



**Illuminating**  
ENGINEERING SOCIETY



**JOINT IDA-IES**

**MODEL  
LIGHTING  
ORDINANCE  
(MLO)**

**with USERS GUIDE**

**Second Public Review**

**June 23 to August 23, 2010**

## The User Notes

The User Notes are intended to clarify the sections of the MLO for the various audiences who will use it: lighting designers, city officials, engineers, citizen groups, and others. Every effort has been made to keep the language technically accurate and clear, but since different disciplines may use the same term in different ways, or have different interpretations, some guidance may be helpful. While these Notes can not be a full tutorial on modern lighting design, it is hoped that the Notes will help facilitate the dialogue necessary to adopt the MLO.

## Background

The problems of light pollution first became an issue in the 1970s when astronomers identified the degradation of the night sky due to the increase in lighting associated with development and growth. As more impacts to the environment by lighting have been identified, an international “dark sky” movement is advocating for the precautionary approach to outdoor lighting design.

Many communities have passed anti-light-pollution laws and ordinances. However, there is little or no agreement among these laws, and they vary considerably in language, technical quality, and stringency. This is confusing for designers, engineers, and code officials. The lack of a common basis prevents the development of standards, educational programs, and other means of achieving the goal of effective lighting control.

This MLO will allow communities to drastically reduce light pollution and glare and lower excessive light levels. The recommended practices of the IES can be met using readily available, reasonably priced lighting equipment. However, many conventional lighting practices will no longer be permitted, or will require special permits.

This Model Lighting Ordinance (MLO) is the result of extensive efforts by the International Dark Sky Association (IDA) and the Illuminating

Engineering Society of North America (IES). Among its features is the use of lighting zones (LZ0-4) which allow each governing body to vary the stringency of lighting restrictions according to the sensitivity of the area as well as accommodating community intent. In this way, communities can fine-tune the impact of the MLO without having to customize the MLO. The MLO also incorporates the Backlight-Uplight-Glare (BUG) rating system for luminaires, which provides more effective control of unwanted light.

## Second Public Review

# Joint IDA-IESNA Model Outdoor Lighting Ordinance (MLO)

IDA & IES Board of Directors Version  
June 3, 2010

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**General Notes in Adopting this Model Ordinance**

Adoption of this ordinance should follow the established development, review, and approval processes of the adopting authority. If no such processes are in place, this ordinance may be adopted as a new independent section of the Municipal Code.

The MLO is probably best adopted as an “overlay zoning” ordinance. This means that it overlays, but is different from, land-use zoning. It can be added to or integrated into existing ordinances or codes and cross-referenced to other applicable codes and ordinances such as the electrical code, the sign code, planning ordinances, etc.

The MLO may best be managed by assigning it to planning officials and using existing administrative structures.

Because of the diverse community and lighting needs across large areas, this MLO is not intended for adoption as a state, provincial or national ordinance. Regional coordination is encouraged. Light pollution knows no boundaries, and the effects of polluting light persist as far as 200 kilometers (about 120 miles) from the source. One large city could adopt the MLO and dramatically affect a region, but adoption in suburbs and small towns must be part of a regional effort to achieve significant improvements in the overall quality of the night sky.

Adopting agencies in California will note that the outdoor lighting power restrictions of Title 24-2008 and ASHRAE/IES 90.1-2010 were used as the basis of the lumen values and may consider allowing energy code certification in lieu of the MLO's prescriptive lumen limit.

Adopting agencies should also consider that the MLO, like all other modern codes, is designed to evolve over time. Lighting technology will change, and MLO changes will be needed every few years. On-going renewal cycles are strongly recommended as any part of an adopting ordinance.

**MLO Development and Task Force Members**

This Model Lighting Ordinance has been developed as a joint undertaking by the Illuminating Engineering Society and the International Dark-Sk Association.

The Joint Task Force responsible for developing the MLO include

IDA  
Co- Chair: Jim Benya  
Co-Chair Nancy Clanton  
Leslie Lipstein  
Leo Smith  
Michael Mutmansky

IES  
Naomi Miller  
Cheryl English  
Denis Lavoie  
Eric Gibson

John Walter representing the electric utility industry also contributed as a member of the Joint Task Force.

**I. PREAMBLE - User's Guide**

In general, the preamble is part of the ordinance but is typically not part of the code. It establishes the reasons why the municipality is undertaking these regulations.

Local governments may add other purposes to the Preamble including established local government environmental or energy goals that support the model lighting ordinance.

**II. LIGHTING ZONES - User's Guide**

Lighting zones reflect the base (or ambient) light levels desired by a community. The use of lighting zones (LZ) was originally developed by the International Commission on Illumination (CIE) and appeared first in the US in IES Recommended Practice for Exterior Environmental Lighting, RP-33-99.

It is recommended that the lowest possible lighting zone(s) be adopted. Using lighting zones allows a great deal of flexibility and customization without the burden of excessive regulation. For example, a jurisdiction may choose to establish vertical lighting zones with the lighting zone at street level at a higher zone than the residential housing on upper levels.

However, if an adjacent use could be adversely impacted by allowable lighting, the adopting authority may require that a particular site meet the requirements for a lower lighting zone. For example, the authority could specify Lighting Zone 1 or 2 requirements if a commercial development were adjacent to a residence, hospital or open space.

**I. PREAMBLE - Ordinance Text**

The purpose of this Ordinance is to provide regulations for outdoor lighting that will:

- a. Permit reasonable uses of outdoor lighting for night-time safety, utility, security, productivity, enjoyment and commerce.
- b. Minimize adverse offsite impacts including light trespass, and obtrusive light.
- c. Curtail light pollution and improve the nighttime environment for astronomy.
- d. Help protect the natural environment from the adverse effects of night lighting from gas or electric sources.
- e. Conserve energy and resources to the greatest extent possible.

**II. LIGHTING ZONES - Ordinance Text**

The Authority shall establish Lighting Zones within its boundaries of its jurisdiction. The Lighting Zone shall determine the limitations for lighting as specified in this ordinance. The Lighting Zones shall be as follows:

**LZ0: No ambient lighting**

Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Human activity is subordinate in importance to nature. The vision of human residents and users is adapted to the total darkness, and they expect to see little or no lighting. When not needed, lighting should be extinguished.

**II. LIGHTING ZONES (cont.) - User's Guide**

**II. LIGHTING ZONES (cont.) - Ordinance Text**

Lighting zones are best implemented as an overlay to the established zoning especially in communities where there is a variety of zone districts within a defined area or along an arterial street. Where zone districts are cohesive, it may be possible to assign lighting zones to established land use zoning. It is recommended that the lighting zone includes churches, schools, parks, and other uses embedded within residential communities.

**LZ1: Low ambient lighting**

Areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.

**LZ2: Moderate ambient lighting**

Areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline.

**LZ3: Moderately high ambient lighting**

Areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline.

**LZ4: High ambient lighting**

Areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.

Zone	Recommended Uses or Areas	Zoning Considerations
LZ-0	Lighting Zone 0 should be applied to areas in which permanent lighting is not expected and when used, is limited in the amount of lighting and the period of operation. LZ-0 typically includes undeveloped areas of open space, wilderness parks and preserves, areas near astronomical observatories, or any other area where the protection of a dark environment is critical. Special review should be required for any permanent lighting in this zone. Some rural communities may choose to adopt LZ-0 for residential areas.	Recommended default zone for wilderness areas, parks and preserves, and undeveloped rural areas.  Includes protected wildlife areas and corridors.
LZ-1	Lighting Zone 1 pertains to areas that desire low ambient lighting levels. These typically include single and two family residential communities, rural town centers, business parks, and other commercial or industrial/storage areas typically with limited nighttime activity. May also include the developed areas in parks and other natural settings.	Recommended default zone for rural and low density residential areas.  Includes residential single or two family; agricultural zone districts; rural residential zone districts; business parks; open space include preserves in developed areas.

