

THE CORPORATION OF THE CITY OF BURLINGTON

GUIDELINES FOR OUTDOOR LIGHTING

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SECTION 1: DEFINITIONS

For the purposes of this Guideline, terms used shall be defined as follows:

City means the Corporation of the City of Burlington.

Direct Light means light emitted directly from the lamp, off the reflector or luminaire.

Fixture means the assembly that houses the lamp or lamps and can include all or some of the following parts: a housing, a mounting bracket or pole socket.

Flood or Spot light means any light fixture or lamp that incorporates a reflector or a refractor to concentrate the light output into a directed beam in a particular direction.

Full-Cut-Off Fixture means a luminaire or light fixture that; by design of the housing, does not allow any light dispersion or direct glare to shine above a horizontal plane from the base of the fixture where light is emitted and must be installed in a horizontal position as designed. (zero candela at and above 90 degrees above nadir)

Glare means light emitting from a luminaire with intensity great enough to reduce a viewer's ability to see, or to produce sensation of discomfort.

Grandfathered Luminaires means luminaires not conforming to this code that were in effect prior to the passage of this Guideline.

IESNA means the Illuminating Engineering Society of North America. This organization issues recommended practices for lighting of exterior and interior environments. They were adopted as industry standards across North America.

Indirect Light means light that has been reflected or has scattered off other surfaces.

Lamp means the component of a luminaire that emits light.

Light Trespass means the shining of light produced by a luminaire beyond the boundaries of the property on which it is located.

Lumen means a unit of luminous flux equal to the light emitted through solid angle of 1 steradian by a uniform point source of 1 candela.

Luminaire means a complete lighting system, including a lamp or lamps enclosed in a housing complete with reflectors, refractors, etc.

Lux means unit of illumination equal to one lumen per square metre.

Mounting Height of Luminaire means the height of a luminaire as calculated by the vertical distance from the ground directly below the centerline of the luminaire to the lowest direct-light-emitting part of the luminaire.

Outdoor Light Fixtures means outdoor artificial illuminating devices, installed or portable, used for flood lighting, general illumination or advertisement.

Sports Field means any area designed for active public recreation included but not limited to baseball/softball diamonds, soccer pitches, football fields, golf courses/ ranges, tennis courts and swimming pools.

Uniformity Ratio of Lighting means the average level of illumination in relation to the lowest level of illumination for a given area.

Wall-Pack Light Fixture means light fixtures on exterior walls of buildings

SECTION 2: PURPOSE

2.1 The purpose of this guideline is to establish a comprehensive set of design criteria for lighting of the exterior environments that will:

- Improve quality of lighting by mandating conformance to IESNA recommended practices for exterior lighting.
- Conserve energy through good design practices and by imposing limits on power consumption.
- Permit reasonable uses of outdoor lighting for night-time safety, utility, security, productivity, enjoyment and commerce while preserving the ambiance of the night.
- Reduce glare from exterior luminaires by mandating full cut-off optics.
- Control light pollution by minimizing non-target light and by encouraging curfews.
- Reduce unwanted light spill and trespass.

2.2 Notwithstanding any other provisions in this Guideline, nothing in this Guideline shall have the effect of requiring outdoor lighting which provides a lower level of illuminance for use or activity than the minimum level of illuminance recommended for such use or activity in the lighting handbook of the IESNA, or in the Ontario Building Code in effect at the time of installation or replacement of outdoor luminaires.

2.3 Notwithstanding any other provisions in this Guideline, nothing in this Guideline shall have the effect of overwriting any more restrictive requirements of the City of Burlington Dark Sky policy or bylaw in effect at the time of installation or replacement of outdoor luminaires.

SECTION 3: GENERAL INFORMATION

3.1 General Requirements

Any person who installs outdoor lighting within the boundaries of the City shall do so in conformity with the requirements of this Guideline. If conflicts arise regarding control and maintenance of outdoor lighting, this Guideline shall be the governing document.

3.2 Luminaire Design Factors For Outdoor Areas

3.2.1 Any person installing an outdoor lighting fixture shall be required to use completely shielded full cut-off fixtures, as identified in Appendix C attached hereto and forming part of this Guideline. Outdoor lighting fixtures shall include, but are not limited to, lights for: buildings and structures, including canopies and overhangs; recreational areas; parking lot lighting; landscape lighting; private street lighting; display and service area lighting; private walkway lighting; residential yard lights; and outdoor lighting for all residential, commercial, industrial, institutional uses not otherwise specified.

