

Chapter 11. LIGHTING

11.1 Purpose and Intent

The purpose of this Chapter is to define practical and effective measures by which the obtrusive aspects of outdoor light usage may be reduced; while preserving safety, security, and the nighttime use and enjoyment of property. Poorly designed lighting contributes to excessive light trespass, strong glare and poor color rendering that can adversely impact adjacent properties, neighboring areas and motorists. These measures are intended to:

- curtail the degradation of the nighttime visual environment;
- reduce light trespass and glare by encouraging lighting practices that direct appropriate amounts of light where and when it is needed and prohibiting the use of poorly shielded or inappropriately directed lighting fixtures; and
- reduce energy waste by increasing the use of energy-efficient sources.

11.2 Applicability

A. The standards of this Chapter are applicable for new development across all zoning districts, except as described in subsection 'B' below. Changes to existing non-conforming lighting are subject to the provisions of Section 13.9.

B. Exemptions

1. **Outdoor Recreational Lighting:** Because of their unique requirements for nighttime visibility and limited hours of operation, the lighting of active recreation areas, such as ball fields and tennis courts, are not considered in this Chapter. However, lighting fixtures for such uses shall be mounted and aimed so that the illumination falls within the primary playing area and immediate surroundings and so that no direct light illumination is directed off site. Under all circumstances, lighting used for active recreational purposes shall be extinguished no later than 11:00 p.m.
2. **Flags:** Lighting of the United States of America or State of North Carolina flags and other non-commercial flags expressing constitutionally protected speech.
3. **Temporary Needs:** Circus, fair, carnival or other similar civic/community event lighting; and construction and emergency lighting; provided said lighting is temporary and is discontinued immediately upon the end of the event, completion of construction work or abatement of the emergency necessitating said lighting.
4. **Underwater:** Underwater lighting used for illumination of swimming pools and fountains.
5. **Gas Lighting:** Ornamental gas lights and lanterns.
6. **Holiday Displays:** Holiday lighting displays so long as said lighting does not produce light trespass.
7. **Low-Voltage Landscape Lighting:** Low-voltage lighting systems so long as said lighting is shielded to not produce glare or light trespass.

11.3 Prohibited Lighting

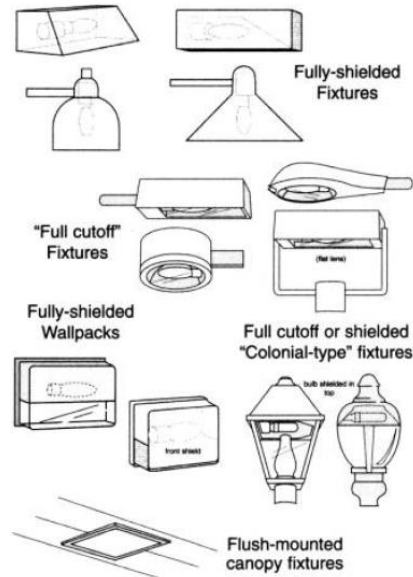
The following lighting is prohibited unless otherwise expressly permitted by this ordinance:

- A. Flickering, rotating, blinking, flashing lights or lights that change in intensity or color.
- B. Search lights, laser lights or any similar high-intensity lights.
- C. Unshielded accent, building-mounted luminous tubes. Shielded neon, argon, LED, fluorescent or similar luminous tubes shall not be used as a source of lighting except as provided for signs in Chapter 12.
- D. Light strings utilizing lamps greater than 15 lumens.
- E. Lighting that could be confused for a traffic control device, or any other fixture or device operated in such a manner as to constitute a hazard or danger to persons or safe vehicular operation.
- F. Wall-mounted fixtures (*e.g. wall packs*) are generally prohibited as they are not intended to provide general building, parking area or site lighting; but they may be permissible as accent lighting (*Section 11.5C*) or security lighting (*Section 11.5E2*).

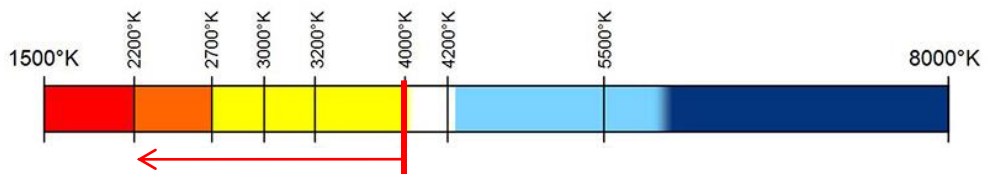
11.4 General Outdoor Lighting Standards

Outdoor lighting shall meet the following general standards as well as any additional standards in Section 11.5 as may apply.

