

SUSTAINABLE LAND USE CODE PROJECT

Capitol Region Council of Governments



MODEL REGULATIONS: OUTDOOR LIGHTING

August 2013



In Association with:
Shipman & Goodwin
Seth Harry and Associates

C L A R I O N

101 Market Street
Suite D
Chapel Hill, NC 27516
919.967.9188

CONTENTS

INTRODUCTION	1
MODEL CODE PROVISIONS FOR OUTDOOR LIGHTING.....	2
1.1. PURPOSE.....	2
1.2. APPLICABILITY.....	2
1.2.1. New Development and Nonconforming Uses	2
1.2.2. Existing Lighting	2
1.2.3. Exempt Lighting	2
1.2.4. Conflict With Existing Standards	4
1.3. LIGHTING PLAN SUBMITTAL REQUIREMENT.....	4
1.3.1. Plan Required	4
1.3.2. Plan Information.....	5
1.4. LIGHTING CLASSIFICATIONS ESTABLISHED	5
1.5. GENERALLY APPLICABLE OUTDOOR LIGHTING STANDARDS.....	5
1.5.1. Standards Applicable to All Uses.....	5
1.5.2. Residential (Single-Family, Two-Family, and Small Multifamily) Outdoor Lighting Standards	6
1.5.3. NonResidential and Large Multifamily Residential Outdoor Lighting	7
1.5.4. Uses with High-Intensity or Special-Purpose Lighting Subject to Special Exception Review	13
1.6. LIGHTING CONTROL AND CURFEW REQUIREMENTS	14
1.6.1. Lighting Controls—Automatic Switching	14
1.6.2. Automatic Lighting Reductions	14
DEFINITIONS.....	14

OUTDOOR LIGHTING

Introduction

One of the major sources of consumption of electricity is outdoor lighting. Lighting was estimated to have consumed about 11 percent of the total electrical demand by the nation's residential sector in 2007. While indoor lighting makes up the bulk of this usage, outdoor lighting still represents a substantial amount. And large commercial establishments like shopping centers use huge amounts of electricity to light parking lots and other outdoor areas.



Parking lot lighting

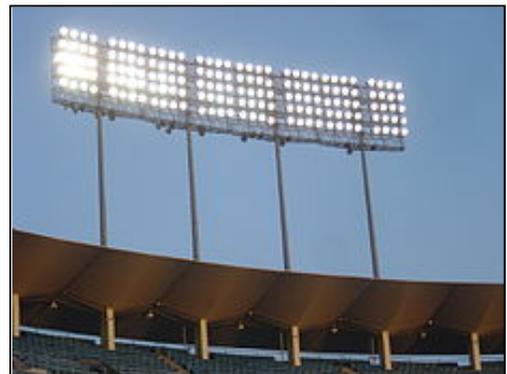
Many communities throughout the United States have adopted strong standards to govern outdoor lighting in their development codes to reduce potential adverse impacts on surrounding properties, to preserve the dark, and, more recently, to reduce energy consumption and greenhouse gas emissions. However, most local development codes in the region contain minimal standards addressing outdoor lighting, and those that do focus primarily on light trespass onto neighboring property. These model regulations propose three main requirements that, if implemented, can save substantial amounts of energy by:

- Establishing a maximum overall lighting budget for each building or site based on the latest recommended practices by the Illuminating Engineering Society of North America (IESNA) and International Dark Sky Association (IDA), thus reducing overlighting and energy waste.
- Setting limits on the brightness of individual light fixtures to prevent glare and light trespass on adjacent property, while still providing adequate light for security, commercial, and other purposes; and
- Requiring that outdoor lighting be turned off or reduced when a business or use is not open or operating.



Pedestrian lighting

Different standards are proposed for residential and nonresidential uses depending on the zone district that is applicable. Single-family and two-family dwellings are exempt.¹ Compared to most of the existing local government lighting regulations in the region, all of the proposed



Sports stadium lighting

¹ As discussed below, there are two options proposed regarding single and two-family dwellings. First, they could be exempted. Second, they could be regulated in a modest way as recommended by the IESNA. This issue has been left open for TAC discussion.

standards will give much clearer guidance to applicants and municipal review staff alike because they establish metrics that are clear, measurable, and enforceable. Because the model regulations employ some technical lighting terminology, an extensive definition section is included at the end of this document.

Model Code Provisions for Outdoor Lighting

1.1. PURPOSE

The general purpose of this section is to require outdoor lighting that is: adequate for safety and convenience; in scale with the activity to be illuminated and its surroundings; directed to the surface or activity to be illuminated; and designed to clearly render people and objects and contribute to a pleasant nighttime environment in an efficient manner. Additional specific purposes are to:

- 1.1.1. Provide safety and personal security as well as convenience and utility in areas of public use or traverse, for uses where there is outdoor public activity during hours of darkness;
- 1.1.2. Permit reasonable use of outdoor lighting for nighttime safety, enjoyment, and commerce;
- 1.1.3. Control glare and excessive brightness to improve visual performance, allow better visibility with relatively less light, and reduce trespass light onto neighboring properties to protect inhabitants from the consequences of obtrusive light;
- 1.1.4. Conserve energy by reducing the use of electricity and gas and cut down on greenhouse gas emissions; and
- 1.1.5. Control light pollution to minimize the negative effects of misdirected light and recapture views to the night sky.