**II. LIGHTING ZONES (cont.) - User's Guide**

Zone	Recommended Uses or Areas	Zoning Considerations
<b>LZ-2</b>	Lighting Zone 2 pertains to areas with moderate ambient lighting levels. These typically include multifamily residential uses, institutional residential uses, schools, churches, hospitals, hotels/motels, commercial and/or businesses areas with evening activities embedded in predominately residential areas, neighborhood serving recreational and playing fields and/or mixed use development with a predominance of residential uses. Can be used to accommodate a district of outdoor sales or industry in an area otherwise zoned LZ-1.	<p><b>Recommended default zone for light commercial business districts and high density or mixed use residential districts.</b></p> <p>Includes neighborhood business districts; churches, schools and neighborhood recreation facilities; and light industrial zoning with modest nighttime uses or lighting requirements.</p>
<b>LZ-3</b>	Lighting Zone 3 pertains to areas with moderately high lighting levels. These typically include commercial corridors, high intensity suburban commercial areas, town centers, mixed use areas, industrial uses and shipping and rail yards with high night time activity, high use recreational and playing fields, regional shopping malls, car dealerships, gas stations, and other nighttime active exterior retail areas.	<p><b>Recommended default zone for large cities' business district.</b></p> <p>Includes business zone districts; commercial mixed use; and heavy industrial and/or manufacturing zone districts.</p>
<b>LZ-4</b>	Lighting zone 4 pertains to areas of high ambient lighting levels and limited to specific intense night uses within large metropolitan areas such as downtowns, entertainment districts or outdoor sales districts. LZ-4 should only be used for special cases and is not appropriate for most communities. May include professional sports, theme parks, and heavy industrial uses such as oil refineries.	<p><b>Not a default zone.</b></p> <p>Includes high intensity business or industrial zone districts.</p>

**III. GENERAL REQUIREMENTS - User's Guide**

This Section sets out the requirements that apply to all lighting, both residential and non-residential.

Each adopting jurisdiction should incorporate their existing standards as to when compliance with new regulations is required, when repair or remodeling triggers compliance and if the new ordinance will be retroactive to existing development. The applicability section of this ordinance should serve as a guide if the adopting jurisdiction does not have standards or policies in place. Likewise, the adopting jurisdiction should use their existing policies and definitions of what constitutes public monuments, and temporary and/or emergency lighting. Community attitudes and precedents should be taken into account in deciding to regulate seasonal holiday lighting.

**EXEMPTIONS - User's Guide**

This is standard language intended to prevent conflict of laws and to give the community the ability to set specific lighting requirements in special plans and under use permits. It can be amended to conform to similar language in other ordinances.

**SIGN LIGHTING - User's Guide**

A sign ordinance is strongly recommended if not already in place. It should carefully limit lighting as over-lighted signs are sometimes used to circumvent lighting ordinances.

**III. GENERAL REQUIREMENTS - Ordinance Text****A. Conformance with All Applicable Codes**

All outdoor lighting shall be installed in conformance with the provisions of this Ordinance, applicable Electrical and Energy Codes, and applicable sections of the Building Code.

**B. Applicability**

Except as described below, all outdoor lighting installed after the date of effect of this Ordinance shall comply with these requirements. This includes, but is not limited to, new lighting, replacement lighting, or any other lighting whether attached to structures, poles, the earth, or any other location, including lighting installed by any third party.

**Exemptions from III.(B.)** The following are not regulated by this Ordinance

- a. Lighting within public right-of-way or easement for the principal purpose of illuminating streets or roads. No exemption shall apply to any lighting within the public right of way or easement when the purpose of the luminaire is to illuminate areas outside the public right of way or easement.

**Note to adopting agency: if using the street lighting ordinance (Section XI), this exemption should read as follows:**

Lighting within the public right-of-way or easement for the principal purpose of illuminating roads and highways. No exemption shall apply to any street lighting and to any lighting within the public right of way or easement when the purpose of the luminaire is to illuminate areas outside of the public right of way or easement.

- b. Lighting for public monuments and statuary.
- c. Lighting solely for signs (lighting for signs is regulated by the Sign Ordinance).
- d. Repairs to existing luminaires not exceeding 25% of total installed luminaires.



**III. GENERAL REQUIREMENTS (cont.) - Ordinance Text**

- e. Temporary lighting for theatrical, television, performance areas and construction sites;
- f. Underwater lighting in swimming pools and other water features
- g. Temporary lighting and seasonal lighting provided that individual lamps are less than 10 watts and 70 lumens.
- h. Lighting that is only used under emergency conditions.
- i. In lighting zones 2, 3 and 4, low voltage landscape lighting controlled by an automatic device that is set to turn the lights off at one hour after the site is closed to the public or at a time established by the authority.

*Exceptions to III. (B.)* When the requirements herein conflict with specific lighting provisions of any of the following, only those specific provisions shall take precedence and all other requirements herein shall remain in force.

- a. Lighting specified or identified in a specific use permit.
- b. Lighting required by federal, state or provincial laws or regulations.

**C. Lighting Control Requirements**

- 1. Automatic Switching Requirements  
Controls shall be provided that automatically extinguish all outdoor lighting when sufficient daylight is available using a control device or system such as a photoelectric switch, astronomic time switch or equivalent functions from a programmable lighting controller, building automation system or lighting energy management system.

**LIGHTING CONTROLS - User's Guide**

This section requires all outdoor lighting to have lighting controls that prohibit operation when sufficient daylight is available, and to include the capability, either through circuiting, dimming or alternating sources, to be able to reduce lighting without necessarily turning all lighting off.

**III. GENERAL REQUIREMENTS (cont.) - Ordinance Text**

**CURFEW REQUIREMENTS - User's Guide**

The intent is to reduce or eliminate lighting after a given time. Benefits include reduced environmental impact, longer hours of improved astronomy, energy savings, and improved sleeping conditions for residents. Additionally, some police departments have indicated that post-curfew light reductions make drive-by patrolling easier because it allows them to see further into and through a site.

The authority should determine the time of curfew and the amount of lighting reduction based on the character, norms and values of the community.

Typically, curfews go into effect one hour after the close of business. Restaurants, bars and major entertainment facilities such as sports stadiums, may require the curfew go into effect two hours after the close of business. The authority may elect to have no curfew for facilities with shift workers and 24 hour operations, or to extend the curfew time to meet specific needs. The MLO can be modified to address those concerns.

Areas without street lights or with very low ambient light levels should consider turning off all non-emergency lighting at curfew while commercial areas or urban areas may prefer a reduction in lighting levels. A reduction of at least 30% is recommended for most uses.

*Exceptions to III.(C.) 1.* Automatic lighting controls are not required for the following:

- a. Lighting under canopies.
- b. Lighting for tunnels, parking garages, garage entrances, and similar conditions.

2. Automatic Lighting Reduction Requirements  
The Authority shall establish curfew time(s) after which total outdoor lighting lumens shall be reduced by at least 30% or extinguished.

*Exceptions to III.(C.) 2.* Lighting reductions are not required for any of the following:

- a. With the exception of landscape lighting, lighting for residential properties including multiple residential properties not having common areas.
- b. When there is only 1 conforming luminaire on the property.
- c. Code required lighting for steps, stairs, walkways, and building entrances.
- d. When in the opinion of the Authority, lighting levels must be maintained.
- e. Motion activated lighting.
- f. Lighting governed by special use permit in which times of operation are specifically identified.
- g. Businesses that operate on a 24 hour basis.

#### IV. NON-RESIDENTIAL LIGHTING - User's Guide

This section addresses non-residential lighting and multiple-family residences having common spaces, such as lobbies, interior corridors or parking. Its intent is to:

- Limit the amount of light that can be used
- Minimize glare by controlling the amount of light that tends to create glare
- Minimize sky glow by controlling the amount of uplight
- Minimize the amount of off-site impacts or light trespass

This MLO provides two methods for determining compliance. The *prescriptive method* contains precise and easily verifiable requirements for luminaire light output and fixture design that limit glare, uplight, light trespass and the amount of light that can be used. The *performance method* allows greater flexibility and creativity in meeting the intent of the ordinance. It should be noted that both the prescriptive or performance method limit the *amount* of light that can be used, but do not control *how* the lighting is to be used.

#### IV. NON-RESIDENTIAL LIGHTING - Ordinance Text

For all non-residential properties, and for multiple residential properties having common outdoor areas, all outdoor lighting shall comply either with Part A or Part B of this section.

**PRESCRIPTIVE METHOD - User's Guide**

Most outdoor lighting projects that do not involve a lighting professional will use the prescriptive method, because it is simple and does not require engineering expertise.

For the prescriptive method, the initial lumen allowances defined in Table A or B will provide basic lighting (parking lot and lighting at doors and/or sensitive security areas) that is consistent with the selected lighting zone. It will provide a safe lighting environment without sky glow or adverse offsite impacts. A jurisdiction may also allow a prescriptive method for classes of sites, such as car dealerships, gas stations, or other common use areas.

Note that the values are for initial lamp lumens, not footcandles on the target (parking lot, sidewalk, etc). Variables such as the efficiency of the luminaire, dispersion, and lamp wear can affect the actual amount of light so the lumens per square foot allowance is not equal to footcandles on the site. By specifying initial lumen values, it is easier for officials to verify that the requirement is being met.