- A. **Plan Required:** Any person submitting a site plan or applying for a building, electrical, or sign permit to install outdoor lighting fixtures shall submit a lighting plan (*Section 16.8B*) providing evidence that the proposed lighting work will comply with the standards of this Chapter.
- B. **Fixture Classification:** Unless otherwise expressly permitted, all exterior lighting fixtures shall either have a fixture cutoff classification of “Full Cutoff” or be fully shielded (*no light at or above horizontal*) as depicted in the sample graphics to the right.
- C. **LED Fixtures:** All street and site lighting utilizing an LED fixture shall:
 - 1. **Color Rendering:** Be rated a minimum Color Rendering Index (CRI) value of 70 or better.
 - 2. **Color Temperature:** Have a ‘white light’ correlated color temperature not exceeding 4,000 K (*degrees Kelvin*).



Kelvin Temperature Chart



- D. Pole Placement:** All pole-mounted outdoor lighting shall be located outside of utility easements, designed in coordination with the landscaping plan (*Section 16.8A*), located outside of landscaping islands and located as far from large shade trees as the landscaping plan will allow.
- E. Maximum Pole Height:** Unless otherwise restricted, all pole-mounted fixtures shall be mounted at heights no greater than 37 feet above grade.
- F. Maximum Light Level at Property Line:** All outdoor lighting fixtures shall be designed and located such that the maximum light level shall be 0.5 maintained FC at any property line unless otherwise permitted by this Chapter or where the required by the NC Building Code as a component of the minimum requirements for a means of egress system.
- G. Severe Changes in Elevation:** In cases of elevated and non-elevated commercial sites that adjoin residential property where lighting installation causes offensive light trespass or glare, the Administrator may require the shielding of fixtures at the time of installation or at any point thereafter. If the installation of shields does not alleviate the offense, the Administrator may require additional mitigation measures including, but not limited to:
- Changing the aim;
 - Re-locating perimeter light fixture(s) to the interior of the site;
 - Changing the mounting height;
 - Changing the light distribution pattern; or
 - Removing the pole and fixture from the site.

11.5 Additional Outdoor Lighting Standards for Specific Lighting Types

In addition to meeting the general lighting standards in Section 11.4, the following types of lighting shall also meet the additional specific standards listed below.

A. Street Lighting

Street lighting shall be placed on all streets by the developer to allow for the safe use of streets by cars, cyclists and pedestrians. Developer placed lighting shall also include all improved frontages on local and NCDOT streets. Developers requesting upgrades from the Town's minimum street light specification of a fiberglass pole with a fully-shielded, arm-mounted LED fixture shall pay the Town up front the difference in the costs of maintenance for the desired LED fixture and pole covering a period of 10 years. Developers interested in pursuing this option should consult with the Administrator concerning the Town's "Premium Lighting Policy". All street lighting shall conform to the specific standards for LED lighting in subsection 'B' as well as the following design standards:

1. **Average Spacing Maximums:** The following maximum average spacing requirements between street lights shall apply to all local, collector and arterial street classifications according to the use context of the adjacent land as listed below, except alleys (*Section 17.3A1*) which are exempt from said requirements.
 - a. **Local & Collector Streets:**
 - i. Residential at less than three (<3) unit per acre - 500 feet
 - ii. Residential from three (3.0) to eight (8.0) units per acre - 250 feet

- iii. Residential over eight (>8.0) units per acre - 150 feet
 - iv. All other uses - 300 feet
 - b. **Arterial Streets:** All uses - 150 feet
- 2. **Minimum Initial Delivered Lumen Levels:**
 - a. Local Streets - 4,800 lumens
 - b. Collector Streets in Residential Areas - 12,500 lumens
 - c. Collector Streets in Other Areas - 12,500 lumens
 - d. Arterial Streets - 18,500 lumens
- 3. **BUG Rating:** All street lights shall be fully-shielded (*no light at or above horizontal*) and shall not exceed the following BUG ratings established for each type of street:
 - a. Local Streets - B1, U1, G1
 - b. Collector Streets in Residential Areas - B2, U2, G2
 - c. Collector Streets in Other Areas - B3, U3, G3
 - d. Arterial Streets - B3, U3, G3
- 4. **Placement:**
 - a. Although the primary purpose of street lighting is to provide adequate lighting for the roadway, street lighting should also promote pedestrian safety. Therefore, lighting should be placed in a manner to minimize the casting of shadows on sidewalks.
 - b. Lighting shall be placed as far from street trees as the landscaping plan will allow.
 - c. Lights on newly constructed streets shall be alternately staggered on each side of the street wherever possible.
 - d. Lighting shall be placed at all street intersections, in street curves and at the end of any street or cul-de-sac.

