Leadership in Energy and Environmental Design
- Light Pollution – Unwanted light which pollutes the atmosphere
- Lux – A measurement of light on a surface
- Mesopic Factor – A factor which is applied to better depict actual light levels encountered for walkway and multi-use trail lighting
- Spill Light – Light with fall outside the area being illuminated
- TAC – Transportation Association of Canada
- UPD – Unit Power Density (measure of efficiency – watts per area)
- W – Watt



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## 2 PROCEDURES

### 2.1 Roadway Lighting Procedure

**Value of Lighting** - Lighting is recommended for urban roadways and urban and rural intersections as it has proven public safety benefits. Unless specifically warranted for safety or a high pedestrian activity is anticipated, it is recommended that the city avoid lighting rural roads and alleyways.

**Security** – Adhere to the principals of Crime Prevention Through Environmental Design (CPTED).

**Light Pollution Reduction** - The control of light pollution outdoors is a consideration that cannot be neglected. To reduce light pollution, we recommend the following:

1. **Avoid over lighting.** Light only to the recommended levels. Do not exceed recommendations by more than 15%.
2. **Reduce spill light to the greatest extent practical.** Vertical spill light levels should not exceed 8 lux in residential areas (at residences).
3. **Where applicable use the lowest BUG rating practical for outdoor luminaires.** Use no worse B2-U0-G2 (or G1, if possible).
4. **Reduce Unwanted Light –**
  - Reduce up-light, spill light (light trespass) to greatest extent practical,
  - Avoid lighting in natural areas,
  - Discretion to be used for historical decorative lighting.

**Energy Savings (General)** – All lighting shall be LED. To ensure maximum efficiency a luminaire should have the lowest UPD (as per CSA C653) possible and where possible should be 0.1 W/m<sup>2</sup> or less and never above 0.2 W/m<sup>2</sup> unless approved by the City.

As is current practice in accordance with policy C564 when retrofitting to LED street lighting the designer should maintain existing lighting levels below TAC.

Adaptive lighting controls (dimming in off peak periods) shall be considered where cost effective. An adaptive technology is not for all roads and should be reviewed on a per road or per area basis. Prior to installing an adaptive technology, it is recommended a feasibility study be undertaken for each road or area. This study should include:

1. A review and estimate of pedestrian activity levels
2. Computer lighting calculations to confirm existing lighting levels
3. A definition of dimming schedules
4. Development of a cost benefit analysis



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5. An assessment of technology options
6. Verification and testing
7. An agreement between owner and utility companies
8. Public education and communications

Lighting should be dimmed with caution in the following applications:

1. Lighting at signalized and un-signalized intersections;
2. Lighting directly adjacent to or incorporated with pedestrian activated flashing beacons or mid-block crosswalks;
3. Lighting within medium or high activity areas;
4. Lighting at key traffic safety locations where there has been a documented history of traffic safety issues.

Incorporating motion detector devices to allow lights to be turned on, or un-dimmed, when needed should be considered.

**Local Roads (Subdivisions)** – The city should continue to light all urban residential roads including rural and urban intersections. Lighting on rural roads, though having some value, would be far less valuable than on urban roads and is therefore is not recommended.

Lighting should continue to follow TAC guidelines<sup>1</sup>.

The city should continue with the retrofit of existing lighting to LEDs and use LED's for all new installations.

Turning off lights or dimming below recommended levels in the middle of the night should be considered to save power however it poses some level of risk thus, prior to undertaking this practice en masse pilot projects shall be undertaken. Prior to undertaking any pilots, the public should be consulted and advised.

**Collector and Arterial Roads** - The city should continue to light all urban collector and arterial roads including urban intersections.

Lighting should continue to follow TAC guidelines<sup>1</sup>.

The city should continue with the retrofit of existing lighting to LEDs and use LED's for all new installations.