Also, since solid state luminaires (such as LEDs) do not have initial lamp lumens, their lumen rating is stated in initial luminaire lumens or absolute photometry. As a result, the MLO requires an adjustment factor to normalize initial lumen ratings for absolute photometry. It is assumed that luminaires are 70% efficient, so the adjustment factor is 1.4 for luminaires tested with absolute photometry methods. Listed below is an example on a typical compliance worksheet for the Prescriptive Method.

**IV. NON-RESIDENTIAL LIGHTING (cont.) - Ordinance Text*****A. Prescriptive Method***

An outdoor lighting installation complies with this section if it meets the requirements of subsections 1 and 2, below.

**1. Total Site Lumen Limit**

The total installed initial lamp lumens of all lighting systems on the site shall not exceed the total site lumen limit. The total site lumen limit shall be determined using either the Parking Space Method (Table A) or the Hardscape Area Method (Table B). Only one method shall be used per permit application, and for sites with existing lighting, existing lighting shall be included in the calculation of total installed lumens.

The total installed 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.

**IV. NON-RESIDENTIAL LIGHTING (cont.) - User's Guide**

**IV. NON-RESIDENTIAL LIGHTING (cont.) - Ordinance Text**

**PRESCRIPTIVE METHOD EXAMPLE**

COMPLIANCE CHART					
<i>Lamp Descriptions</i>	<i>QTY</i>	<i>Lamp Initial Lumens</i>	<i>Adjustment Factor for Absolute Photometry</i>	<i>Adjusted Lumens</i>	<i>Total Lamp Initial Lumens</i>
70 W Metal Halide	8	5,600	N/A	5,600	44,800
150 W Metal Halide	20	14,000	N/A	14,000	280,000
18 W LED	24	1,070	1.4	1,498	35,952
<b>TOTAL LAMP INITIAL LUMENS</b>					<b>360,752</b>
<b>SITE ALLOWED TOTAL INITIAL LUMENS*</b>					<b>400,000</b>
<b>PROJECT IS COMPLIANT?</b>					<b>YES</b>

\* Listed below is the method of determining the allowed total initial lumen for non-residential outdoor lighting using the hardscape area method. (Table B).

SITE ALLOWED TOTAL INITIAL LUMENS	
<i>Site Description</i>	Light Commercial
<i>Lighting Zone</i>	LZ-2
<i>Hardscape Area (SF)</i>	100,000
<i>Allowed Lumens per SF of Hardscape (Table B)</i>	4.0
<i>Site Allowed Total Initial Lumens (lumens per SF X hardscape area)</i>	400,000

**PRESCRIPTIVE METHOD (cont.) - User's Guide**

**IV. NON-RESIDENTIAL LIGHTING (cont.) - Ordinance Text**

**LIMITS TO OFFSITE IMPACTS**

**PRESCRIPTIVE METHOD**

**2. Limits to Off Site Impacts**

The prescriptive method of the MLO restricts uplighting, including upward light emitted by decorative luminaires. A jurisdiction may choose to preserve some types of lighting, including lighting of monuments or historic structures. In this case, the adopting jurisdiction should exempt or otherwise regulate these types of lighting carefully so that it does not inadvertently allow glaring or offensive lighting systems.

All luminaires shall be rated and installed according to Table C.

Offsite impacts include both light pollution and light trespass. Both of these are a function of the fixture or luminaire design and installation. This document replaces the previous luminaire classification terminology of full cut-off, semi cut-off, cut-off because those classifications were not as effective in controlling offsite impacts as the new IESNA luminaire classification system as described in TM-15-07.

A traditional method of defining light trespass is to identify a maximum light level at or near the property line. However, this method does not address offensive light that is not directed toward the ground, or the intensity of glaring light shining into adjacent windows. The requirements defined in Table C limit the amount of light in all quadrants that is directed toward or above the property line. The Backlight/Uplight/Glare (BUG) rating will better limit both light trespass and glare. (A detailed explanation of the BUG system is provided in the section on Table C.)

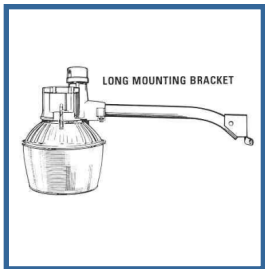
The limits for light distribution established in Table C (for the BUG rating system) prevent or severely limit all direct upward light. A small amount of uplight reflected by snow, light-colored pavement or a luminaire's supporting arms is inevitable and is not limited by this ordinance.

**PRESCRIPTIVE METHOD (cont.) - User's Guide**

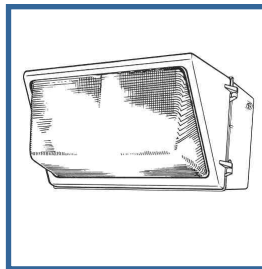
**IV. NON-RESIDENTIAL LIGHTING (cont.) - Ordinance Text**

**LIMITS TO OFFSITE IMPACTS**

A seemingly non-compliant fixture, such as a post-top translucent acorn luminaire, may in certain cases meet the BUG ratings, as long as it has proper interior baffling within the acorn globe. However, the BUG ratings in Table C will limit the use of the following types of luminaires in some lighting zones:



**Barn Lights**



**Non-Shielded  
Wall Packs**



**Floodlights or  
lights not aimed  
downward**

**PERFORMANCE METHOD - User's Guide**

The performance method is best for projects with complex lighting requirements or when the applicant wants or needs more flexibility in lighting design. The performance method is also used when any light fixtures are required to be aimed or directed upward. An engineer or lighting professional generally will be required to design within the performance method. An adopting jurisdiction may also wish to hire an engineer or lighting professional to review and approve projects using this method and/or incorporate review of the performance method into special review procedures.

The Performance Method allows layers of light depending on the complexity of the site compared to the prescriptive method which only has one layer of light.

The first step in the Performance Method regulates overlighting by establishing the Total Initial Site Lumens (Table D) that are allowed.

Allowances include the summation of the following (Table D):

- 1) Initial lumen allowance per site
- 2) Per area (SF) of hardscape
- 3) Per length (linear feet) of hardscape perimeter.

Table E allows additional lumens for unique site conditions.

Examples of allowances include:

- 1) Per building entrance/exit
- 2) Per length (linear feet) of Outdoor Sales Frontage Perimeter
- 3) Per area (SF) of Vehicle Service Station Canopy
- 4) Plus more ...

The Site Total Initial Site Lumens allowed are a combination of allowances from Table D and Table E.

**IV. NON-RESIDENTIAL LIGHTING (cont.) - Ordinance Text*****B. Performance Method*****1. Total Site Lumen Limit**

The total installed initial lamp lumens of all lighting systems on the site shall not exceed the allowed total initial site lumens. The allowed total initial site lumens shall be determined using Tables D and E. For sites with existing lighting, existing lighting shall be included in the calculation of total installed lumens.

The total installed initial lamp lumens of all 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.



**IV. NON-RESIDENTIAL LIGHTING (cont.) - User's Guide**

**IV. NON-RESIDENTIAL LIGHTING (cont.) - Ordinance Text**

**LIMITS TO OFFSITE IMPACTS (cont.)**

**PERFORMANCE METHOD**

The Second Step in the Performance Method is to determine if the proposed luminaires are producing off site impacts such as glare, sky glow and light trespass. One may either use Option A which are the Maximum Allowable BUG Ratings in Table C, or Option B through computer lighting calculations show compliance with Maximum Line of Sight Illuminance or "TV" Illuminance at any point in the plane of the property line in Table F. Option B will be required for all non-residential luminaires that do not have BUG ratings, exceed the BUG ratings or have adjustable mountings.

**2. Limits to Off Site Impacts**

All luminaires shall be rated and installed using either Option A or Option B. Only one option may be used per permit application.

Option A: All luminaires shall be rated and installed according to Table C.

Option B: The entire outdoor lighting design shall be analyzed using industry standard lighting software including inter-reflections in the following manner:

For the performance method, Option B (2) requires photometric calculations for the site perimeter, to a height of no less than 10 feet (3 meters) above the tallest luminaire. A horizontal plane photometric plan will give a "snapshot" view of the lighting when the site complies with this ordinance. Since it is easiest to field verify horizontal levels, it would be possible to verify compliance by comparing actual site conditions to the photometric plan submitted during review. Note that the MLO specifies 'total initial lamp lumens' as a measurement in addition to footcandles/lux. The footcandle is equal to one lumen per square foot, for those more used to working with those units.