1.2. APPLICABILITY

1.2.1. NEW DEVELOPMENT AND NONCONFORMING USES

As of the date of adoption of this ordinance, the following standards shall be applicable to all new developments in all zone districts and to any new lighting added as part of an expansion of an existing nonconforming use or noncomplying structure subject to (Add cross reference to nonconforming use/structure regulations if applicable.)

1.2.2. EXISTING LIGHTING

When in any three-year period 50 percent of existing outdoor light fixtures are being replaced or modified on a mixed-use or nonresidential site or building, then all lighting shall be made to conform to the provisions of this ordinance. However, the (insert name of local government) strongly encourages all existing uses to adhere to the requirements in this ordinance to reduce energy use and costs as well as to reduce glare and light trespass.

1.2.3. EXEMPT LIGHTING

The following types of lighting are exempt from the requirements of this section.

- A. Soffit or wall-mounted luminaires that are permanently attached to single- and two-family residential dwellings, not to exceed the height of the eave, except as provided in Section 1.5, Generally Applicable Outdoor Lighting Standards.

- B. Lighting for transportation corridors, public streets and rights-of-way, and abutting pedestrian sidewalks, trails, paths, and walkways. No exemption shall apply to any street or other public right-of-way lighting when the purpose is to illuminate areas outside the public right-of-way.
- C. Lighting for public monuments, statuary, and landmark sites.
- D. Lighting for signage as regulated under (Add reference to lighting provisions in local sign regulations if applicable.).
- E. Temporary decorative seasonal lighting.
- F. Temporary lighting for emergency conditions, nighttime work and construction, theatrical, television, and performance areas, or for special public events or private events approved by the (insert name of local government).
- G. Lighting for a special district, street, or building that, according to an adopted municipal plan or ordinance, and as approved by the (insert name of decision-making official such as planning director) is determined to require special lighting aesthetics as part of its physical character.
- H. Lighting required and regulated by the Federal Aviation Administration or other federal or state agency.
- I. Lighting for tunnels, covered parking garages (not including uncovered floors), garage entrances, and similar conditions, provided that lighting at entrances to such facilities employ full cut-off shielding to prevent light from causing glare on adjacent properties or exceeding 0.10 footcandles at the property line within or adjacent to any residential zone, or 0.2 footcandles in nonresidential zones.
- J. Lighting for public and private outdoor recreational uses such as athletic playing areas (e.g., soccer fields, ball diamonds, playing fields, tennis courts) and similar uses, provided that such uses comply with the following standards. If any of these standards are exceeded or not complied with, then such lighting shall be subject to the special permit requirements in Section 1.5.4.
 - 1. All site lighting not directly associated with the outdoor recreational use shall conform to the lighting standards in this ordinance.
 - 2. All lighting for athletic playing areas or fields shall utilize full cutoff luminaires that are installed in a fashion that maintains the full cutoff characteristics unless certified by a licensed electrical engineer that such shielding is impractical. Every such lighting system design shall be certified by a licensed electrical engineer as conforming to all applicable restrictions of this ordinance. Where full cutoff fixtures are not utilized, acceptable luminaires shall include those that:
 - a. Are provided with internal and/or external glare control louvers and installed so as to limit direct uplight to less than five percent of the total lumens exiting from the installed fixtures and minimize offsite light trespass, and;

- b. Are installed and maintained with minimum aiming angles of 25 degrees downward from the horizontal. The aiming angle shall be measured from the axis of the luminaire maximum beam candlepower as certified by independent testing agency. The manufacturer shall supply a drawing showing the aiming alignment of each fixture with the measurement referencing the field and the pole locations.

