

## Technical Bulletin 95-001

# Development of Regional Impact Guidance for **EXTERIOR LIGHTING DESIGN**

## ■ INTRODUCTION

The intent of this Technical Bulletin is to provide additional guidance concerning an exterior lighting design which will meet the Regional Policy Plan's Minimum Performance Standard (MPS) HPCC2.11.

Uncoordinated and excessive exterior lighting can disrupt night-time aesthetics, and may compromise safety and utility, and wastes energy and money. MPS HPCC2.11 is intended to maintain a harmonious community character by requiring Developments of Regional Impact to create a coordinated exterior lighting design, and prevent general light pollution. It is also designed to improve night-time aesthetics, visibility and the safety of pedestrians and motorists by limiting glare and off-site light trespass to adjacent properties and roads.

To provide a comparison between different land uses and the recommended foot-candle levels described below, the following levels are listed in the IES Lighting Handbook, Reference Volume and Application Volume, Illuminating Engineering Society of North America, John E. Kaufman (ed.), New York, 1981 (shown in chart on the following page).

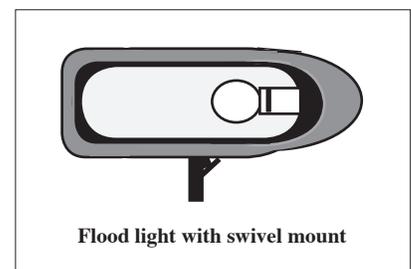
## 1. Definitions

- **Area Lighting** - See definition for "Flood Lights or Lighting."
- **Equipment Factor** - A factor used in the illuminance or luminance calculations that compensates for light losses due to normal production tolerances of commercially available luminaires when compared with laboratory photometric test models. It is common practice to approximate these losses using a 5% to 10% loss factor (EF=0.95- 0.90).
- **Fixture** - An electrical device that is secured to a wall, ceiling, pole, or post and is used to hold one or more lamps.

Use	Level (in foot-candles)
Professional Baseball (infield)	50.0
Recreational Softball (infield)	10.0
Playgrounds	5.0
Roads	
Expressways	0.6
Dense commercial with pedestrians	2.0
Residential (Local)	0.4
Building Exteriors	
Entry (Active)	5.0
General grounds	1.0
Bikeways (along roads)	
Dense commercial	0.9
Residential	0.2
Parking Areas	1.0

- **Flush-mounted or Recessed Luminaires** - A luminaire that is mounted above a ceiling, wall or other surface, with the opening of the luminaire level with that surface.

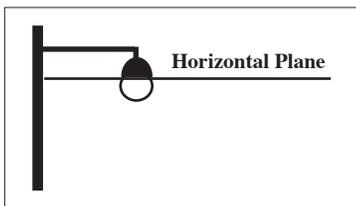
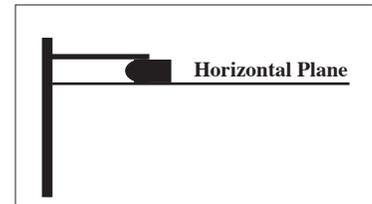
- **Flood Lights or Lighting** - A form of luminaire that is designed to direct the output of a lamp in a specific single direction utilizing reflective elements which are external to the lamp. Such luminaires may be designed to be mounted on a building, pole, or on the ground, may be manufactured with or without mounting hardware that can be swiveled, and are not equipped with optics designed to be aimed straight down.



- **Foot-candles (Fc)** - A unit of measure of the amount of light falling on a surface. The illumination level is equal to the amount of light generated by one candle shining on one square foot of surface, one foot away. Also equal to one lumen per square foot on a surface.
- **Horizontal Foot-candles** - The amount of illumination equal to one lumen per square foot on a horizontal surface.
- **IES** - Illuminating Engineering Society of North America (IES). An association of professionals in the field of lighting and related professions.