The full cut-off optics requirement also applies to wall-pack lights.

Luminaires with adjustable or swivel type heads shall not be permitted.

3.2.2 The use of low wattage lights for decorative purposes such as Christmas lighting and property ornamentation shall be exempt from the requirements of Paragraph 3.2.1.

3.2.3 Luminaires for sports fields illumination are also exempt from the full-cut-off requirements of Paragraph 3.2.1.

3.2.4 It is the responsibility of the property owner and its lighting consultant to ensure that any poles or structures utilized for mounting of outdoor luminaires shall have a non-reflective finish, to minimize the reflected glare.

3.2.5 Only the light sources with efficacy of 60 lumens per watt shall be allowed for lamps of 100 watts or more.

3.3 Property Illumination

All artificial lighting for exterior environments, including but not limited to private yards, parking areas, etc., shall be arranged so as:

a) To conserve energy by means of:

- Controlling the lights turn-on and turn-off times with automatic controls in accordance with the provisions of the Ontario Building Code, Sentence 12.3.4.11.

- Conforming to the limits on power consumption imposed by the Ontario Building Code, Sentence 12.3.4.10; Refer to Appendix B for the maximum allowable lighting power densities for the various types of outdoor areas.

b) To limit glare; In addition to the full cut off optics requirement of Paragraph 3.2.1, depending on their respective locations, some luminaires may require external shielding to conceal the source of light and thus reduce glare. This may be the case for luminaires adjacent to public roads or adjacent to residential developments.

c) To limit sky glow; In this respect, consideration shall be given to:

- Reducing the wattage of the luminaires,
- Turning off or reducing the lighting in periods of limited activity in order to minimize ground reflected light which contributes to light pollution of the night sky.

d) To limit light trespass; All outdoor lighting installations are subject to light trespass restrictions as identified in Table D.1. of Appendix D.

In order to limit light trespass, consideration shall be given to:

- Avoiding locating poles in close proximity to the property limits.
- Shielding of the luminaires in proximity of the property limits.
- Lowering mounting height of luminaires in proximity of the property limits.
- Utilizing lower wattage luminaires.

Light trespass may be reported to the City for problem resolution. Obtrusive fixtures may be required to be relocated or removed as directed by the City.

3.4 Prohibitions

3.4.1 Laser Source Light

The use of laser source light or any similar high intensity light for outdoor advertising or entertainment purposes is prohibited.

3.4.2 Searchlights

The operation of searchlights for advertising or entertainment purposes is prohibited.

3.4.3 Strobe/Twinkling/ Chasing Lights

The use of strobe/ twinkling/ chasing lights for advertising or entertainment purposes is prohibited.

3.5 Grandfathering of Non-conforming Luminaires

3.5.1 All luminaires lawfully in place prior to the date of passing of the Guideline shall be grandfathered. Any luminaire that replaces, modifies, or moves a grandfathered luminaire shall be required to meet the provisions of this Guideline.

3.5.2 All existing grand fathered wall-mounted lights shall be encouraged to adhere to the requirements of Paragraph 3.2.1. Property owners whose structures are furnished with unshielded wall-packs shall be encouraged to shield such fixtures.

3.5.3 Existing (or grandfathered) luminaires, which are determined by the City to direct light toward streets, parking lots or private residences and cause glare to motorists, cyclists or residents and therefore deemed to be a public safety concern or deemed a nuisance shall be either shielded, re-directed or removed within 90 days of notification to the owner.

SECTION 4: NEW DEVELOPMENT APPLICATIONS

4.1 Submission Contents

The applicant for a development requiring outdoor lighting shall submit to the City as part of the application for development, evidence that the proposed works complies with this Guideline. The submission shall contain, but shall not necessarily be limited to, the following:

a. Plans indicating the location of lighting on the premises, and the type of illuminating devices, fixtures, lamps, supports, reflectors, and other devices, and stating the design power consumption for the overall lighting installation, and demonstrating compliance with the power density restriction as per the calculation method of APPENDIX B;

b. Description of the illuminating devices, fixtures, lamps, supports, reflectors, and other devices and the description may include, but is not limited to, catalogue cuts by manufacturers and drawings (including sections where required);

c. Photometric data, such as that furnished by manufacturers, or similar documentation demonstrating compliance with full cut-off requirement.

d. A detailed photometric plan for the subject property, containing the following information:

- Horizontal illumination calculations for a 4m x 4m grid of points, unless specified otherwise in this Guideline, complete with respective statistics for every applicable area/use classification identified in Appendix A.