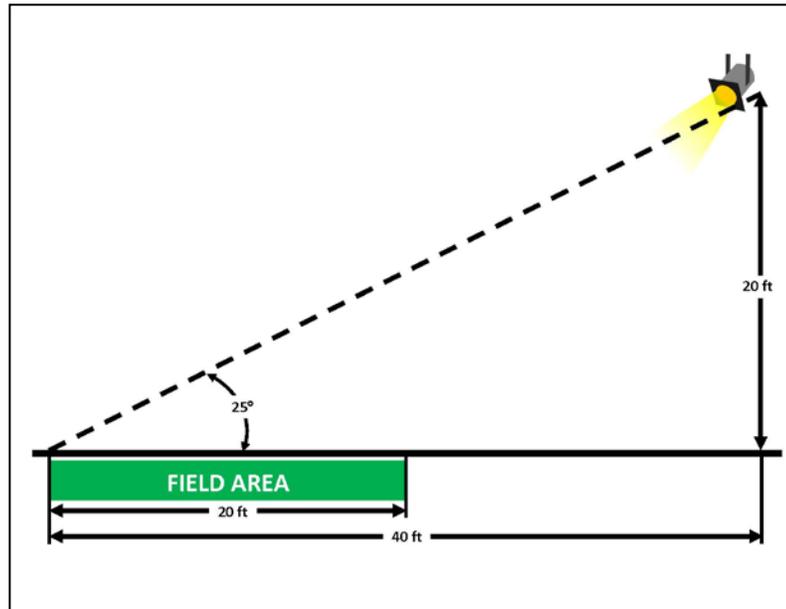


Figure 1.2-1: Aiming angle

- 3. Maximum permitted light post height: 80 feet at finished grade.
- 4. Maximum permitted illumination at the property line: 2.0 footcandles.
- 5. Limits on hours of illumination: Outdoor recreational lighting shall be extinguished between the hours of 11 p.m. and 7 a.m., or one hour after activities or games on the site are completed, whichever is later.

1.2.4. CONFLICT WITH EXISTING STANDARDS

If the standards prescribed by this ordinance conflict with an existing standard relating to outdoor lighting in (insert cross reference to other municipal regulations addressing lighting, if any), the more restrictive shall apply.

1.3. LIGHTING PLAN SUBMITTAL REQUIREMENT

1.3.1. PLAN REQUIRED

All nonresidential developments and all residential developments with more than five lots or dwelling units shall submit a proposed outdoor lighting plan prepared by a qualified electrician, electrical engineer, or similarly qualified profession acceptable to the (insert name of local government). The plan must be submitted concurrently with any application for development or site plan if required.

1.3.2. PLAN INFORMATION

- A. The outdoor lighting plan shall include plans and specifications for streetlights, parking lot and garage lights, and exterior building lights.
- B. The specifications shall include details of the pole, fixture height and design, luminaire type and specifications (including initial lamp lumens), number of lamps per luminaire, lumens, spacing of lights, and proposed hours of operation.
- C. The outdoor lighting plan shall include necessary calculations and information demonstrating compliance with the requirements of this ordinance including the site lighting budget for nonresidential uses.

1.4. LIGHTING CLASSIFICATIONS ESTABLISHED

The following lighting classifications are hereby established within the (insert name of local government). All zone districts listed (insert cross reference to zone district section of local zoning regulations) shall be classified as set forth in Table 1.4-A:

TABLE 1.4-A: LIGHTING CLASSIFICATIONS		
Lighting Classification	Description	Applicable Zone Districts ²
Class 1	Intended for low-density single, and two-family, and multifamily residential areas, open space, and parks	<ul style="list-style-type: none"> All agricultural districts All open space districts All large-lot or low-density residential districts (Review with staff)
Class 2	Intended for high density residential, mixed-use developments, low and moderate intensity commercial areas, and light industrial areas	<i>Local staff to insert</i>
Class 3	Intended for major business districts and manufacturing and heavy industrial areas	<i>Local staff to insert</i>

1.5. GENERALLY APPLICABLE OUTDOOR LIGHTING STANDARDS

1.5.1. STANDARDS APPLICABLE TO ALL USES

The following standards shall apply to all outdoor lighting associated with both residential and nonresidential uses.

- A. No flickering or flashing lights shall be permitted, except for temporary decorative seasonal lighting.
- B. Maximum lighting level uniformity (maximum to minimum) for parking lots that have outdoor lighting shall be 20:1.³

² Local planning staff should insert existing local zone districts into the appropriate lighting classification based on the description in Column 2.

³ This is the recommended maximum/minimum ratio from the IESNA. Some model codes use an average/minimum ratio of 4:1.

- C. All fixtures shall utilize one of the following bulb types: metal halide, induction lamp, compact fluorescent, incandescent (including tungsten-halogen), LED, solid state lighting, or high-pressure sodium with a color rendering index above 70.
- D. Lighting installations shall not have an adverse impact on traffic safety and shall not shine onto or produce glare beyond the lot line or exceed 0.1 footcandles at the property line within or adjacent to any residential zone or 0.2 footcandles in nonresidential zones unless specifically provided otherwise in this ordinance.
- E. The maximum height of any lighting pole serving a residential use shall be 16 feet. The maximum height serving any other type of use shall be 25 feet, except in parking lots larger than five acres, the maximum height shall be 35 feet if the pole is located at least 100 feet from any residential use or except as provided in this ordinance for outdoor recreational uses in Section 1.2.3.
- F. For upward-directed architectural, landscape, and decorative lighting, direct light emissions shall not be visible above the building roof line or beyond the property line.