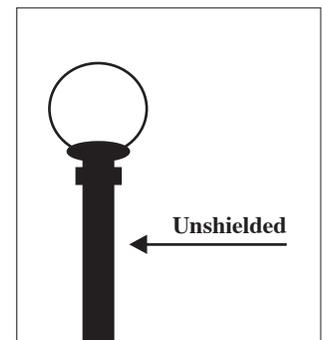
- **Initial Foot-candle** - The amount of illumination (measured by foot-candles) given off by a luminaire at the point of installation.
- **Lamp** - A bulb which is a component of a luminaire. It consists of an outer glass envelope and a metal base enclosing a filament or arc tube and electrodes. See also "Fixture" and "Luminaire."
- **Landscape Accent Luminaires** - Luminaires that are less than 42 inches in total height, and that are "accent lighting" in addition to pole-mount, wall-pack, or safety accent luminaires, and that are used to illuminate landscaped areas, walkways, edges of curbs or in similar situations.

- **Lighting Fixtures (Fully Shielded)** - A fixture with shielding so that light rays emitted by the fixture project only below the horizontal plane (less than ninety (90) degrees) passing through the lowest point on the fixture from which light is emitted.



- **Lighting Fixtures (Partially Shielded)** - A fixture with shielding so that the lower edge of the shield is at or below the centerline of the light source or lamp so as to minimize the light rays emitted above the horizontal plane.

• **Lighting Fixtures (Unshielded)** - A fixture that does not meet the definition of fully shielded or partially shielded fixtures.

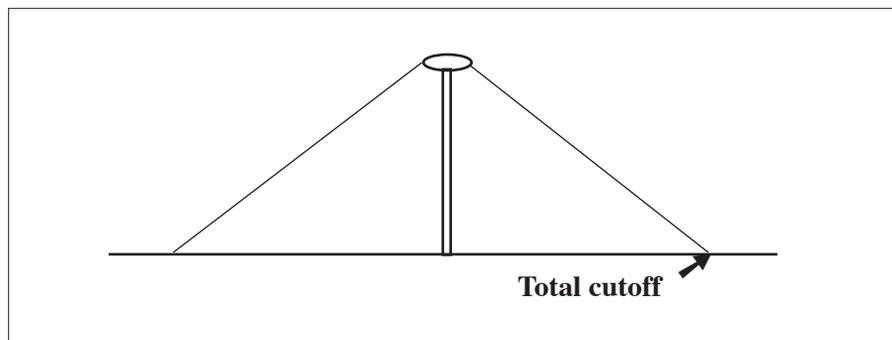


- **Light Loss Factors** - The depreciation factors that are applied to the calculated initial foot-candles to determine the maintained foot-candles at a predetermined time in the operating cycle, usually just prior to relamping, and which reflect the decrease in effective light output of a lamp and luminaire during its life. The variables that should be considered when determining the light loss factors are:

1. Decrease of lamp lumen output with burning hours Lamp Lumen Depreciation (LLD);
2. Frequency and effectiveness of luminaire cleaning Luminaire Dirt Depreciation (LDD);
3. Schedule of lamp replacement;
4. Operation of light sources at other than current voltage;
5. Equipment factors (EF).

- **Lumen** - The amount of light energy generated by a light source. Lights are typically rated for their efficiency in lumens per watt, where watts are a measure of the amount of electricity a fixture uses.

- **Luminaire** - A complete lighting unit consisting of one or more lamps, together with the components that are designed to distribute the light, to position and protect the lamps, and to connect the lamps to the electrical power supply; also called the light fixture.
- **Maintained Foot-candles** - The amount of illumination (measured by foot-candles) given off by a luminaire after being adjusted for light loss factors.
- **Outdoor Lighting Fixtures** - Outdoor artificial illuminating devices, installed or portable, used for flood lighting, general illumination, or advertisement of commercial or industrial developments.
- **Reflector** - A method (in combination with the refractors) of controlling the distribution of light on the surface.
- **Refractor** - The lower portion of the luminaire, used in combination with the reflector, to control the distribution of light on the surface. The refractor is generally a molded glass element that provides prismatic control of light.
- **Safety Accent Lighting** - Any luminaire that is mounted not more than 36 inches from the surface to be illuminated, and that is “accent lighting” in addition to pole-mount, wall-pack, and/or landscape accent luminaires, and that is used to illuminate handrails, steps, edges of curbs or walls or in similar situations.
- **Total Cutoff** - The point at which all light rays are completely shielded.