(Note: For additional information on the connectivity and circulation of streets, please refer to Chp. 9)

- B. Post-Top Pedestrian Lighting:** Unless otherwise expressly permitted, decorative post-top fixtures may only be used for the lighting of pedestrian walkways and plazas and shall also meet the following standards:
1. **Mounting Height:** Shall not be mounted at a height greater than 18 feet;
 2. **BUG Rating:** LED or other BUG-rated fixtures shall not exceed a rating of B3, U1, G1;
 3. **Lumens:** Shall not exceed 7,250 initial delivered lumens (*LED*) or 9,000 source lumens as may apply; and
 4. **Permitted Locations:** Shall only be utilized in the following locations:
 - In commercial and mixed-use area street rights-of-way where sidewalk, utility and planting strips have been combined (*see Sections 17.3A3, 4, 5 & 7*), or
 - Along pedestrian facilities located outside the street right-of-way, or
 - Along pedestrian facilities located more than 20 feet from any vehicular accommodation area.
- C. Accent Lighting - Building, Landscaping and Signs:** All accent lighting, except for low-voltage lighting systems (*Section 11.2B7*) shall meet the following additional standards:
1. **Lamp Output:** Accent lighting should be integrated with the architectural character of the building, and shall use low-luminosity lamps (*2,000 source lumens or less*) unless otherwise justified
 2. **Maximum Vertical Illuminance:** The illumination on any vertical surface shall not exceed 0.5 FC maintained, and shall not spill over roof lines or building edges.
 3. **Signs:** Light fixtures used to illuminate signs shall be mounted on the top of the sign structure whenever possible.
 4. **Residential Post Lights:** All residential post top lights shall:
 - a. Not exceed eight (8) feet in height; and
 - b. Have a translucent lens covering the light source.
- D. Vehicular Accommodation Area and General Site Lighting:** General site lighting and lighting for vehicular accommodation areas shall have an average horizontal illumination as specified in the tables in Section 11.6 “Lighting Levels”, and shall meet the following additional standards:
1. **BUG Rating:** LED or other BUG-rated fixtures exceeding 7,250 initial delivered lumens or 9,000 source lumens as may apply, shall not exceed a rating of B3, U0, G2
 2. **Circumstances Requiring Forward Throw:** Parking area lighting fixtures within 25 feet of any public street right-of-way or a commercial to residential/group care facility property line must be a forward throw fixture (*type IV light distribution as defined by IESNA*).

E. Security Lighting

1. **Flood/Spot Lights:** Spot lights shall not be used as general site lighting, but may be permissible for added security provided the following standards are met.
 - a. Spot lights shall be aimed so that the main beam from the light source is not visible from a neighboring property.
 - b. Spot lights shall be installed such that the fixture shall be aimed down at least 45 degrees from horizontal.
 - c. Fixtures shall use low luminosity lamps (*2,000 source lumens or lower*).
 - d. Shields shall be added as needed for conformity to this Section.

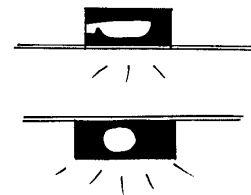
2. **Wall-Mounted Lights:** Wall-mounted fixtures are not intended to provide general building or site lighting, but may be used at building entrances for added security. Wall-mounted fixtures shall:
 - Use low luminosity lamps (*2,000 source lumens or lower*) unless justified otherwise through the planning approval process.

3. **Dawn to Dusk Security Lights:**
 - a. Each lamp shall not exceed 7,250 initial delivered lumens (*LED*) or 9,000 source lumens as may apply.
 - b. Each lamp shall be mounted at heights no greater than 27 feet above grade.