1.5.2. RESIDENTIAL (SINGLE-FAMILY, TWO-FAMILY, AND SMALL MULTIFAMILY) OUTDOOR LIGHTING STANDARDS⁴

A. Applicability⁵

Option 1: All outdoor lighting for single-family, two-family, and small multifamily⁶ uses shall be exempt from the provisions of this ordinance except as provided in Section 1.5.

Option 2: Outdoor lighting is not required for any single-family, two-family, or small multifamily residential use, except for purposes of public safety. However, if installed, all residential outdoor lighting shall meet the following standards in addition to those in Section 1.5.

B. General Requirements

- 1. Except for motion-activated security lighting and floodlighting permitted by this section, all lamps and bulbs more than 600 lumens⁷ located in residential zone districts shall be within a fully shielded fixture or shall be within a light fixture where the bulb or lamp is obscured from view by a material that diffuses the light (e.g., frosted glass), except as otherwise permitted in this ordinance.⁸
- 2. Shielded directional floodlighting must be aimed away from adjacent properties and not exceed 1800 lumens.



Illustration of open flame gas lamp

⁴ As noted above, many communities exempt single and two-family dwellings from outdoor lighting controls. For purposes of this ordinance, multifamily residential buildings with more than three units and all mixed-use buildings containing residential units shall be defined and regulated as nonresidential uses under Section 1.5.3.

⁵ We have provided two options for applicability for local governments to consider.

⁶ As defined by the local government (generally those with 3 to 5 dwelling units).

⁷ 600 lumens is approximately 40 watts.

⁸ Illustrations of a range of cut-off lighting is set forth in Figure 1.5-2

3. Open flame gas lamps without mantels are exempt from regulation under this ordinance.
4. Lighting installed with a vacancy or motion sensor shall be set to extinguish the light no more than 15 minutes after the area is vacated or motion ceases. Motion sensors shall not activate lighting when motion is generated from a source outside the property boundary.
5. Lighting systems that provide lighting for recreational purposes such as sports courts and similar facilities shall direct lighting downward and inward from the perimeter lot boundary, shall not exceed 16 feet in height, and shall be turned off between the hours of 10:00 p.m. and 7:00 a.m.

C. Landscape Lighting

All lighting associated with landscaping shall comply with the requirements set forth above and in Section 1.5. Landscape lighting shall not be aimed onto adjacent properties.

1.5.3. NONRESIDENTIAL AND LARGE MULTIFAMILY RESIDENTIAL OUTDOOR LIGHTING⁹

Outdoor lighting for nonresidential uses and large multifamily¹⁰ residential uses shall meet the following requirements.

A. Site Lighting Budget

The total installed initial lamp lumens on all lighting systems on the site shall not exceed the site lumen limit set forth in Table 1.5-A. The total initial lamp lumens is calculated as the sum of the initial lamp lumens for all luminaires tested with relative photometry and 140% of initial lamp lumens for all luminaires tested with absolute photometry.

B. Light Budget Calculation Option 1

Comment: These model regulations propose two options for calculating a site lighting budget to allocate the amount of lighting used on a site. Option 1, described in this Subsection B, breaks-up the lighting across different lighting applications, such as parking lots or building entrances. This provides a detailed and fairly precise distribution of lighting across different lighting areas on a site, but it is somewhat difficult to calculate and administer. Option 2, described below in Subsection C, provides a single, simple calculation for the site and a minimum amount of lighting provided to smaller sites. This approach is more straightforward to calculate and administer. This approach does not, however, attempt to distribute the lighting across the site. This may result in unintended consequences where most of the lighting is aggregated on a site such as in a parking lot.

1. Maximum Lighting

The maximum allowed lighting limit shall be calculated as follows:

- a. Applying the rules set forth in Section 1.5.3.B.2, multiply the area (square footage) of each lighting application type (e.g., parking lot, building

⁹ Most local government outdoor lighting ordinances enacted over the past two decades have required full cut-off shielding for lighting as the primary means of control. While this approach helped reduce light escaping upwards and reduced light trespass on adjacent properties to a certain extent, it did not address the intensity of the lighting/energy consumption in any measurable way. This model ordinance goes beyond simply requiring full cut-off shielding.

¹⁰ As defined by the local government (generally those with 6 or more dwelling units).

entrance, building façade) in Table 1.5-A by the maximum allowed lamp lumens for the appropriate lighting classification of the development.

b. Add up the total of lumens for each lighting application type.

2. **Calculation Rules**

a. A lighting budget is not allowed for any lighting application types not listed, unless exempted by this ordinance or classified as special purpose in Section 1.5.4.

b. If two lighting application types are within one area, the lighting application type with the lower number of lumens shall be used.

c. Canopy allowances include only the area within the drip line area of the canopy.

d. The entire area of a site shall not be used for calculating the site budget. Areas that are not designed to be illuminated may not be counted toward the total lighting limit for the site.