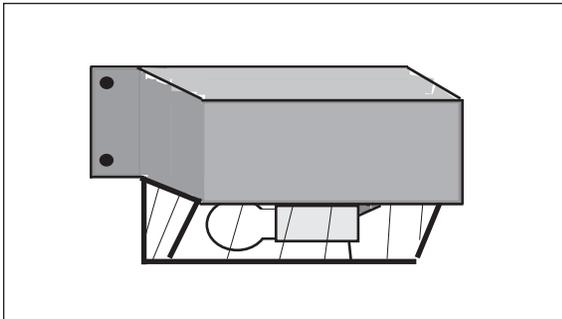


- **Up-lighting** - Any luminaire that is aimed or capable of being aimed above the horizontal plane.
- **Vertical Foot-candles** - The amount of illumination equal to one lumen per square foot on a vertical surface.

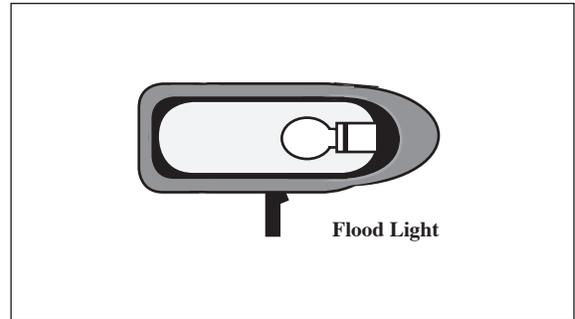
## 2. General Exterior Lighting Design Guidance

2.1 The light source should be either high pressure sodium or metal halide. Other sources, including but not limited to incandescent, tungsten hallogen, and compact fluorescent may be considered by the Commission, particularly for flush mounted or recessed luminaires, landscape accent luminaires or safety accent luminaires. In all cases, however, all proposed luminaires should comply with Technical Bulletin Guidance 2.2 to 2.6 unless specifically stated otherwise.

2.2 Pole-mount or wall-pack luminaires should be “shoe-box” type or decorative in nature (with interior directional shields), consistent with the architectural theme of the development. Flood, Area and Up-lighting is unacceptable. Where wall-pack luminaires are utilized for exterior illumination, the fixture should be equipped with a prismatic lens to reduce glare. Wall pack luminaires with visible lamping to normal viewing angles are not recommended.



Wall pack: visible lamp not recommended. (See 2.2 and 2.3)

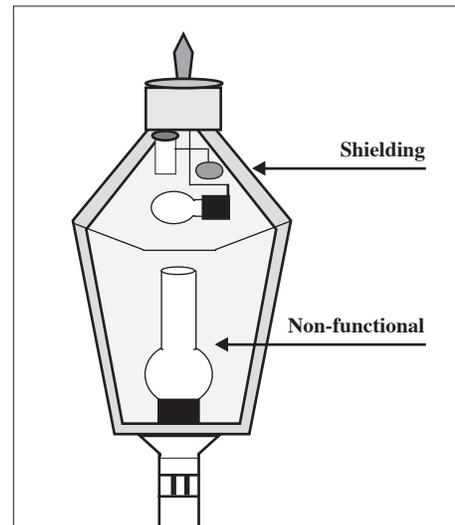


Flood light: unshielded with swivel mount: unacceptable. (See 2.3)

2.3 All luminaires, regardless of their intended use or mounting configuration should have a total cutoff of all light at less than ninety (90) degrees from vertical (fully shielded lighting fixtures) and the lighting fixture should only be visible from below. The Commission may make a limited exception to this requirement for pole or wall-mounted fixtures that use only incandescent or compact fluorescent bulbs similar to what would be used in a residential setting.