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<sup>1</sup> IESNA recommendations should be used if they are more applicable or current



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Adaptive lighting controls should be considered to save power. Prior to undertaking this practice en masse pilot projects shall be undertaken. Prior to undertaking any pilots, the public should be consulted and advised.

Lighting on rural roads, though having some value, would be far less valuable therefore it is not recommended. Lighting on rural intersections should be reviewed on an individual basis. Where lights exist they should remain in operation.

**Energy Savings for Alleyways** – The lighting of alleyways is not recommended.

If the city wishes to maintain alley lighting then it is recommended that lighting be retrofitted to low wattage LED's with motion sensors. Prior to undertaking this practice en masse pilot projects shall be undertaken. Prior to undertaking any pilots, the public should be consulted and advised.

Business owners shall be encouraged to install their own security lighting, using City adopted luminaire BUG ratings, on motion sensors.

**Energy Reduction on Freeways and Highways** – The city should light all freeways and highways where lighting is warranted by TAC guidelines<sup>1</sup>.

Lighting should continue to follow TAC guidelines<sup>1</sup>.

The city should continue with the retrofit of existing lighting to LEDs and use LED's for all new installations.

**Public Engagement and Communications Program** - When considering turning-off or dimming lights during off-peak periods, the public shall be consulted. This consulting shall define what is proposed, the reasoning, and the objectives with some of the key support information in this document. Open house meetings and forums should be considered with local communities such that feedback could be obtained.

The city shall also develop a "Public Safety" campaign to promote the use of retro-reflective clothing to improve pedestrian and cyclist safety at night. This significantly improves the visibility of pedestrians/cyclists at night, maybe more so than lighting alone.

A well-defined media campaign shall be developed and shall include technical information and public consultation.

<sup>1</sup> IESNA recommendations should be used if they are more applicable or current



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**Compliance and Enforcement** - As with any policy and regulations created, enforcement is critical. City engineering staff currently reviews designs that are typically undertaken by the utility provider EPCOR or by consultants.

Update the city Road and Walkway Lighting Design and Construction and Materials Standards to include these policies.

## 2.2 Outdoor Lighting Procedure

**Security** – Adhere to the principals of Crime Prevention Through Environmental Design (CPTED).

**Light Pollution Reduction** - To reduce light pollution:

5. **Avoid over lighting.** Light only to the recommended levels. Do not exceed recommendations by more than 15%.
6. **Reduce spill light to the greatest extent practical.** Vertical spill light levels should not exceed 8 lux in residential areas (at residences). In areas of dense residential or commercial with no front yards where the building is tight to property line or sidewalk 15 lux level would mainly apply, if achieving less than 8 lux is a challenge;
7. **Where applicable use the lowest BUG rating practical for outdoor luminaires.** Use no worse than B2-U0-G2 (or G1, if possible). The BUG rating does not apply to sports lights and flood lights;
8. **Limit Source Brightness to the greatest extent practical.** For high wattage applications such as recreational and sports lighting including ski slopes (1000 W and greater), define source brightness limits of 10,000 cd when viewed from any residence or Right-of-Way;
9. **Use lighting controls to turn lighting off when not required.** Control options range from simple astronomical time clocks to fully adaptive lighting control systems;
10. **Reduce Unwanted Light**  
Reduce up-light, spill light (light trespass) to greatest extent practical and avoid lighting in natural areas



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**Energy Allowances (General)** - For other outdoor applications and areas listed the Unit Power Density (UPD) shall not exceed the following requirements:

Application	Residential	Suburban / Industrial	Downtown
Uncovered Parking Lots	0.65 W/m <sup>2</sup>	1.1 W/m <sup>2</sup>	1.4 W/m <sup>2</sup>
Walkways and plazas	1.5 W/m <sup>2</sup>	1.7 W/m <sup>2</sup>	2.2 W/m <sup>2</sup>
Stairways	10.8 W/m <sup>2</sup>	10.8 W/m <sup>2</sup>	10.8 W/m <sup>2</sup>
Landscaping	0.54 W/m <sup>2</sup>	0.54 W/m <sup>2</sup>	0.54 W/m <sup>2</sup>
Building Facades	1.1 W/ m <sup>2</sup> or 8.6 W/Linear m of wall surface	1.6 W/m <sup>2</sup> or 12.3 W/Linear m of wall surface	2.2 W/m <sup>2</sup> or 16.4 W/Linear m of wall surface
Sports Fields (soccer, football, baseball, etc.)	8 W/m <sup>2</sup>	8 W/m <sup>2</sup>	8 W/m <sup>2</sup>
Additional requirements: <ul style="list-style-type: none"> <li>• Lighting shall be controlled by device which automatically turns lights off when daylight</li> <li>• Building façade lighting should turn off at midnight or when business closes (whichever is later) and 6 AM or business opening (whichever comes first).</li> <li>• Sports field UPD levels based on "class III" level play defined in IESNA RP-6. UPD not based on ASHRAE 90.1.</li> </ul>			

To effectively enforce and maintain these UPD levels they shall be part of the permitting process. The onus is on the lighting designer to provide UPD calculations and certify UPD values are not exceeded. The UPD calculations shall be signed and sealed by a professional engineer and submitted to the city as part of the approval process.

Where possible, use energy efficient technologies such as LED or induction luminaries.

**Walkway and Multi-use Trail Lighting** – Walkway and multi-use trails should only be lighted if all the following conditions are met:

- Urban areas;
- High night time usage;
- Paved surface.



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For light level recommendations refer to the most current edition of the Transportation Association of Canada Guide for the Design of Road and Walkway Lighting<sup>1</sup>. Levels shall be “basic” with the exception of areas where security or public safety is an issue then “enhanced levels” levels shall be applied. The UPD levels shall adhere and be a part of the permit process. Lighting controls shall be utilized to dim or turn off lighting in off peak periods.

Use energy efficient technologies such as LED luminaries.

**Building Lighting** – Lighting of building exteriors shall be used only where there is historical or cultural significance. It is recommended the applicable City departments develop guidelines on lighting requirements and lighting levels for buildings.

Where façade lighting is required it shall be designed to minimize light pollution to the greatest extent possible.

For light level recommendations and lighting effects refer to the IESNA Lighting Handbook.

Lighting controls shall be used to turn off lighting in off-peak periods. The UPD levels shall adhere to and be a part of the permit process.

Use energy efficient technologies such as LED luminaries.

**Parking Lot Lighting** - Parking lots in urban areas shall be lighted.

For lighting level recommendations refer to the most current edition of the TAC Guide for the Design of Road and Walkway Lighting<sup>1</sup>. A “basic” lighting level should be used with the exception of where security is an issue then “enhanced” levels shall be applied. It is recommended the applicable City departments develop guidelines on lighting requirements and lighting levels for parking lots.

Dimming and motion sensors shall be used to reduce power when lighting is not needed. The UPD levels shall adhere to and be a part of the permit process.

Where possible, use energy efficient technologies such as LED or induction luminaries.

**Sports Field Lighting** – Sports field lighting is required for night-time usage.

Different sports and levels of play will require different levels of lighting and uniformity as defined in the most current edition of IESNA RP-6 Recommended Practice for Sports and Recreational Area Lighting.

The UPD levels shall adhere to and be a part of the permit process.

<sup>1</sup> IESNA recommendations should be used if they are more applicable or current



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Lighting controls should also be used which are tied into the field scheduling software.

Spill light source intensity levels listed above shall adhere to in order to limit impacts on adjacent users.

**Parks and Open Space Lighting** – Parks, and open spaces (POS) should only be lighted where there is a heavy night-time public usage or where it is a main travel route. It is recommended based on the City categorization of POS, Parks and Sustainable Development Departments develop guidelines on lighting requirements and lighting levels for those categories.

There are no specific standards for park and open space lighting however the IESNA Lighting Handbook defines similar lighting application which can be used.