- 1) Input data shall describe the lighting system including luminaire locations, mounting heights, aiming directions, and employing photometric data tested in accordance with IES guidelines. Buildings or other physical objects on the site within three object heights of the property line must be included in the calculations.
- 2) Analysis shall utilize an enclosure around the perimeter of the site. The top of the enclosure shall be no less than 10 feet (3 meters) above the tallest luminaire. Calculations shall include total lumens upon the inside surfaces of the box top and vertical sides and maximum line of sight or "TV" illuminance (footcandles and/or lux) on the sides of the enclosure.

The design complies if:

- a) The total lumens on the inside surfaces of the box are less than 10% of the total site lumen limit; and
- b) The maximum line of sight or "TV" illuminance on any vertical surface is less than the allowed maximum illuminance per Table F.

## **DESIGN COMPLIANCE - User's Guide**

The application form will require information about the number of luminaires, the number of lamps in each luminaire and the initial lumen output for each lamp (based on the wattage and type of lamp selected) as well as plans showing the site area measurements. This will allow the reviewer to verify that the lumen output of all the luminaires does not exceed the allowance.

Field verification can be achieved by asking the applicant and/or owner to verify that the lamp type and wattages specified have been used. Since the initial lumens are usually listed on the box in which the lamp is sold, this can be achieved by providing the box for review.

However, if a jurisdiction requires additional on-site verification, it may also request a point-by-point photometric plan. While this will not be a true measure of compliance with the criteria of this Ordinance, comparing the actual measured levels on site to the photometric plan can be an indication whether or not the installed lighting varies from the approved design.

**V. RESIDENTIAL LIGHTING - User's Guide**

This section applies to single family home, duplexes, row houses, and low rise multi-family buildings that do not have interior hallways, common parking lots or other common spaces.

**RESIDENTIAL LIGHTING EXCEPTIONS**

The exceptions allow for typical lighting that might exceed the specified limits.

Landscape Lighting - While not common in residential areas, it can cause light pollution and light trespass if it is not controlled.

Lighting controlled by Vacancy (Motion) Sensor - Reduces light pollution and light trespass and should be encouraged.

**V. RESIDENTIAL LIGHTING - Ordinance Text**

*A. General Requirements*

For residential properties including multiple residential properties not having common areas, all outdoor luminaires shall be fully shielded and shall not exceed the allowed lumen output in Table G, row 2.

*Exceptions*

1. One partially shielded or non-shielded luminaire at the main entry, not exceeding the allowed lumen output in Table G row 1.
2. Any other partially shielded or non-shielded luminaires not exceeding the allowed lumen output in Table G row 3.
3. Low voltage landscape lighting aimed away from adjacent properties and not exceeding the allowed lumen output in Table G row 4.
4. Shielded directional flood lighting aimed away from adjacent properties and not exceeding the allowed lumen output in Table G row 5.
5. Open flame gas lamps.
6. Lighting installed with a vacancy sensor, where the sensor extinguishes the lights no more than 15 minutes after the area is vacated.
7. Lighting exempt per Section III (B.).

*B. Requirements for Residential Landscape Lighting*

1. Shall comply with Table G.
2. Shall not be aimed onto adjacent properties.

**VI. LIGHTING BY SPECIAL PERMIT ONLY - User's Guide**

**VI. LIGHTING BY SPECIAL PERMIT ONLY - Ordinance Text**

This section addresses types of lighting that are intrusive or complex in their impacts and need a higher level of scrutiny and/or site sensitivity.

It should be noted that safety could be compromised if lighting conforming to this ordinance is located adjacent to excessively bright and/or glaring lighting.

It is important that the authority set clear and reasonable guidelines for applying for a special lighting use permit, and establish rules and procedures for granting or refusing them. They may differ from existing special use policies, in which case one or the other may be changed to achieve the overall goal of effective lighting without glare, sky glow, or light trespass.

**A. High Intensity and Special Purpose Lighting**

The following lighting systems are prohibited from being installed or used except by special use permit:

1. Temporary lighting in which any single luminaire exceeds 20,000 lumens or the total lighting load exceeds 160,000 lumens.
2. Aerial Lasers.
3. Searchlights.
4. Other very intense lighting defined as having a light source exceeding 200,000 lumens or an intensity in any direction of more than 2,000,000 candelas.

**B. Complex and Non-Conforming Uses**

Upon special permit issued by the Authority, lighting not complying with the technical requirements of this ordinance but consistent with its intent may be installed for complex sites or uses or special uses including, but not limited to, the following applications:

1. Sports facilities, including but not limited to unconditioned rinks, open courts, fields, and stadiums.
2. Construction lighting.
3. Lighting for industrial sites having special requirements, such as petrochemical manufacturing or storage, shipping piers, etc.
4. Parking structures.
5. Urban parks
6. Decorative and architectural lighting of bridges, public monuments, and public buildings.
7. Theme and amusement parks.

To obtain such a permit, applicants shall demonstrate that the proposed lighting installation:

- a. Has sustained every reasonable effort to mitigate the effects of light on the environment and surrounding properties, supported by a signed statement describing the mitigation measures. Such statement shall be accompanied by the calculations required for the Performance Method.

**VII. EXISTING LIGHTING - User's Guide**

Adoption of this section on existing lighting is strongly encouraged.

If the adopting jurisdiction has criteria in place that require a property to come into compliance with the current zoning ordinance, it is recommended that the criteria also be applied to bringing existing lighting into compliance. If there are no established criteria, this section of the MLO is recommended.

Amortization allows existing lighting to gradually and gracefully come into compliance. Substantial changes or additions to existing properties are considered the same as new construction, and must comply.

**VI. LIGHTING BY SPECIAL PERMIT ONLY (cont.) - Ordinance Text**

- b. Employs lighting controls to reduce lighting at a Project Specific Curfew (“Curfew”) time to be established in the Permit.
- c. Complies with the Performance Method after Curfew.

The Authority shall review each such application. A permit may be granted if, upon review, the Authority believes that the proposed lighting will not create unwarranted glare, sky glow, or light trespass.

**VII. EXISTING LIGHTING - Ordinance Text**

Lighting installed prior to the effective date of this ordinance shall comply with the following.

**A. Amortization**

On or before [amortization date], all outdoor lighting shall comply with this Code.

**B. New Uses or Structures, or Change of Use**

Whenever there is a new use of a property (zoning or variance change) or the use on the property is changed, all outdoor lighting on the property shall be brought into compliance with this Ordinance before the new or changed use commences.

**C. Additions or Alterations**

**1. Major Additions.**

If a major addition occurs on a property, lighting for the entire property shall comply with the requirements of this Code. For purposes of this section, the following are considered to be major additions:

**VII. EXISTING LIGHTING (cont.) - Ordinance Text**

Additions of 25 percent or more in terms of additional dwelling units, gross floor area, seating capacity, or parking spaces, either with a single addition or with cumulative additions after the effective date of this Ordinance.

Single or cumulative additions, modification or replacement of 25 percent or more of installed outdoor lighting luminaires existing as of the effective date of this Ordinance.

**2. Minor Modifications, Additions, or New Lighting Fixtures for Non-residential and Multiple Dwellings**

For non-residential and multiple dwellings, all additions, modifications, or replacement of more than 25 percent of outdoor lighting fixtures existing as of the effective date of this Ordinance shall require the submission of a complete inventory and site plan detailing all existing and any proposed new outdoor lighting.

Any new lighting shall meet the requirements of this Ordinance.

**3. Resumption of Use after Abandonment**

If a property with non-conforming lighting is abandoned for a period of six months or more, then all outdoor lighting shall be brought into compliance with this Ordinance before any further use of the property occurs.

**VIII. ENFORCEMENT & PENALTIES - Ordinance Text**

**(Reserved)**

**VIII. ENFORCEMENT AND PENALTIES - User's Guide**

Enforcement and penalties provisions are to be developed by each jurisdiction.

**IX. TABLES - User's Guide**

The tables are to be reviewed periodically by a joint committee of the IES and IDA, and adjusted as standards and technology permit. If more research on the impacts of outdoor lighting shows the effects of light pollution to be a significant concern, then the values in the tables may be modified. Such changes will have no significant impact to the balance of the language of the Ordinance or Code.

**IX. TABLES - Ordinance Text**

**Table A - Allowed Total Initial Lumens per Site for Non-residential Outdoor Lighting, Per Parking Space Method**

May only be applied to properties up to 10 parking spaces (including handicapped accessible spaces).