- Horizontal illumination calculation points spaced at 4m apart along the boundary line of the subject property, with the maximum point value not exceeding the limits as specified in Appendix D.

- Horizontal illumination calculations for a 4m x 4m grid of points for a 20m wide zone immediately outside the property limits, for reference purposes.

- All calculations points shall be in units of lux, accurate to single digit after the decimal point.

The above required plans, descriptions and data shall be sufficiently complete to enable the City to readily determine compliance with the provisions of this Guideline. If such plans, descriptions and data are not sufficient to allow the City to determine compliance by reason of the nature or configuration of the devices, fixtures, or lamps proposed, the applicant shall consult with the City to find an acceptable solution. If required by the City, peer reviews of the lighting proposals may be undertaken at the developer's expense.

All lighting plans and photometric documentation must be prepared and stamped and certified by a Professional Engineer, and that all lighting must be installed and maintained by the applicant/ Owner in accordance with the approved drawings.

Prior to any City approvals for lighting proposals, the applicant/owner/developer will be required to post a performance security in an amount to be determined by the City.

4.2 Lamp or Luminaire Substitution

Should it be necessary for any outdoor light fixture, or the light source therein to be changed after the approval has been issued, a change request must be submitted to the City for approval, together with adequate information to enable the City to ensure the provisions of this Guideline are met, prior to implementing the installation.

4.3 As Built Certification

The applicant shall provide certification that the lighting installation has complied with the approved designs. The City reserves the right to review any deviations from the approved plans. If these deviations are deemed unacceptable, the City reserves the right to request that the deficiencies be rectified.

4.4 Infill Development Applications

Developers of infill properties in vicinity of existing commercial, industrial, sports or recreational area lighting installations shall include a warning clause in their agreements of purchase and sale to make the property buyers aware of the inconvenience that may potentially be experienced due to the lighting at the neighbouring lands.

SECTION 5: OFFENCES AND PENALTIES

5.1 Whenever the City Inspector, finds lighting (including portable lighting) to be in violation of the provisions of this Guideline, he/she shall notify the owner of the property in writing requiring them to repair, change, or remove such lighting within ten (10) days from the receipt of such notice.

5.2 Where lighting is determined to pose risk to public safety, and consequently, repair, change or removal is a matter of urgency, City staff may verbally direct the Owner to undertake immediate remedial action.

5.3 Refusal by the owner to comply with Paragraphs 5.1 or 5.2 will allow the City to remove the offending lighting at the expense of the owner and the expenses incurred may be recovered in like manner as municipal taxes as per By-law ####.

SECTION 6: DETAILED DESIGN CRITERIA

6.1 PARKING LOTS

6.1.1 General

This section applies to parking lots that are unroofed or enclosed.

The primary objective in the design of lighting for parking lots is the safety of the pedestrians. The lighting has to be designed such as to enable the driver/pedestrian to detect an object in the dark areas in the field of view, while looking at the brightest spot in the field of view. The MAX/MIN uniformity metric is therefore most significant, while the range of average illumination levels (as long as they are above a minimum) has less bearing on the ability to detect objects.

The design criteria for illumination of the parking lots are summarized in Table A1 of Appendix A. These criteria apply to any resident, customer, employee or general public parking lots.

6.1.2 Special Considerations

Special consideration should be given to the entrances, exits, ring roads or cross-aisles to enhance safety. In general these locations will require higher illumination levels, and in the case of exits, the light levels should be at least matching the levels of the intersecting roadway, and for high traffic areas, shall exceed them by 50%.

For parking lots illuminated significantly higher than the abutting access roads, careful consideration should be given to transitioning, and adapting to the lower levels of lighting of the adjacent roadways, at the parking lot exits.

For parking lots illuminated to the minimum requirements, the ability to detect objects and hazards is related to the colour rendering characteristics of the light source. In these cases, facial recognition is therefore improved when utilizing metal halide lamps rather than high pressure sodium units. Facial recognition, however, is most enhanced by increasing the illumination levels (specifically the vertical component). The ability to identify assailants is a key crime deterrent factor and therefore plays a significant role in areas where personal security is a concern.