It is recommended that lights in playgrounds are turned-off or dimmed via controls if deemed safe to do so.

Tree and landscape lighting serves no safety benefits therefore it shall only be considered in areas of aesthetic significance and where installed shall be turned-off via controls in non-peak periods. For light level recommendations and lighting effects refer to the IESNA Lighting Handbook.

Where possible, use energy efficient technologies such as LED or induction luminaries.

The UPD levels shall adhere to and shall be a part of the permit process.

**Lighting for Special Places (ie; Telus World of Science)** - All lighting in special places must have a specific application such as pedestrian safety and guidance. It is recommended the applicable City departments develop guidelines on lighting requirements and lighting levels for special places.

Lighting shall have controls (ie; motion sensors) to turn off or dim lighting when not required.

For light level recommendations refer to the IESNA Lighting Handbook.

The UPD levels listed should also be adhered to.

**Transit Facilities** – Where night-time usage exists they shall be lighted for pedestrian and driver safety. It is recommended the applicable City departments to develop guidelines on lighting requirements and lighting levels for transit facilities.





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Specific lighting criteria for transit facilities do not exist in TAC or IESNA documents, so criteria based on similar applications have been defined in the table below.

Lighting levels for specific elements of Transit Passenger-Pick-Up and Drop-Off Facilities, Transit Exchanges, and Transit Park and Rides shall be as follows:

Area	Maintained Average Horizontal Illuminance	Uniformity Ratio (Average : Minimum)	Maintained Average Vertical Illuminance	Reference
Bus Loading/Unloading Berths and Roads	17 lux	3:1	n/a	Levels based on those for an arterial roadway with high pedestrian activity. Reference TAC Guide for the Design of Roadway Lighting Appendix A
Bus Layover Areas	9 lux	3:1	n/a	Levels based on those for an arterial roadway with low pedestrian activity. Reference TAC Guide for the Design of Roadway Lighting Appendix A
Platforms	30 lux	3:1	n/a	Level based on IESNA Lighting Handbook Table 4.1 Recommended Illuminance Targets, Category I, 25-65.
Crosswalks	17 lux	3:1	40 lux	Levels based on a high pedestrian activity. Reference TAC Guide for the Design of Roadway Lighting Chapter 12 Mid-Block Crosswalks
Parking Areas	10 lux	5:1	n/a	Levels based on a "Basic Parking Lot Illumination Level". Reference TAC Guide for the Design of Roadway Lighting Chapter 16 Off-Roadway Facilities – Table 16-4. Where public security is a concern, or CCTV cameras are required or present then consider "Enhanced" levels.
Crew Room (Indoor)	100 lux	3:1	30 lux	Level based on IESNA Lighting Handbook Table



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				22, Support Spaces – Break Room/Lunch Room, 25-65.
Bus Shelters (within the Shelter footprint)	10-20 lux	3:1	n/a	Level based on IESNA Lighting Handbook Table 4.1 Recommended Illuminance Targets, Categories F,G & H, 25-65. Where no power is available solar power can be considered.

Lighting shall be designed for the hours of darkness and typically controlled via lighting contactor(s) and photocells. However, in areas where a facility has no activity during later hours of the evening, the majority of the lighting may be shut off or dimmed via suitable controls.

**Public Engagement and Communications Program** - When considering turning-off or dimming lights during off-peak periods, the public shall be consulted. This consulting shall include brochures defining what is proposed, the reasoning, and the objectives with some of the key support information in this document. Open house meetings and forums should also be considered with local communities such that feedback could be obtained. A well-defined media campaign shall include some technical information and public consultation.

**Compliance and Enforcement** - In terms of energy efficiency and unit power density levels defined, they shall be included in city bylaws and reviewed for compliance as part the city review and permitting process. Lighting controls for city outdoor lighting shall be under full control of the city senior staff. Senior staff, not those operating the system, shall approve changes to controls.