LZ-0	LZ-1	LZ-2	LZ-3	LZ-4
500 lms/space	700 lms/space	900 lms/space	1,200 lms/space	1,500 lms/space

**Table B - Allowed Total Initial Lumens per Site for Non-residential Outdoor Lighting, Hardscape Area Method**

*May be used for any project. When lighting intersections of site drives and public streets or road, a total of 600 square feet for each intersection may be added to the actual site hardscape area to provide for intersection lighting.*

LZ-0	LZ-1	LZ-2	LZ-3	LZ-4
1.5 lumens per SF of hardscape	2.5 lumens per SF of hardscape	4.0 lumens per SF of hardscape	8.0 lumens per SF of hardscape	12.0 lumens per SF of hardscape

**IX. TABLES - TABLE C BUG RATING - User's Guide**

Work on the BUG system started in 2005 when the IES upgraded the roadway cutoff classification system. The original system, which included the ratings full cutoff, cutoff, semi-cutoff and non cutoff, had been designed as a rating system focused on brightness and glare control. However, increasing demand for control of uplight and light trespass in addition to glare, IES realized that a more comprehensive system was needed. IES developed *TM-15 Luminaire Classification System for Outdoor Luminaires*.

As this is a relatively new rating system, and many people may not be familiar with it, more explanation of how the rating system works is provided here. For example, some people are familiar with terms such as "full cutoff" and they may expect the MLO to include those terms. It will be very important that all groups recognize that older terms and concepts are inadequate for the complex tasks of controlling light pollution. It is recommended that the new system provided by the MLO be used intact and exclusively.

BUG requires downlight only with low glare (better than full cut off) in lighting zones 0, 1 and 2, but allows a minor amount of uplight in lighting zones 3 and 4. In lighting zones 3 and 4, the amount of allowed uplight is enough to permit the use of very well shielded luminaires that have a decorative drop lens or chimney so that dark sky friendly lighting can be installed in places that traditional-appearing luminaires are required. BUG typically cannot be used for residential luminaires unless they have been photometrically tested. For non-photometrically tested residential luminaires, shielding description is used instead.

The lumen limits established for each lighting zone apply to all types of lighting within that zone. This includes, but is not limited to, specialty lighting, façade lighting, security lighting and the front row lighting for auto dealerships. BUG rating limits are defined for each luminaire and

**IX. TABLES (cont.) - Ordinance Text**

**Table C - Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings**

May be used for any project. A luminaire may be used if it is rated for the lighting zone of the site or lower in number for all ratings B, U and G. Luminaires equipped with adjustable mounting devices permitting alteration of luminaire aiming in the field shall not be permitted.

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
<b>Allowed Backlight Rating</b>					
<b>Greater than 2 mounting heights from property line</b>	<b>B1</b>	<b>B3</b>	<b>B4</b>	<b>B5</b>	<b>B5</b>
<b>1 to 2 mounting heights from property line and properly oriented*</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B4</b>	<b>B4</b>
<b>0.5 to 1 mounting heights from property line and properly oriented*</b>	<b>B0</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B3</b>
<b>Less than 0.5 mounting height to property line adjacent to a street and properly oriented* **</b>	<b>B0</b>	<b>B0</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>
<b>Less than 0.5 mounting height to property line and properly oriented*</b>	<b>B0</b>	<b>B0</b>	<b>B0</b>	<b>B1</b>	<b>B2</b>
<b>Allowed Uplight Rating</b>	<b>U0</b>	<b>U0</b>	<b>U1</b>	<b>U2</b>	<b>U3</b>
<b>Allowed Glare Rating **</b>	<b>G0</b>	<b>G1</b>	<b>G2</b>	<b>G3</b>	<b>G4</b>
<b>Building Mounted Luminaires only*** Greater than 2 mounting heights to any property line</b>	<b>G0</b>	<b>G1</b>	<b>G2</b>	<b>G3</b>	<b>G4</b>
<b>Building Mounted Luminaires only*** 1 to 2 mounting heights to any property line</b>	<b>G0</b>	<b>G0</b>	<b>G1</b>	<b>G1</b>	<b>G2</b>



**IX. TABLES - TABLE C BUG RATING (cont.) - User's Guide**

**IX. TABLES (cont.) - Ordinance Text**

are based on the internal and external design of the luminaire, its aiming, and the initial lamp lumens of the specified lamp(s). The BUG rating limits also take into consideration the distance the luminaire is installed from the property line in multiples of the mounting height (See Table C).

**Table C - Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings - Continued**

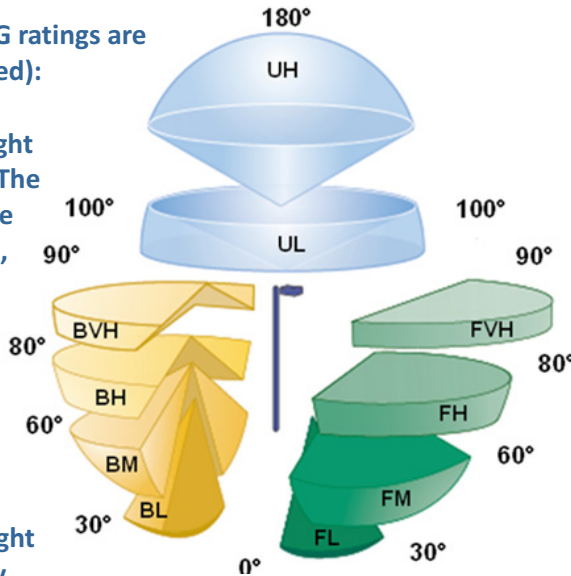
The three components of BUG ratings are based on IES TM-15-07 (revised):

**Backlight**, which creates light trespass onto adjacent sites. The B rating takes into account the amount of light in the BL, BM, BH and BVH zones, which are in the direction of the luminaire OPPOSITE from the area intended to be lighted.

**Uplight**, which causes artificial sky glow. Lower uplight (zone UL) causes the most sky glow and negatively affects professional and academic astronomy. Upper uplight (UH) not reflected off a surface is mostly energy waste. The U rating defines the amount of light into the upper hemisphere with greater concern for the light at or near the horizontal angles (UL, FVH and BVH solid angles.)

**Glare**, which can be annoying or visually disabling. The G rating takes into account the amount of frontlight in the FH and FVH zones as well as BH and BVH zones.

BUG ratings apply to the Lighting Zone of the property under consideration.



	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
<b>Allowed Glare Rating</b>					
<b>Building Mounted Luminaires only*** 0.5 to 1 mounting heights of any property line</b>	<b>G0</b>	<b>G0</b>	<b>G0</b>	<b>G1</b>	<b>G1</b>
<b>Building Mounted Luminaires only*** Less than 0.5 mounting heights of any property line</b>	<b>G0</b>	<b>G0</b>	<b>G0</b>	<b>G0</b>	<b>G1</b>

\* The luminaire must be mounted with backlight towards the property line.

\*\*For property lines that abut public walkways, bikeways, plazas, and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the center-line of the public roadway or public transit corridor for the purpose of determining compliance with this section. NOTE: This adjustment is relative to Table C only and shall not be used to increase the lighting area of the site.

\*\*\* Building mounted luminaires that cannot be mounted with their backlight to the property line shall meet the Allowed Glare Rating for all luminaires. Light from a building mounted luminaire must not exceed the B rating in the direction to the property line.

**IX. TABLES - TABLE C BUG RATING (cont.) - User's Guide**

(Key: UH=Uplight High, UL=Uplight Low, BVH=Backlight Very High, BH=Backlight High, BM=Backlight Medium, BL=Backlight Low, FVH=Forward Light Very High, FH=Forward Light High, FM=Forward Light Medium, FL=Forward Light Low.)

Note that in LZ0, LZ1 and LZ2 lumens are also limited in BVH and FVH, since they can contribute to uplight.

In general, a higher BUG rating means more light is allowed in solid angles, and the rating increases with the lighting zone. However, a higher B (backlight) rating simply indicates that the luminaire directs a significant portion of light behind the pole, so B ratings are designated based on the location of the luminaire with respect to the property line. A high B rating luminaire maximizes the spread of light, and is effective and efficient when used far from the property line. When luminaires are located near the property line, a lower B rating will prevent unwanted light from interfering with neighboring properties.

Looking at the 90-180 degree ranges:

- Zone 0 allows no light above 90 degrees.
- Zone 1 allows only 10 lumens (incidental) in the UH and UL zones, 20 lumens total in the complete upper hemisphere. (For comparison, a candle flame emits about 12 lumens.)
- Zone 2 allows only 100 lumens in the UH and UL zones, 200 lumens total in the complete upper hemisphere. (This is roughly equivalent to a 20 W incandescent lamp).
- Zone 3 allows only 500 lumens in the UH and UL zones, 1000 lumens total (less than a 75W incandescent lamp).