2.4 Reflectors of proper (IES) distribution should be selected for maximum efficiency. Reflectors and shielding should provide total cutoff of all light at the property lines of the parcel to be developed.

2.5 Developments that abut residential areas and/or regional vistas or are visible from public roadways should not utilize light poles exceeding 20'-0" in height (base + pole + head). Developments that do not abut residential areas and/or regional vistas should not utilize light poles exceeding 25'-0" in height (base + pole + head). Light poles utilized for walkway lighting should



Recommended. (See 2.3)

not exceed 12'-0" in height (base + pole + head). The location of wall-pack luminaires should not exceed 20'-0" in height. Landscape Accent Luminaires should not be more than 42 inches in total height. Safety Accent Luminaires should be mounted not more than 36 inches from the surface to be illuminated.

2.6 All exterior lights, with the exception of Landscape and Safety Accent Luminaires, should have a maximum initial horizontal foot-candle level of 8.0 foot-candles, as measured directly below the luminaire(s) at grade.

### 3.0 Technical Submittals

The following information should be submitted to the Commission as part of a Development of Regional Impact application:

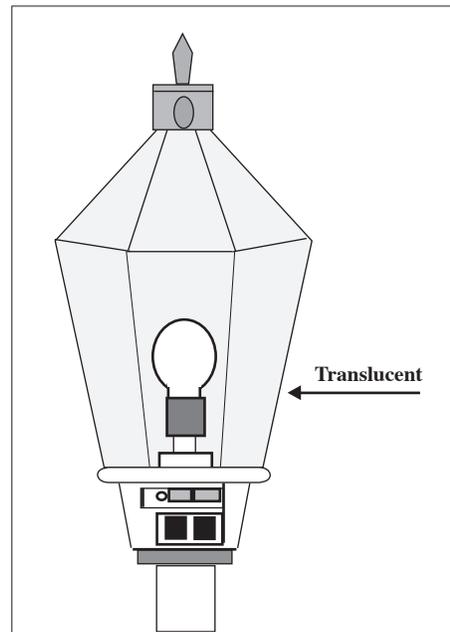
3.1 A site lighting design drawing or drawings, stamped and signed with the seal of a Massachusetts Registered Professional Electric Engineer. All electrical design drawings should include the following information:

3.1.1 Electrical site plan indicating the location of each and every exterior luminaire to be installed. The fixtures should be labeled as to the type of luminaires specified. Where pole-mounted fixtures are to be used, a diagram should be included of such proposed lights, including walkway lights, that shows height of the base, pole and fixture head. Where wall-mounted luminaires are specified, the mounting heights of fixtures should be indicated on the plan.

3.1.2 A lighting fixture schedule that designates the type of luminaires specified including the following information:

- a) The number and type of lamps to be used in each luminaire;
- b) A description of the luminaire and light pole if applicable;
- c) The manufacturer's name and catalog numbers of the specified equipment; and
- d) Other pertinent data that may be helpful for proper evaluation.

3.2 Manufacturers specification sheets should be provided for all proposed luminaires and poles to be used (where poles are used). Manufacturers' specification sheets should indicate the shape and dimensions of the luminaires and poles. ISO foot-candle diagrams should also be included. Manufacturers' specification sheets should clearly indicate which options and accessories are to be provided. The luminaire beam cutoff data should be stated.



Not recommended. (See 2.3)

3.3 Manufacturers' computer-generated point-to-point printouts should be submitted indicating the horizontal initial and maintained foot-candle levels at grade, within the property to be developed and twenty-five (25) feet beyond the property lines. Computer-generated printouts shall indicate the locations and type of luminaires analyzed. Maintained foot-candle levels should be calculated, using IES recommended procedures. Light loss factors used to calculate maintained foot-candle levels should be indicated on the computer-generated printouts. Pertinent data, such as building outline, building entrances and exits, loading areas, landscaping, walkways, roadways, bikeways, parking areas, curbs and property lines should also be shown.