Consideration should also be given to the light pole locations with respect to buildings, structures and any significant landscape features to minimize the shadow effects. **Any such structures affecting the light distribution should be modeled for the purpose of photometric calculations**.

6.1.3 Energy Conservation

Excluding parking lots for the apartment buildings and areas where personal safety is a concern, the parking lot operators are encouraged to reduce the lighting levels some time after business close or at times when no pedestrian activity is expected. Commercial sites governed by development control agreements can be required to reduce lighting levels after business operating hours.

6.2 PARKING GARAGES

6.2.1 General

With respect to illumination design criteria, this section applies only to the top level of the unroofed above-grade parking garages. These criteria are summarized in Table A.2. of Appendix A, and they apply to any resident, customer, employee or general public parking garages.

6.2.2 Special Considerations

6.2.2.1 Equipment

Portions of the parking garage structure, including ramps that are exposed to daylight and also require artificial illumination shall be furnished with luminaires with enhanced glare control characteristics (i.e. limited light output between 75° and 90° above the horizontal plane, and shielding where necessary). It shall be the responsibility of the of the parking garage owner and its lighting consultant to ensure that the proposed luminaires will not cause glare to motorists, cyclists or pedestrians on the adjacent roads, and will not cause nuisance glare to the residents of the adjacent properties.

6.2.2.2 Emergency Lighting

The purpose of the emergency lighting is to provide reduced illumination during power outages. Emergency luminaires should be strategically located in order to provide approximately 10% of normal illumination levels (as per Table A.2.) with a minimum of 10 lux at areas of pedestrian exits, or to satisfy any applicable codes and regulations (whichever has higher illumination requirements).

6.2.3 Light Sources

It should be noted that there have been rare instances of violent end-of-life failures of the metal halide lamps when operated continuously, which is not an uncommon scenario for parking garages. These violent failures can be avoided either by group relamping or periodic (e.g. weekly) cycling of power for short intervals of time.

6.3 AUTOMOBILE SALES LOTS AND OUTDOOR SALES AREAS

6.3.1 General

The main objective for lighting the car dealership lots or any outdoor sales areas is to create interest in the displayed product in order to attract potential buyers and to create conditions in which the merchandise can be comfortably examined. This should be accomplished without producing excessive brightness and without causing disability glare to the motorists and nuisance glare to the residents in the surrounding area.

In case of automobile sales lots, the typical implementations of these objectives include dedicated lighting for the front row of vehicles along the primary road, where the poles are located between the road and the front row such that shielding of the luminaires can be easily achieved with the standard "house side" shields. The remaining portion of the lot is typically illuminated to half of the front row

level. The suggested illuminance levels and uniformity ratios are summarized in Table A.3. of Appendix A.

6.4 GAS AND SERVICE STATIONS

6.4.1 General

The objective for the gas and service station lighting is to create safe and welcoming environments that attract customers. Overlighting the entire area of the station should be avoided. Typically, the luminaires in the canopy at the pump area should provide enough light spill to illuminate the station. The gradual fading of illumination when moving away from the canopy is also desired as it creates smooth transition from light to dark surroundings, as is the case when re-entering the darker roadway.

All canopy lights shall comply with the full cut-off requirement of Paragraph 3.2.1.

The suggested illuminance levels and uniformity ratios are summarized in Table A.4. of Appendix A.

6.5 RECREATIONAL FACILITIES AND SPORTS FIELDS LIGHTING

6.5.1 General

The objective in lighting of the sports fields is to enhance the contrast of the playing target, the competitors and the surrounding background. Generally, higher speed sports like baseball or tennis will require bigger quantity of light – higher horizontal illumination levels – and better quality of light – more uniform illumination. Uniformity is especially important as poor uniformity may result in visual distortion of the playing target.

The lighting consultant shall design the illumination system to meet the criteria as defined in the IESNA Recommended Practice for Sports and Recreational Area Lighting, RP-6, latest edition.

6.5.2 Glare Reduction

The flood type luminaires shall be equipped with an internal louver system and optionally with external baffles, where practical, in order to minimize the glare experienced from properties adjacent to the sports fields. **Note: appropriate photometric data corresponding to the louver / baffle systems must be used in calculations.**

6.5.3 Light Trespass

The lighting system for the sporting facilities shall be designed to closely control light trespass. The maximum trespass shall be in conformance with the limit identified in Table D.1. of Appendix D, and corresponding to Environmental Zone E4.