**IX. TABLES - TABLE C BUG RATING (cont.) - User's Guide**

- Zone 4 allows only 1000 lumens in the UH and UL zones, 2000 lumens total (about the output of a 150W incandescent bulb).

**TABLE D EXAMPLE - PERFORMANCE METHOD - User's Guide**

The first step in the Performance Method is to establish the Site Total Initial Site Lumens which regulates overlighting. The performance method allows layers of light depending on the complexity of the site compared to the prescriptive method which only has one layer of light.

Table D establishes the basic total initial site lumens allowed. These lumen allowances are added together for a total initial site lumen allowance. Allowances include:

- 1) Initial lumen allowance per site
- 2) Per area (SF) of hardscape
- 3) Per length (linear feet) of hardscape perimeter

**IX. TABLES (cont.) - Ordinance Text**

**Table D Performance Method Allowed Total Initial Site Lumens**

*May be used on any project.*

Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Zero (0) lumens per site; plus,	22,000 lumens per site; plus,	33,000 lumens per site; plus,	55,000 lumens per site; plus,	80,000 lumens per site; plus,
1.0 lumens per sf of hardscape; plus	2.0 lumens per sf of hardscape; plus	3.0 lumens per sf of hardscape; plus	7.0 lumens per sf of hardscape; plus	10.0 lumens per sf of hardscape; plus
10 lm per lin. ft. of hardscape perimeter; plus	20 lm per lin. ft. of hardscape perimeter; plus	30 lm per lin. ft. of hardscape perimeter; plus	65 lm per lin. ft. of hardscape perimeter; plus	100 lm per l. ft. of hardscape perimeter; plus
The smaller of the specific use allowance(s) from Table E or the actual lighting lumens for that lighting				

**Table E Performance Method Additional Initial Lumen Allowances. All of the following are “use it or lose it” allowances.**  
All area and distance measurements in plan view unless otherwise noted.

Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
<b>Building Entrances or Exits.</b> This allowance is per door. In order to use this allowance, luminaires must be within 20 feet of the door.	750 lumens	2,000 lumens	4,000 lumens	6,000 lumens	8,500 lumens
<b>Entrances at Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities.</b> This allowance is lumens per primary entrance. To use this allowance, luminaire(s) must be installed within 100 feet of the entrance door.	750 lumens	2,000 lumens	4,000 lumens	6,000 lumens	8,500 lumens

**TABLE E PERFORMANCE METHOD - User's Guide**

The allowable light levels for these uses defined in Table E may be used to set a prescriptive lighting allowance for these uses in each lighting zone. It should be noted that the lighting allowance defined in Table E is only applicable for the area defined for that use and cannot be transferred to another area of the site. For some uses, such as outdoor sales, the jurisdiction is encouraged to define a percentage of the total hardscape area that is eligible for the additional lighting allowance. For example, a set percentage of a car dealership's lot may be considered a display area and receive the additional lighting allowance where the remainder of the lot would be considered storage, visitor parking, etc. And cannot exceed the base light levels defined in Table A.

**TABLE E EXAMPLE - PERFORMANCE METHOD - User's Guide**

**IX. TABLES (cont.) - Ordinance Text**

**Table E - Performance Method Additional Initial Lumen Allowances (cont.)**

Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
<b>Building Facades.</b> This allowance is lumens per unit area of building façade that are illuminated. To use this allowance, luminaires must be aimed at the façade and capable of illuminating it without obstruction.	Not allowed	Not allowed	12 lumens per square foot	25 lumens per square foot	40 lumens per square foot
<b>Outdoor Sales Lots.</b> This allowance is lumens per square foot of uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale, and may not include driveways, parking or other non sales areas. To use this allowance, luminaires must be within 10 mounting heights of sales lot area.	Not allowed	10,000 lumens plus 10 lumens per square foot	10,000 lumens plus 40 lumens per square foot	15,000 lumens plus 60 lumens per square foot	22,000 lumens plus 125 lumens per square foot
<b>Outdoor Sales Frontage.</b> This allowance is for lineal feet of sales frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. In order to use this allowance, luminaires must be located between the principal viewing location and the frontage outdoor sales area	Not allowed	Not allowed	1650 lumens per foot	2850 lumens per foot	2850 lumens per foot
<b>Hardscape Ornamental Lighting.</b> This allowance is in lumens per square foot of the total illuminated hardscape area. In order to use this allowance, luminaires must be rated for 1000 lumens or less	Not allowed	Not allowed	1.2 lumens per square foot	2.4 lumens per square foot	3.6 lumens per square foot
<b>Drive Up Windows.</b> This allowance is lumens per window. In order to use this allowance, luminaires must be within 20 feet of the center of the window.	Not allowed	2,700 lumens	4,000 lumens	8,000 lumens	13,000 lumens

**IX. TABLES (cont.) - Ordinance Text**

**Table E - Performance Method Additional Initial Lumen Allowances (cont.)**

<b>Lighting Application</b>	<b>LZ 0</b>	<b>LZ 1</b>	<b>LZ 2</b>	<b>LZ 3</b>	<b>LZ 4</b>
<b>Guard Stations.</b> This allowance is lumens per unit area of guardhouse plus 2000 sf per vehicle lane. In order to use this allowance, luminaires must be within 2 mounting heights of a vehicle lane or the guardhouse.	<b>Not allowed</b>	<b>10 lumens per square foot</b>	<b>25 lumens per square foot</b>	<b>50 lumens per square foot</b>	<b>80 lumens per square foot</b>
<b>Outdoor Dining.</b> This allowance is lumens per unit area for the total illuminated hardscape of outdoor dining. In order to use this allowance, luminaires must be within 2 mounting heights of the hardscape area of outdoor dining	<b>Not allowed</b>	<b>1 lumens per square foot</b>	<b>10 lumens per square foot</b>	<b>15 lumens per square foot</b>	<b>25 lumens per square foot</b>
<b>Special Security Lighting for Retail Parking and Pedestrian Hardscape.</b> This allowance is lumens per unit area for the total area of illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	<b>Not allowed</b>	<b>0.2 lumens per square foot</b>	<b>2 lumens per square foot</b>	<b>3 lumens per square foot</b>	<b>3 lumens per square foot</b>
<b>Vehicle Service Station Hardscape.</b> This allowance is lumens per unit area for the total illuminated hardscape area less area of buildings, area under canopies, area off property, or areas obstructed by signs or structures. In order to use this allowance, luminaires must be illuminating the hardscape area and must not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure	<b>Not allowed</b>	<b>5 lumens per square foot</b>	<b>10 lumens per square foot</b>	<b>25 lumens per square foot</b>	<b>40 lumens per square foot</b>

**IX. TABLES (cont.) - Ordinance Text**

**Table E - Performance Method Additional Initial Lumen Allowances (cont.)**

<b>Lighting Application</b>	<b>LZ 0</b>	<b>LZ 1</b>	<b>LZ 2</b>	<b>LZ 3</b>	<b>LZ 4</b>
<b>Vehicle Service Station Canopies.</b> This allowance is lumens per unit area for the total area within the drip line of the canopy. In order to use this allowance, luminaires must be located under the canopy.	<b>Not allowed</b>	<b>30 lumens per square foot</b>	<b>60 lumens per square foot</b>	<b>80 lumens per square foot</b>	<b>80 lumens per square foot</b>
<b>Vehicle Service Station Uncovered Fuel Dispenser.</b> This allowance is lumens per fueling side (2 max) per dispenser. In order to use this allowance, luminaires shall be within 2 mounting heights of the dispenser.	<b>Not allowed</b>	<b>7,500 lumens</b>	<b>15,000 lumens</b>	<b>20,000 lumens</b>	<b>20,000 lumens</b>
<b>All Other Sales Canopies.</b> This allowance is lumens per unit area for the total area within the drip line of the canopy. In order to qualify for this allowance, luminaires must be located under the canopy.	<b>Not allowed</b>	<b>10 lumens per square foot</b>	<b>40 lumens per square foot</b>	<b>65 lumens per square foot</b>	<b>65 lumens per square foot</b>
<b>Non-sales Canopies.</b> This allowance is lumens per unit area for the total area within the drip line of the canopy. In order to qualify for this allowance, luminaires must be located under the canopy.	<b>Not allowed</b>	<b>5 lumens per square foot</b>	<b>13 lumens per square foot</b>	<b>25 lumens per square foot</b>	<b>25 lumens per square foot</b>

**IX. TABLES (cont.) - Ordinance Text**

**Table F Maximum Line of Sight or “TV” Illuminance at any point in the plane of the property line**

Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
0.05 FC or 0.5 LUX	0.1 FC or 1.0 LUX	0.3 FC or 3.0 LUX	0.8 FC or 8.0 LUX	1.5 FC or 15.0 LUX