TABLE 1.5-A: SITE LIGHTING BUDGET				
In maximum lumens per square foot				
Lighting Application	Allowed Area For Purposes of Calculating Lighting Budget	Lighting Class 1	Lighting Class 2	Lighting Class 3
		Lighting classes are described at the bottom of this table		
Parking lots, plazas, hardscape lighting, driveways, on-site private drives	Paved areas plus 5 feet of the perimeter of adjacent unpaved land. Includes planters and landscaped areas less than 20 feet wide that are enclosed by hardscape on at least 3 sides.	0.3 maximum lumens/sq ft	0.6	1.2
Sidewalks, walkways, and bikeways	Paved area plus 5 feet of unpaved land on either side of the path of travel.	0.6	1.2	2.25
Building entrances without canopy	Width of doors plus 3 feet on either side times a distance outward from the building from the surface of the doors 20 feet.	5.25	7.5	10.5
Building entrances with canopy and canopies for drive-up sales, loading docks, and general use	Drip line area under canopy. 200 lumens plus the value in the Lighting Class column.	1.5	3.0	6.0
Vehicle service stations	Drip line area under canopy or 500 square feet per double-sided fuel dispenser unit not under canopy.	4.5	9.0	16 ¹¹
Building facades	Entire vertical area of facade	Not Allowed	2.7	3.0

¹¹ The IESNA model outdoor lighting code recommends a range of from 16 to 24 for major commercial and industrial areas. We have selected the lower end of the range to prevent overlighting of service stations.

TABLE 1.5-A: SITE LIGHTING BUDGET				
In maximum lumens per square foot				
Lighting Application	Allowed Area For Purposes of Calculating Lighting Budget	Lighting Class 1	Lighting Class 2	Lighting Class 3
		Lighting classes are described at the bottom of this table		
Outdoor sale lots	Portion of uncovered outdoor sales lot used for display of vehicles or other merchandise for sale. All adjacent access drives, walkway areas, customer parking areas, vehicle service or storage areas that are not surrounded on at least three sides by sales area shall be considered hardscape.	Not Allowed	7.5	7.5
Outdoor sales frontage (frontage in linear feet and the allowance is per linear foot)	Valid only for sections of an outdoor sales area that re along the frontage. A corner sales lot may include both sides provided that a different principal viewing location exists for each side	Not Allowed	Not Allowed	300 lumens/linear foot
Decorative lighting	Entire site	By Conditional Use Permit Only	0.15	0.30
Descriptions of Lighting Classifications:	Class 1: Intended for low-density single, two-family, and multifamily residential developments, open space, and parks. Class 2: Intended for high-density residential developments, mixed-use developments, low and moderate intensity commercial areas, and light industrial areas. Class 3: Intended for major business districts and manufacturing and heavy industrial areas			

Site Lighting Budget Example: The proposed development is for a small commercial use (Lighting Class 2). The total site size is 40,000 square feet and the building will be 10,000 square feet (100 ft X 100 ft) and 24 feet high. The use will have 15,000 square feet of parking and driveways, 400 square feet of sidewalks, two entry doors without canopies (one 6 feet wide and one 3 feet wide), and a total building façade of 2,400 square feet to be illuminated (100 X 24 ft X 1 facade). The site lighting budget would be calculated as follows:

15,000 square feet of parking X 0.6 lumens/square foot (from table) = 9,000 lumens

400 square feet of sidewalk X 1.2 lumens (from table) = 480 lumens

Entry doors:

6 foot width plus 3 feet on each side = 12 feet X 20 feet = 240 X 7.5 lumens (from table) = 1,800 lumens

3 foot width plus 3 feet on each side = 9 feet X 20 feet = 180 X 7.5 lumens (from table) = 1,340 lumens

2,400 square feet of building façade to illuminate (100 X 24) X 2.7 lumens (from table) = 6,480 lumens

Total Lumens Allowed On Site = 19,100 lumens (approx. 1,273 watts)

C. Lighting Budget Calculation Option 2

1. Maximum Lighting

The maximum allowed lighting limit shall be calculated as follows: multiply the allowed lumens for the appropriate lighting class in Table 1.5-A times the square footage of hardscape on the site. Hardscape is defined as permanent hardscape improvements to the site, including parking lots, drives, entrances, curbs, ramps, stairs, steps, medians, walkways, and non-vegetated landscaping that is ten feet wide or less in width. Materials may include concrete, asphalt, stone, gravel, and similar materials.

2. Minimum Lighting

Notwithstanding the calculation set forth in C.1 above, each site shall have an allowed minimum lumens as set forth in Table 1.5-A.