The required cut off at the property boundary lines of the sports facility can be achieved by the following:

a) Selection of the optical system of a luminaire such that the defined beam is confined to within the facility limits;

b) Specifying the mounting heights such that the top of the beam's field angle (in vertical plane) is at least 10° below horizontal; No more than 5% of the luminaires used should violate this requirement.
c) Using luminaires with internal louvers or external baffles as per Paragraph 6.5.2 above.

6.5.4 Hours of Operation

All sports field lighting installations shall include master timer to control designated turn-off at curfew hour.

6.5.5 Construction Considerations

6.5.5.1 Floodlight Aiming

The contractor shall be provided with floodlight aiming diagram. Spot aiming diagram is the preferred option over angle aiming specifications, which tend to be less accurate.

6.5.5.2 Field Testing and Verification

All floodlight installations shall be field verified and certified by the Professional Engineer responsible for preparing the plans, independent of the installing contractor or the lighting product manufacturer and adjusted by the contractor as necessary.

6.6 ARCHITECTURAL LIGHTING

6.6.1 General

The objective of architectural lighting is to attract attention to an object or edifice through visual effects involving architectural characteristics of the structure and by creating ambiance for the night environment.

Architectural lighting may involve floodlighting, spotlighting, outlining, silhouetting, etc. Lighting shall be designed so as to minimize light that does not illuminate target surfaces. Illumination of tall, slender structures is discouraged.

The average illumination levels of the floodlighted vertical building surfaces shall not exceed the limits identified in Table A.5. of Appendix A.

6.6.2 Up-light

No luminaires shall be oriented or aimed in such a way as to directly produce up light.

6.6.3 Glare

There shall be no glare emanating from the luminaires in accordance with fully shielded design.

No illumination of highly polished, specular and reflective surfaces such as glass, stone, glazed tile or brick, etc. shall be allowed, to avoid producing reflected glare.

6.7 SIGN LIGHTING

6.7.1 General

This section applies to pylon signs and road monument signs.

6.7.2 Special Considerations

6.7.2.1 Internally illuminated signs

Internally illuminated signs shall be equipped with light diffusers.

6.7.2.2 Externally illuminated signs

Lighting shall be designed so as to minimize light that does not illuminate target surfaces.

Bottom / ground mount luminaires shall not be permitted.

6.7.3 Energy conservation

Signs used for advertising purposes are to be turned off when the activity in the area stops or between hours of 11 p.m. and 6 a.m. Exceptions may be granted for those facilities providing 24 hour service.

The portion of the sign with the municipal address of the property shall remain illuminated throughout the night.

6.8 SECURITY LIGHTING

6.8.1 General

As a general practice, all locations with pedestrian traffic after dusk should be lit. The exceptions are parks where need for lighting should be evaluated on case by case basis.

The objective for the lighting is to create well defined exterior environments. This is usually achieved through

- good uniformity of lighting;
- enhancing the vertical component of light for easier face recognition;
- lighting of vertical surround surfaces to minimize dark areas and shadows;
- reducing high brightness contrast to maximize perception, as human eye adapts to the brightest source of light;

As an alternative approach, illumination should be provided at the hazardous locations only, like bridges, stairs, steep slopes, obstacles, etc.

Table A.2. – Design Criteria for Illumination of Parking Garages (after IESNA RP-20-98).

Area	Min. Horizontal Illuminance [lux] (NOTE 1)	Max/Min Uniformity Ratio (NOTE 2)	Min. Vertical Illuminance [lux] (NOTE 3)
Top levels of multi-level garages that are unroofed	5	15:1	2.5
Stairways	20		10

Note 1 – Does not take into account any shadowing effect from parked vehicles.

Note 2 – Ratio of the highest horizontal illuminance area to lowest horizontal illuminance point, or alternatively the average of the lowest area.

Note 3 – Measured at 1.5m above pavement, at the point of lowest horizontal illuminance, excluding facing outward along boundaries.

SECTION 7 APPENDICES

APPENDIX A – Photometric Design Criteria

Table A.1. – Design Criteria for Illumination of Parking Lots (after IESNA RP-20-98, except for average horizontal illuminance values).