**Table G - Residential Lighting Limits**

Lighting Application	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Row 1 Maximum Allowed Luminaire Lumens* for Unshielded Luminaires at one entry only	Not allowed	600 lumens	900 lumens	900 lumens	900 lumens
Row 2 Maximum Allowed Luminaire Lumens* for each Fully Shielded Luminaire	900 lumens	1,800 lumens	1,800 lumens	1,800 lumens	1,800 lumens
Row 3 Maximum Allowed Luminaire Lumens* for each Unshielded Luminaire excluding main entry	Not allowed	450 lumens	450 lumens	450 lumens	450 lumens
Row 4 Maximum Allowed Luminaire Lumens* for each Landscape Lighting	Not allowed	Not allowed	1,500 lumens	3,000 lumens	3,000 lumens
Row 5 Maximum Allowed Luminaire Lumens* for each Shielded Directional Flood Lighting	Not allowed	Not allowed	1,800 lumens	3,000 lumens	3,000 lumens

**\* Luminaire lumens equals Initial Lamp Lumens for a lamp, multiplied by the number of lamps in the luminaire**

**TABLE G RESIDENTIAL LIGHTING - User's Guide**

**Residential Light Levels**

Most residential lighting has traditionally used incandescent lamps which are identified by their wattage. However, since new technologies provide more light for fewer watts, it is no longer possible to regulate residential lighting solely by providing a maximum wattage. Table G, therefore, lists maximum luminaire lumens only.

**X. DEFINITIONS - User's Guide**

Definitions are typically generally added to any code when new code sections are added. The definitions are legally required and play a significant role in the interpretation of the ordinance and code.

Most city attorneys will not accept references to outside sources regardless of credibility, such as the IES Handbook. Thus as a general rule, a definition for an unfamiliar term (e.g. lumens) must be added by the adopting ordinance.

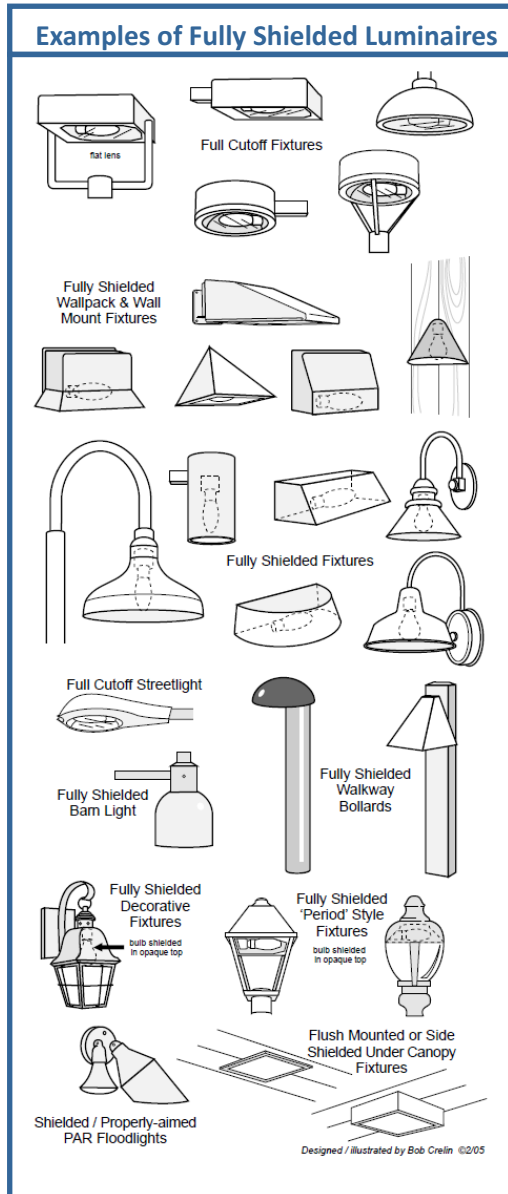
When adopting or integrating the MLO definitions, be sure to retire conflicting technical terminology. In particular, the latest IES Luminaire Classification System as defined in IES TM-15-07 is likely to need attention.

**X. DEFINITIONS - Ordinance Text**

<i>Absolute photometry</i>	Photometric measurements (usually of a solid-state luminaire) that directly measures the output of the luminaire.
<i>Architectural Lighting</i>	Lighting designed to reveal architectural beauty, shape and/or form and for which lighting for any other purpose is incidental.
<i>Authority</i>	The adopting municipality, agency or other governing body.
<i>Astronomic Time Switch</i>	An automatic lighting control device that switches outdoor lighting relative to time of solar day with time of year correction.
<i>Backlight</i>	For an exterior luminaire, flux radiated in the quarter sphere below horizontal and in the opposite direction of the intended orientation of the luminaire. For luminaires with symmetric distribution, backlight will be the same as front light.
<i>BUG</i>	A luminaire classification system that evaluates backlight (B), uplight (U) and glare (G).
<i>Canopy</i>	A covered, unconditioned structure with at least one side open for pedestrian and/or vehicular access. (An unconditioned structure is one that may be open to the elements and has no heat or air conditioning.)
<i>Common Outdoor Areas</i>	One or more of the following: a parking lot for three or more domiciles or buildings; a parking garage or covered entrance intended to be used by three or more domicile or buildings; an entrance for three or more domiciles or buildings; or open public space primarily intended to be used by the occupants of three or more domiciles or buildings.
<i>Curfew</i>	A time defined by the authority when outdoor lighting is reduced or extinguished.



**Fully Shielded Luminaires**



**X. DEFINITIONS - Ordinance Text**

<b>Emergency conditions</b>	Generally, lighting that is only energized by an emergency power source; or to illuminate the path of egress solely during a fire or other emergency situation; or, lighting for security purposes used solely during an alarm.
<b>Fully Shielded Luminaire</b>	A luminaire with opaque top and sides, capable of only emitting light only in the lower photometric hemisphere as installed.
<b>Forward Light</b>	For an exterior luminaire, flux (lumens) radiated in the quarter sphere below horizontal and in the direction of the intended orientation of the luminaire.
<b>Footcandle</b>	A non-SI unit of illuminance or light intensity, defined as the amount of illumination the inside surface of a 1-foot radius sphere would be receiving if there were a uniform point source of one candela in the exact center of the sphere. The foot-candle is equal to one lumen per square foot.
<b>Glare</b>	Lighting entering the eye directly from luminaires or indirectly from reflective surfaces that causes visual discomfort or reduced visibility.
<b>Hardscape</b>	Permanent hardscape improvements to the site including parking lots, drives, entrances, curbs, ramps, stairs, steps, medians, walkways and non-vegetated landscaping that is 10 feet or less in width.
<b>Hardscape Area</b>	Hardscape area measured in square feet is used to calculate the Total Site Lumen Limit in both the Prescriptive Method and Performance Methods. Refer to Hardscape definition.
<b>Hardscape Perimeter</b>	Hardscape perimeter measured in linear feet is used to calculate the Total Site Lumen Limit in the Performance Method. Refer to Hardscape definition.

**X. DEFINITIONS - Ordinance Text**

<b><i>IDA</i></b>	International Dark-Sky Association.
<b><i>IESNA</i></b>	Illuminating Engineering Society of North America.
<b><i>Illuminated area</i></b>	An exterior areas for which lighting of reasonable uniformity (20:1 or less maximum to minimum illuminance ratio) and illumination (average greater than 0.2 fc) is provided; not incidentally lighted or partially lighted.
<b><i>Industry Standard Lighting Software</i></b>	Lighting software that calculates point-by-point illuminance that includes reflected light using either ray-tracing or radiosity methods.
<b><i>Initial lamp lumens</i></b>	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><i>Lamp</i></b>	A generic term for a source of optical radiation (i.e. “light”), often called a “bulb” or “tube”. Examples include incandescent, fluorescent, high-intensity discharge (HID) lamps, and low pressure sodium (LPS) lamps, as well as light-emitting diode (LED) modules and arrays.
<b><i>Landscape Lighting</i></b>	Lighting designed specifically for illuminating exterior architectural and natural features.
<b><i>LED</i></b>	Light Emitting Diode.
<b><i>Lighting</i></b>	“Electric” or “man-made” or “artificial” lighting. See “lighting equipment”.
<b><i>Lighting Equipment</i></b>	Equipment specifically intended to provide gas or electric illumination, including but not limited to, lamp(s), luminaire(s), ballast(s), poles, posts, lens(s), and related structures, electrical wiring, and other necessary or auxiliary components.