TABLE 1.5-A: SITE LIGHTING BUDGET			
Lighting Classification	Lighting Class 1	Lighting Class 2	Lighting Class 3
Allowed Lumens per square foot of hardscape	1.25 lumens per sq. ft.	2.5 lumens per sq. ft.	5.0 lumens per sq. ft.
Allowed minimum lumens per site	3,500	7,000	14,000

Site Lighting Example: Each site would be allowed a minimum amount of lumens whatever its size (Row 2 of the table). For example, a small industrial site (Class 3) with 2,000 square feet of hardscape would be allowed 14,000 lumens. Total lumens for larger sites would be calculated by multiplying the total square footage of hardscape times the allowed lumens per square foot from the table based on the lighting class for the use/zone district. For example, if a small commercial site (Class 2) had 10,000 square feet of hardscape, it would be allowed to have 25,000 lumens of lighting throughout the site. Such lighting could be placed wherever the applicant desired, subject to other regulations in the ordinance regarding light spillover, maximum fixture illumination, etc.

D. Alternative Site Lighting Budget Calculation

1. If an applicant or the Director determines that the lighting needs or potential impacts of a particular use are unique and that the method of calculating the allowable total lumens for a site are inappropriate, the Director may authorize the applicant to undertake an alternative site lighting budget calculation conducted and certified by an electrical engineer or similarly qualified professional. The (insert name of local government) may require the applicant to provide funding to retain an electrical engineer to review the alternative site lighting budget calculation produced by the applicant.

2. The entire proposed lighting design shall be analyzed and certified by the applicant using industry standard lighting software meeting the following requirements:
 - a. Input data shall describe the lighting system, including luminaire locations, mounting heights, aiming directions, and employ photometric data tested in accordance with IESNA guidelines. Buildings or other physical objects on the site within three object heights of the property line must be included in these calculations.
 - b. Analysis shall utilize a theoretical enclosure around the perimeter of the site. The top of the enclosure shall be no less than ten feet above the tallest luminaire. Calculations shall include total lumens upon the inside surfaces of the enclosure and vertical sides and maximum line of sight or "TV" illuminance (footcandles and/or lux) on the sides of the enclosure.
3. The Director may approve the lighting plan if the total lumens on the inside surfaces of the theoretical enclosure are less than ten percent of the total site lumen limit as set forth in Table 1.5-B and the maximum line of sight or "TV" illuminance on any vertical surface is less than the allowed maximum illuminance set forth in Table 1.5-B.
4. The maximum allowable illumination at any point in the plane of the property line of any property, residential or not residential, shall be as set forth in table 1.5-B.

TABLE 1.5-B: MAXIMUM LINE OF SIGHT OR TV ILLUMINANCE AT ANY POINT IN THE PLANE OF THE PROPERTY LINE		
Lighting Class 1	Lighting Class 2	Lighting Class 3
0.1 footcandles or 1.0 lux	0.3 footcandles or 3.0 lux	0.8 footcandles or 8.0 lux

E. Maximum Allowable Luminaire Lighting Intensity¹²

The maximum allowable lighting intensity of a luminaire utilized for outdoor lighting for all uses subject to this ordinance shall be as set forth in Table 1.5-C below.

TABLE 1.5-C: MAXIMUM ALLOWABLE LIGHTING INTENSITY (In Lumens)[1]				
Lighting Classification (described at the bottom of this table)	Full Shielding Required (IESNA Full Cut-Off)	Must Be Shielded (IESNA Cut-Off)	Must Be Partially Shielded (IESNA Semi Cut-Off)	Can Be Unshielded (IESNA Non Cut-Off)
	<i>See Figure 1.5-2, below, for illustrations of IESNA cut-off standards</i>			
Lighting Class 1	1,050	450	None Permitted	None Permitted
Lighting Class 2	2,250	825	None Permitted	Low Voltage Landscape Lighting Permitted

¹² Table 1.5-C complements the site lighting budget approach by not allowing any individual luminaire to be overly bright (for example, parking lot luminaires). Luminaire brightness is allowed to increase with degree of shielding as shown in the illustrations following the table.

TABLE 1.5-C: MAXIMUM ALLOWABLE LIGHTING INTENSITY (In Lumens)[1]				
Lighting Classification (described at the bottom of this table)	Full Shielding Required (IESNA Full Cut-Off)	Must Be Shielded (IESNA Cut-Off)	Must Be Partially Shielded (IESNA Semi Cut-Off)	Can Be Unshielded (IESNA Non Cut-Off)
	See Figure 1.5-2, below, for illustrations of IESNA cut-off standards			
Lighting Class 3	6,750	1,500	825	Landscape and Façade Lighting— 1,500 or less; Ornamental lights— 825 or less
Notes:	<p>[1] 1 watt = 15 lumens (e.g., 100 watt bulb = 1,500 lumens)</p> <p>Lighting Classifications:</p> <p>Class 1: Intended for low-density single, and two-family, and multifamily residential areas, open space, and parks.</p> <p>Class 2: Intended for high density residential, mixed-use developments, low and moderate intensity commercial areas, and light industrial areas.</p> <p>Class 3: Intended for major business districts and manufacturing and heavy industrial areas</p>			