Metric	Basic Security	Enhanced Security (NOTE 1)
Min. Horizontal Illuminance [lux]	2	5
Max/Min Uniformity Ratio	20:1	15:1
Average Horizontal Illuminance [lux]	10-25	25-75 (NOTE 2)

Note 1 – Enhanced security specifications should be applied for areas where personal security or vandalism is a concern. They may also be applied as a matter of preference for business related reasons (i.e. customer attraction, etc.).

Note 2 – Averages of 45 lux and above are permitted for strictly commercial and/or industrial land uses with no close proximity to residential or other sensitive land use.

Table A.3. – Design Criteria for Illumination of Automobile Sales Lots (after IESNA RP-33-99).

Area Description	Max Horizontal Illuminance [lux]	Max:Min
Main Business Districts		
Front Row	100-200	5:1
Other Rows	50-100	10:1
Entrances	50-100	5:1
Driveways	20-30	10:1
Secondary Business Districts		
Front Row	50-100	5:1
Other Rows	25-50	10:1
Entrances	25-50	5:1
Driveways	10-20	10:1

Table A.4. – Design Criteria for Illumination of Service Station or Gas Pump Area (after IESNA RP-33-99).

Area Description	Average Illuminance [lux]
Dark Surroundings	
Entrance	15
Driveway	15
Pump Island	50
Building Façade	20
Service Areas	20
Landscape Highlights	10
Light Surroundings	
Entrance	20
Driveway	20
Pump Island	100
Building Façade	30
Service Areas	30
Landscape Highlights	20

Table A.5. – Average Illumination Targets for Floodlighting Building Walls (after IESNA RP-33-99).

Area Description	Avg. Target Vertical Illuminance [lux]
Bright Surroundings	
Light Surfaces	50
Medium Light Surfaces	70
Dark Surfaces	100
Dark Surroundings	
Light Surfaces	20
Medium Light Surfaces	30
Medium Dark Surfaces	40
Dark Surfaces	50

APPENDIX B – Power Density Limits for Outdoor Lighting

The maximum lighting power allowance for outdoor areas shall be determined by multiplying the LPD factor from Table B.1. below, by the area or length, whichever is applicable, of the outdoor spaces.

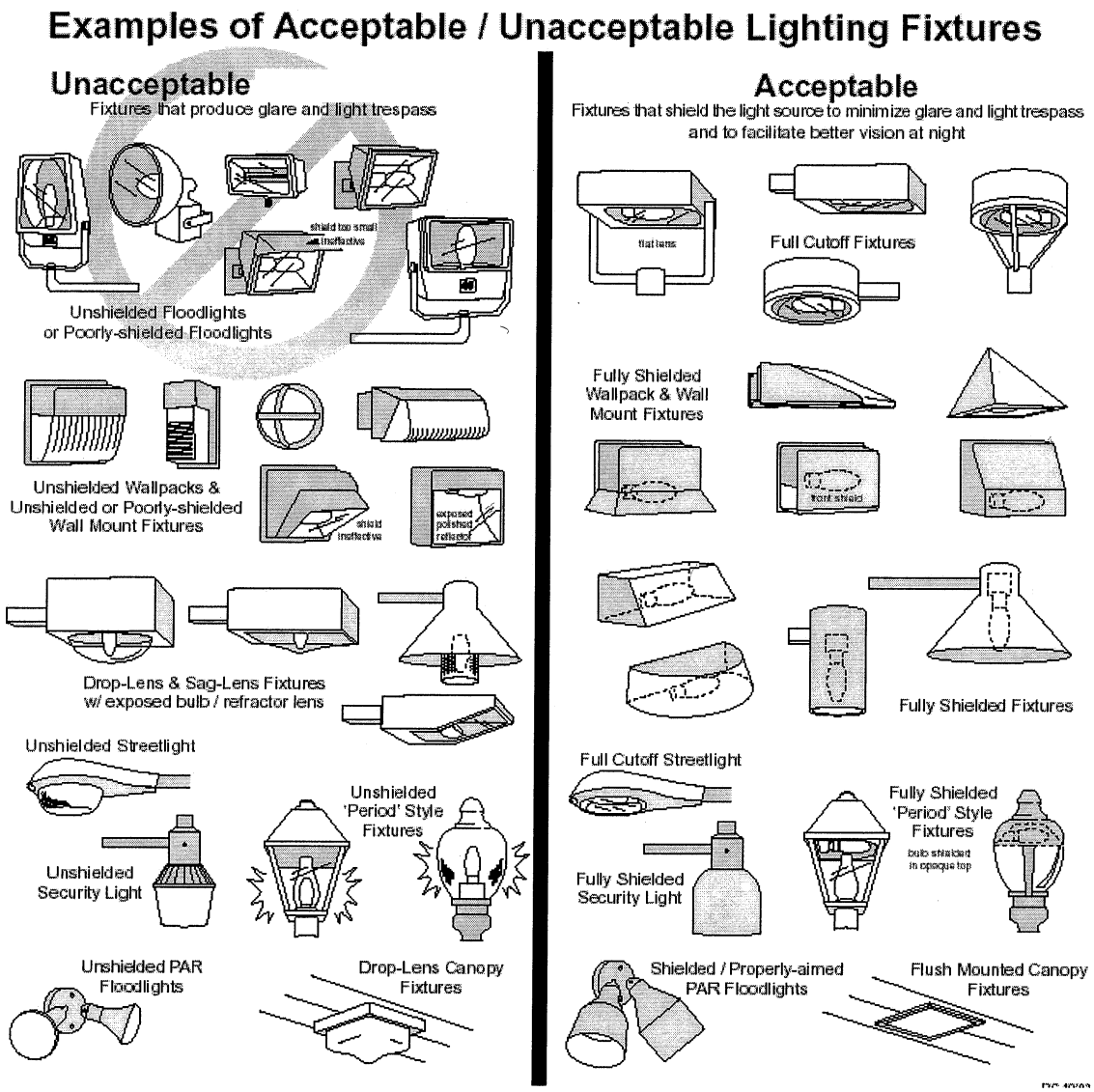
The total outdoor lighting installation power consumption allowance shall be the sum of the power allowances of all different types of exterior areas plus an additional 5% of that sum.