**X. DEFINITIONS - Ordinance Text**

<b><i>Lighting System</i></b>	On a site, all exterior electric lighting and controls.
<b><i>Lighting Zone</i></b>	An overlay zoning system establishing legal limits for lighting for particular parcels, areas, or districts in a community.
<b><i>Low Voltage Landscape Lighting</i></b>	Landscape lighting powered at less than 15 volts and limited to lamps having a rated initial lumen output of 750 or less.
<b><i>Lumen</i></b>	The unit of luminous flux, a measure of the power of light perceived by the human eye. If a light source emits one candela of luminous intensity uniformly across a solid angle of one steradian, its total luminous flux emitted into that angle is one lumen.
<b><i>Luminaire</i></b>	The complete lighting unit (fixture), consisting of a lamp, or lamps and ballast(s) (when applicable), together with the parts designed to distribute the light (reflector, lens, diffuser), to position and protect the lamps, and to connect the lamps to the power supply.
<b><i>Luminaire Lumens</i></b>	The cumulative total of lumens emitted by all lamps contained within a single luminaire.
<b><i>Mounting height</i></b>	The height of the photometric center of a luminaire above grade level.
<b><i>New lighting</i></b>	Lighting for areas not previously illuminated; newly installed lighting of any type except for replacement lighting or lighting repairs.
<b><i>Non Shielded Luminaire</i></b>	A luminaire capable of emitting light in any direction including downwards.
<b><i>Ornamental lighting</i></b>	Lighting that does not impact the function and safety of an area but is purely decorative, or used to illuminate architecture and/or landscaping, and installed for aesthetic effect.

***Mounting Height:*** The horizontal spacing of poles is often measured in units of “mounting height”. Example: “The luminaires can be spaced up to 4 mounting heights apart.”

**X. DEFINITIONS - Ordinance Text**

<b><i>Ornamental Street Lighting</i></b>	A streetlight luminaire that may have a historical period appearance or decorative housing, globe, arm, or pole.
<b><i>Outdoor Lighting</i></b>	Lighting equipment installed outdoors.
<b><i>Outdoor Lighting Energy Code</i></b>	An energy code at least as stringent as ASHRAE/IES 90.1-2007 with amendments providing for 4 or 5 lighting zones.
<b><i>Partly shielded luminaire</i></b>	A luminaire with opaque top and translucent or perforated sides, designed to emit most light downward.
<b><i>Photoelectric Switch</i></b>	A control device employing a photocell or photodiode to detect daylight and automatically switch lights off when sufficient daylight is available.
<b><i>Property line</i></b>	The edges of the legally-defined extent of privately owned property.
<b><i>Relative photometry</i></b>	Photometric measurements made of the lamp plus luminaire, and adjusted to allow for light loss due to reflection or absorption within the luminaire.
<b><i>Replacement Lighting</i></b>	Lighting installed specifically to replace existing lighting that is sufficiently broken to be beyond repair.
<b><i>Repair(s)</i></b>	The reconstruction or renewal of any part of an existing luminaire for the purpose of its ongoing operation, other than relamping or replacement of components including capacitor, ballast or photocell. Note that retrofitting a luminaire with new lamp and/or ballast technology is not considered a repair and for the purposes of this ordinance the luminaire shall be treated as if new.

**X. DEFINITIONS - Ordinance Text**

<b><i>Sales area</i></b>	Uncovered area used for sales of retail goods and materials, including but not limited to automobiles, boats, tractors and other farm equipment, building supplies, and gardening and nursery products.
<b><i>Seasonal lighting</i></b>	Temporary lighting installed and operated in connection with holidays or traditions.
<b><i>Shielded Directional Luminaire</i></b>	A fully shielded luminaire with an adjustable mounting device allowing aiming in a direction other than straight downward.
<b><i>Sign</i></b>	Advertising, directional or other outdoor promotional display of art, words and/or pictures.
<b><i>TV Illuminance</i></b>	Line-of-sight illuminance, measured at the eye in a plane perpendicular to the line-of-sight when looking at the brightest source in the field of view.
<b><i>Temporary lighting</i></b>	Lighting installed and operated for periods not to exceed 60 days, completely removed and not operated again for at least 30 days.
<b><i>Third Party</i></b>	A party contracted to provide lighting, such as a utility company.
<b><i>Time Switch</i></b>	An automatic lighting control device that switches lights according to time of day.
<b><i>Translucent</i></b>	A material allowing light to pass through, but obscures or diffuses the image (not transparent or clear).
<b><i>Uplight</i></b>	For an exterior luminaire, flux radiated in the hemisphere at or above the horizontal plane.

## XI. OPTIONAL STREETLIGHT ORDINANCE - User's Guide

This section was added since the first public review. It is designed to work closely with the proposed revision to ANSI/IES RP-8 Standard Practice for Roadway and Street Lighting.

Street and roadway lighting is the world's largest cause of artificial skyglow. Many adopting agencies will recognize that the MLO will make privately owned lighting more efficient and environmentally responsible than their street lighting systems. But because the process of designing street lighting is often more critical, applying the MLO directly to street lighting is not advised. Using existing standards of street lighting is recommended, particularly IES RP-8 and AASHTO standards.

Until a new recommended practice for street lighting can be developed, this section can serve to prevent most of the uplift of street lighting systems without setting specific requirements for the amount of light, uniformity of light, or other performance factors. Adopting agencies should include these basic improvements to street lighting along with regulations to private lighting.

Few street lighting warranting processes exist. The adopting agency needs to gauge whether a complex warranting systems is required, or if a simple one using posted speeds, presence of pedestrians, or other practical considerations is sufficient.

Examples of a current street lighting warranting system are included in the Transportation Association of Canada's Guide for the Design of Roadway Lighting 2006.

## XI. OPTIONAL STREETLIGHT ORDINANCE - Ordinance Text

**Note to the adopting authority:** *the intent of this section is that it only applies to streets and not to roadways or highways.*

### A. Preamble

The purpose of this Ordinance is to control the light pollution of street lighting, including all collectors, local streets, alleys, sidewalks and bike-ways, as defined by ANSI/IES RP-8 Standard Practice for Roadway and Street Lighting and in a manner consistent with the Model Lighting Ordinance.

### B.Scope

All street lighting not governed by Federal or State regulations.

**EXCEPTION:** lighting systems mounted less than 10.5 feet above street level and having less than 1000 initial lumens each.

### C.Definitions

Roadway lighting is defined as lighting provided for freeways, expressways, limited access roadways, and roads on which pedestrians, cyclists, and parked vehicles are generally not present. The primary purpose of roadway lighting is to help the motorist remain on the roadway and help with the detection of obstacles within and beyond the range of the vehicle's headlights.

Street lighting is defined as major, collector, and local roads where pedestrians and cyclists are generally present. The primary purpose of street lighting is to help the motorist identify obstacles, provide adequate visibility of pedestrians and cyclists, and assist in visual search tasks, both on and adjacent to the roadway.

Ornamental Street Lighting is defined as a luminaire used for street lighting that may have an historical period appearance or decorative housing, globe, arm, or pole.

**XI. OPTIONAL STREETLIGHT ORDINANCE - Ordinance Text**

***D. Master Lighting Plan***

The Authority shall develop a Master Lighting Plan based on the American Association of State Highway and Transportation Officials (AASHTO) Roadway Lighting Design Guide GL-6, October 2005, Chapter 2. Such plan shall include, but not be limited to, the Adoption of Lighting Zones and:

1. Goals of street lighting in the jurisdiction by Lighting Zone
2. Assessment of the safety and security issues in the jurisdiction by Lighting Zone
3. Environmentally judicious use of resources by Lighting Zone
4. Energy use and efficiency by Lighting Zone
5. Curfews to reduce or extinguish lighting when no longer needed by Lighting Zone

***E. Warranting***

The Authority shall establish a warranting process to determine whether lighting is required. Such warranting process shall not assume the need for any lighting nor for continuous lighting unless conditions warrant the need. Lighting shall only be installed where warranted.

***F. Light Shielding and Distribution***

All street lighting shall have no light emitted above 90 degrees.

Exception: By special permit only, ornamental street lighting for specific districts or projects shall meet the requirements of Table H without the need for external field-added modifications.

**XI. OPTIONAL STREETLIGHT ORDINANCE - Ordinance Text**

**Table H - Uplight Control Requirements for Street Lights by Special Permit for Ornamental Street Lighting Only**

<b>Lighting Zone</b>	<b>Maximum Uplight Rating</b>
LZ-0	U-0
LZ-1	U-1
LZ-2	U-2
LZ-3	U-3
LZ-4	U-4