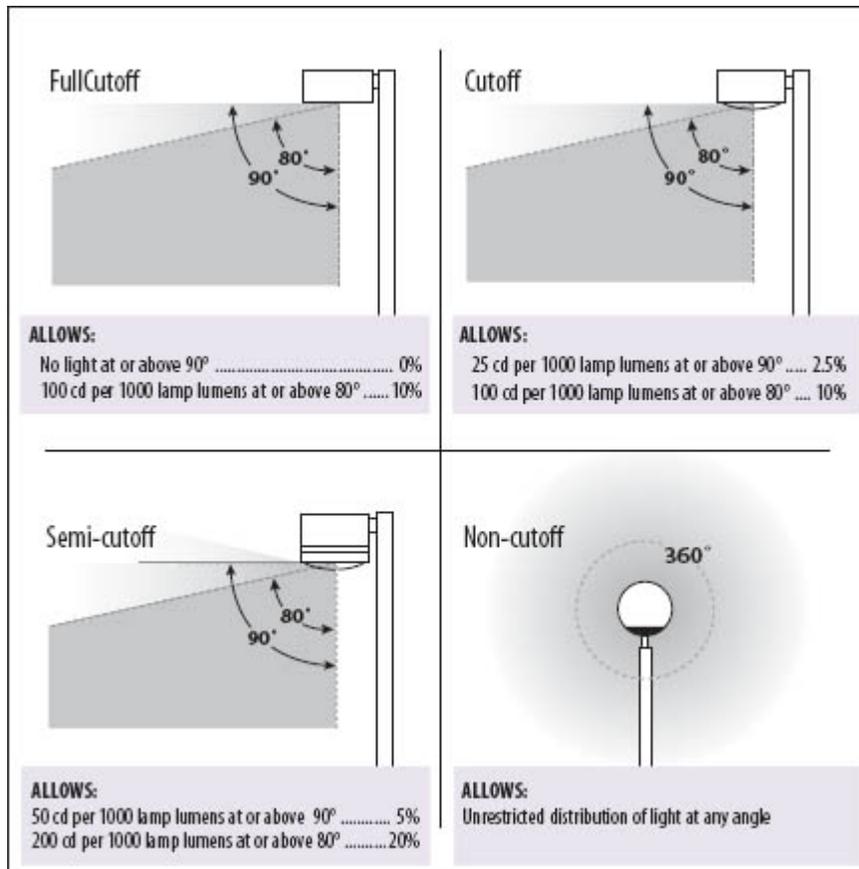


Figure 1.5-2: IESNA lighting cutoff shielding standards

F. Use Regulations

The following regulations shall be applied to specific uses as follows:

1. Lighting on automobile service station, convenience store, and other outdoor canopies shall be fully recessed into the canopy and shall not protrude downward beyond the ceiling of the canopy or shall be fully shielded.
2. Other¹³

1.5.4. USES WITH HIGH-INTENSITY OR SPECIAL-PURPOSE LIGHTING SUBJECT TO SPECIAL EXCEPTION REVIEW

The following uses with high-intensity or special-purpose lighting shall be subject to review and approval by the (insert name of appropriate decision-making body) pursuant to the procedures set forth in (Insert cross reference to conditional use or special permit provisions of local zoning regulations.) The (insert name of appropriate decision-making body for condition use or special permits.) shall impose appropriate conditions on the proposed use to mitigate any potential adverse impacts of outdoor lighting associated with the use.

A. Major Outdoor Recreation Facility

Any outdoor recreation facility that exceeds the exemption limits set forth in Section 1.2.3.J shall be subject to (insert conditional use or special permit) review. The applicant shall demonstrate that the proposed lighting installation employs lighting controls to reduce lighting at project specific curfew times as set forth in the (insert name of appropriate permit) and complies with the alternative site lighting budget calculation set forth in Section 1.5.3.C.

B. Very Intense Lighting

Any use that proposes light that exceeds:

1. 200,000 lumens or an intensity in any direction of more than two million candelas, such as aerial lasers, searchlights, or other directional luminaire.
2. Temporary lighting in which any single luminaire exceeds 20,000 lumens or the total lighting load exceeds 160,000 lumens.

C. Complex, Special Purpose Lighting

Any lighting not complying with the technical requirements of this ordinance that is used for special purposes such as construction site lighting, lighting for industrial sites with special requirements such as petrochemical manufacturing or storage, theme and amusement parks, decorative and architectural lighting of bridges and overpasses, and similar uses as determined by the Director. The applicant shall demonstrate that the proposed lighting installation employs lighting controls to reduce lighting at project specific curfew times as set forth in the conditional use permit and complies with the alternative site lighting budget calculation set forth in Section 1.5.3.C.

¹³ Local government staff would add any other specific types of lighting that might be an issue in the community.