Table B.1. – Lighting Power Densities (after Ontario Building Code, Table 12.3.4.10, and ANSI/ASHREA/IESNA Standard 90.1-2004, Tables 9.4.5 and 9.5.1).

Location type	Lighting power density (LPD)
Uncovered parking lots and unroofed top levels of parking garages	1.6 W/m^2
Outdoor Sales – open areas	5.4 W/m^2
Outdoor Sales – street frontage for vehicle sales lots in addition to "open area" allowance	65.6 W/m
Building facades	2.2 W/m^2 OR 16.4 W/m (NOTE 1)
Canopies (freestanding and attached and overhangs	13.5 W/m^2
Walkways less than 3m wide	3.3 W/m
Walkways 3m or greater, plaza areas, special feature areas	2.2 W/m^2
Stairways	10.8 W/m^2
Building main entries	98 W/m of door width
Other doors	66 W/m of door width
Entrances and gatehouse inspection stations at guarded facilities	13.5 W/m^2 of uncovered area
Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM location
Loading areas for law enforcement and emergency service vehicles	5.4 W/m^2 of uncovered area
Drive-up windows	400 W per drive-through
Parking near 24-hour retail entrances	800 W per main entry

Note 1 – Whichever is more restrictive.

APPENDIX C – Full or Sharp Cut Off Definition



APPENDIX D – Light Trespass

The light trespass limitations shall be defined as a function of the surrounding area uses, as different light spill can be tolerated in areas with very high ambient lighting (i.e. downtown) vs. darker areas of the city suburbs.

All areas shall fall into one of the following four environmental zone categories (E1 to E4; adopted after Commission Internationale de l'Eclairage CIE, and IESNA RP -33-99):

Zone E1: Areas with intrinsically dark landscapes. Examples include conservation parks, very environmentally-sensitive areas, etc.

Zone E2: Areas of low ambient brightness. These typically include outer urban and rural residential areas.

Zone E3: Areas of medium ambient brightness. These are typically urban residential areas.

Zone E4: Areas of high ambient brightness. These are generally urban areas with high density residential and commercial components.

The restrictions on the light trespass are expressed in terms of horizontal illuminance at the property boundary line, and are summarized in Table D.1. below.

Table D.1.

Environmental Zone	Recommended max illuminance level	
	Pre-curfew	Post-curfew
E1	1 lux	0 lux (NOTE 1)
E2	3 lux	1 lux
E3	8 lux	2 lux
E4	15 lux	6 lux

Note 1 – The 0 lux limit excludes the luminaires intended for public safety and security, in which case subject lighting shall not exceed 1 lux.