F. Vehicular Canopies and Gas Station/Convenience Store Aprons: Areas under a vehicular canopy and the approach to the canopy shall have an average horizontal illumination as specified in the table in Section 11.6B “Other Outdoor Areas”, and shall meet the following additional standards:

1. Lighting under vehicular canopies shall be designed so as not to create glare off site. Acceptable methods include one or more of the following:
 - a. Recessed fixture incorporating a lens cover that is either recessed or flush with the bottom surface of the vehicular canopy; or
 - b. Surface mounted fixture incorporating a flat lens that provides a fully shielded light distribution.

2. Lights shall not be mounted on the top or sides (fascia) of the canopy, and the sides of the canopy shall not be externally illuminated.



11.6 Lighting Levels

The following standards shall be required of all exterior lighting with the exception of public street lighting which is exempt.

The quantity of fixtures to be provided shall be based upon the desired level of uniform illumination as established by the following table and current standards of the IESNA. Fixture locations should be chosen to minimize glare, trespass and conflicts with the landscaping plan as stated in Section 11.2(B). If a lighting installation causes offensive light trespass or glare, the Administrator may require the shielding of fixtures at the time of installation or at any point thereafter.

The level of illumination shall be based upon the primary activity in each area to be lighted as outlined below.

A. Open Parking Facilities

For lighted parking lots, the minimum light level shall be no less than 0.2 FC. All light levels are measured at ground level. The light level requirements for individual parking lots vary depending on the activity classification.

The specified minimum FC value above 0.2 FC as outlined in the following table means that the lowest light level point or location in the parking lot must not exceed the minimum stated FC value in the table (*i.e. 0.9 FC for large shopping centers*). An average to minimum uniformity ratio of 4:1 means that the average FC to minimum FC ratio cannot be worse (*higher*) than 4:1. See the following table:

Light Levels for Open Outdoor Parking Facilities*		
Activity	Maintained Footcandles	Uniformity Avg/Min
1. Parking, residential, multi-family <ul style="list-style-type: none"> ▪ Low to medium activity 	0.6 FC Min	4:1
2. Parking, industrial/commercial/institutional/municipal <ul style="list-style-type: none"> ▪ High activity, i.e. large shopping centers/ fast food facilities, major athletic/civic cultural events 	0.9 FC Min	4:1
<ul style="list-style-type: none"> ▪ Medium/low activity, i.e. community shopping, office parks, hospitals, commuter lots, cultural/civic/recreational events, residential neighborhood shopping, industrial employee parking, schools, churches 	0.6 FC Min	4:1

* Source: IESNA 8th Edition Lighting Handbook with modifications

Notes: 1. Illumination levels are horizontal on the task, e.g. at grade or area surface.

2. Uniformity ratios dictate that average illuminance values shall not exceed minimum values by more than the product of the minimum value and the specified ratio. For example, for commercial parking medium/low activity, the average footcandles shall not be in excess of 2.8 (0.7 x 4).

3. The Administrator shall be responsible for determining the activity level of a development. Applicants may appeal this decision to the Land Use Review Board.

B. Other Outdoor Areas

Use	Maximum Illumination Allowed (Avg. Footcandles Maintained) *
Service Stations: Approaches/Pump Islands	7/30
Outdoor Display Areas (i.e. Car Lots)	30
Tractor Trailer and Other Outdoor Storage Areas	20
Building Exteriors	3
Public Entrances	5
Employee or Other Entrances	3
Building Surroundings	2
Vital Locations or Structures	5

** Footcandles are for a "typical application" per IESNA 9th Edition Handbook. Adjustments may be required depending on specific circumstances and would require approval from the Administrator.*

11.7 Measurement

- A. Location:** Light level measurements shall be made at the property line of the property upon which the light to be measured is being generated. If measurement on private property is not possible or practical, light level measurements may be made at the boundary of the public street right-of-way that adjoins the property of the complainant or at any other location on the property of the complainant. Measurements shall be made at finished grade (*ground level*), with the sensor in the horizontal position and not mounted more than six (6) inches above ground level, and with the light-registering portion of the meter held parallel to the ground and pointing upward.
- B. Light Meter Specifications:** Lighting levels are to be measured in FCs with a direct-reading portable light meter. The meter shall:
1. have cosine and color correction;
 2. have an accuracy tolerance of no greater than plus or minus five percent (5%); and
 3. have been calibrated within the last two (2) years.