1.6. LIGHTING CONTROL AND CURFEW REQUIREMENTS¹⁴

1.6.1. LIGHTING CONTROLS—AUTOMATIC SWITCHING

Controls shall be provided on all nonresidential lighting that automatically extinguish all outdoor lighting when sufficient daylight is available. Control devices or systems may be photoelectric switches, astronomic switches or equivalent functions from a programmable lighting controller, building automation system, lighting energy management system, or an equivalent system approved by the Director. Automatic controls shall not be required for tunnels, parking garages, garage entrances, and similar conditions.

1.6.2. AUTOMATIC LIGHTING REDUCTIONS

All nonresidential uses shall extinguish all outdoor lighting or reduce it by a minimum of 50 percent in terms of lumens two hours after the close of business or activity on the site. Lighting reductions are not required for any of the following:

- A. When there is only one conforming luminaire on the property;
- B. Building code required lighting for steps, stairways, walkways, trails, and building entrances;
- C. Motion-activated lighting;
- D. Security lighting permitted by this ordinance;
- E. Lighting governed by a conditional use or other (insert name of local government) approval in which times of operation are specifically identified;
- F. Uses that operate on a twenty-four hour basis; or
- G. Uses that the Director determines must retain lighting levels for purposes of safety and other public welfare considerations.

DEFINITIONS

These are definitions related to these outdoor lighting standards, which should be located with the ordinance's other definitions.

Absolute photometry

Photometric measurements (usually of a solid state luminaire) that directly measure the output of the luminaire.

Astronomic time switch

An automatic lighting control device that switches outdoor lighting relative to time of solar day with time of year correction.

Decorative lighting

Lighting used primarily to enhance or illuminate the appearance of a structure and not for safety or convenience purposes.

¹⁴ Automatic lighting controls and lighting curfews can significantly reduce energy use.

Curfew

A time defined by the (insert name of local government) when outdoor lighting must be reduced or extinguished.

Fully shielded luminaire

A luminaire with 100 percent opaque top and sides capable of emitting light only below the horizontal plane.

Footcandle

A non-International System unit of illuminance or light intensity, defined as the amount of illumination the inside surface of a one-foot radius sphere would be receiving if there were a uniform point source of one candela in the exact center of the sphere. A footcandle is equal to one lumen per square foot.

Glare

Light entering the eye directly from luminaires or indirectly from reflective surfaces that causes visual discomfort or reduced visibility.

Hardscape

Permanent improvements to a site, including parking lots, drives, entrances, curbs, ramps, stairs, steps, medians, walkways, and non-vegetated landscaping that is ten feet or less in width. Hardscape shall not include buildings or structures or their footprints for purposes of this definition.

IDA

International Dark-Sky Association

IESNA

Illuminating Engineering Society of North America

Initial lamp lumens

Calculated as the sum of the initial lamp lumens for all luminaires tested with relative photometry and 140 percent of initial lamp lumens for all luminaires tested with absolute photometry.

Lamp

A generic term for a source of light, often called a “bulb” or “tube.”

Landmark Site

A building or site of historic importance designated by the (insert appropriate agency, commission, or local government).

Landscape lighting

Lighting designed specifically for illuminating exterior architectural and natural features and vegetation.

LED

Light-emitting diode

Lighting

Artificial, electric, or man-made lighting.

Lumen

The unit of luminous flux. A measure of the power of light perceived by the human eye.

Luminaire

The complete lighting fixture, including a lamp, ballasts, and other parts such as reflectors, lenses, and diffusers to position, protect, and connect the lamps to a power supply.

Luminaire lumens

The cumulative total of lumens emitted by all lamps contained with a single luminaire.

Lux

The International System (SI) unit of illumination, equal to one lumen per square meter.

Mounting height

The height of the photometric center of a luminaire above grade level.

Non-shielded luminaire

A luminaire capable of emitting light in any direction including downwards.

Outdoor lighting

Lighting equipment installed outdoors.

Photoelectric switch

A control device employing a photocell or photodiode to detect daylight and automatically switch lights off when sufficient daylight is available.

Property line

The legally defined boundary of public or private property or rights-of-way.

Relative photometry

Photometric measurement made of the lamp plus luminaire and adjusted to allow for light loss due to reflection or absorption within the luminaire

Seasonal lighting

Temporary lighting installed and operated in connection with holidays or traditions.

TV illuminance

Line-of-sight illuminance measured at the eye in a plane perpendicular to the line of sight when looking at the brightest source of the field of view.

Temporary lighting

Lighting installed and operated for periods not to exceed 60 days, completely removed and not operated again for 30 days.

Time switch

An automatic lighting control device that switches lights according to time of day.

Uplight

For an outdoor luminaire, light radiated at or above the horizontal plane.

Watt

The International System unit of power, equivalent to one joule per second and equal to the power in a circuit in which a current of one ampere flows across a potential difference of one volt. Until being replaced by lumens, was a common unit of measurement for the power of lighting.