LEED Pilot Credit Library

Pilot Credit 7: Light Pollution Reduction

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Applicable Rating Systems

This credit is available for pilot testing by the following LEED project types:

- New Construction
- Core & Shell
- Schools
- Retail – New Construction
- Healthcare
- Existing Buildings: Operations & Maintenance

Intent
To increase night sky access, improve nighttime visibility, and reduce development impacts on wildlife environments.

Requirements

NC, CS, SCHOOLS, RETAIL, HEALTHCARE

Exterior Lighting
Meet either Option 1 or Option 2 for Uplight and either Option 1 or Option 2 for Light Trespass based on the photometric characteristics of each luminaire when mounted in the same orientation and tilt as specified in the project design.

Use the definitions of Lighting Zones provided in the Illuminating Engineering Society/ International Dark Sky Association (IES/IDA) Model Lighting Ordinance (MLO) User Guide. Use the lowest-numbered MLO lighting zone of the LEED Project and of all areas immediately adjacent to the LEED Project Boundary at the time construction begins.

Internally-Illuminated Signage: Any exterior signage within the LEED Project Boundary shall not exceed a luminance of 200cd/m2 (nits) during nighttime hours and 2000 cd/m2 (nits) during daytime hours.

Requirement 1. Uplight
Meet either Option 1 or Option 2 for all exterior luminaires located within the LEED Project Boundary.

OPTION 1. BUG Rating Method
Do not exceed the following maximum luminaire uplight ratings, based on the lumen output of the lamp(s) as defined in IESNA TM-15-11, Addendum A:

Table 1. Maximum uplight ratings for luminaires

MLO Lighting Zone	Luminaire Uplight Rating
LZ0	U0
LZ1	U1
LZ2	U2
LZ3	U3
LZ4	U4

OR

OPTION 2. Calculation Method
Do not exceed the following maximum percentage of total lumens emitted above horizontal:

Table 2. Maximum percentage of lumens above horizontal

MLO Lighting Zone	Maximum Allowed Percentage of Total Lumens Emitted Above Horizontal
LZ0	0%
LZ1	0%
LZ2	1.5%
LZ3	3%
LZ4	6%

Requirement 2. Light Trespass
Meet either Option 1 or Option 2 for all exterior luminaires located within the LEED Project Boundary.

OPTION 1. BUG Rating Method
Do not exceed the following luminaire backlight and glare ratings, as defined in IESNA TM-15-11, Addendum A, based on the lumen rating of the lamp, mounting location, and distance from the Lighting Boundary.

Table 3. Maximum backlight and glare ratings

	MLO Lighting Zone				
Luminaire Mounting	LZ0	LZ1	LZ2	LZ3	LZ4

	Allowed Backlight Ratings				
>2 mounting heights from Lighting Boundary	B1	B3	B4	B5	B5
1 to 2 mounting heights from Lighting Boundary and properly oriented	B1	B2	B3	B4	B4
0.5 to 1 mounting height to Lighting Boundary and properly oriented	B0	B1	B2	B3	B3
<0.5 mounting height to Lighting Boundary and properly oriented	B0	B0	B0	B1	B2
	Allowed Glare Ratings				
Building-mounted >2 mounting heights from any Lighting Boundary	G0	G1	G2	G3	G4
Building-mounted 1-2 mounting heights from any Lighting Boundary	G0	G0	G1	G1	G2
Building-mounted 0.5 to 1 mounting heights from any Lighting Boundary	G0	G0	G0	G1	G1
Building-mounted <0.5 mounting heights from any Lighting Boundary	G0	G0	G0	G0	G1
All Other Luminaires	G0	G1	G2	G3	G4

OR

OPTION 2. Calculation Method
Do not exceed the following maximum vertical illuminances at the Lighting Boundary. Calculation points shall be no more than 5 feet (1.5 meters) apart. The MLO lighting zone for each calculation point is based on the lighting zone of the immediately adjacent property at the time construction begins.

Table 4. Maximum vertical illuminance at Lighting Boundary

MLO Lighting Zone	Vertical Illuminance
LZ0	0.05 foot candles (fc)
LZ1	0.05 fc
LZ2	0.10 fc
LZ3	0.20 fc
LZ4	0.60 fc

Exemptions from Exterior Uplight and Light Trespass Requirements:
The following are exempt from the requirements, provided they are controlled separately from the nonexempt lighting:

- specialized signal, directional, and marker lighting associated with transportation processes;
- lighting that is used solely for façade and landscape lighting in MLO lighting zones 3 and 4, and is automatically turned off from midnight until 6 a.m.;
- lighting that is integral to other equipment or instrumentation that has been installed by the equipment or instrumentation manufacturer;
- lighting for theatrical purposes for stage, film, and video performances;
- government-mandated roadway lighting;
- hospital emergency departments, including associated helipads;
- lighting for the national flag in MLO lighting zones 2, 3, or 4; and
- lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation.

FOR PROJECTS THAT ARE PART OF A MULTITENANT COMPLEX
Meet the requirements above and develop a comprehensive master lighting plan that includes the project site and the surrounding buildings. The lighting master plan must incorporate:

- The credit requirements for exterior lighting;
- How this plan will reduce uplight, light trespass and energy consumption, and share exterior lighting amenities;
- How specific projects fit into the overall design; and
- How safety, security, comfort and economic activity of the entire project environment will be enhanced by the use of a master plan.

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Meet the Light Pollution Reduction requirements for:

- Interior Lighting, and
- One Exterior Lighting option

ESTABLISHMENT

Requirement 1. Interior Lighting
For all spaces with luminaires having a direct line of sight to exterior fenestration, all interior lighting exiting the space shall be automatically reduced by at least 90% whenever the space becomes unoccupied during nighttime hours.

Exemptions:

- lighting specifically required to be operated 24-7;
- emergency lighting that is automatically off during normal building operation;
- lighting within dwelling units;
- lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation; and
- decorative gas lighting systems.

AND

Requirement 2. Exterior Lighting
Meet the requirements of one of the options below:

OPTION 1. Fixture Shielding
Shield all exterior fixtures (where the sum of the mean lamp lumens for that fixture exceeds 2,500) such that the installed fixtures do not directly emit any light at a vertical angle more than 90 degrees from straight down.

OR

OPTION 2. Meet BD&C Requirements
If the project is certified under LEED for New Construction, Schools, demonstrate that the project complies with the exterior lighting requirements of the latest published LEED for New Construction SS Credit, Light Pollution Reduction.

If the project is certified under LEED for Core & Shell Development and 75% of the floor area is LEED for Commercial Interiors, demonstrate that the project complies with the exterior lighting requirements of the latest published requirements for both rating systems.

OR

Option 3. Perimeter Measurements
Measure the night illumination levels at regularly spaced points around the LEED Project Boundary, taking the measurements with the building's exterior and site lights both on and off.

At least 8 measurements are required at a maximum spacing of 100 feet (30 meters) apart. The illumination level measured with the lights on must not be more than 20% above the level measured with the lights off.

PERFORMANCE
None.

Credit Submittals

General:
1. Register for Pilot Credit(s) here.
2. Register a username at LEEDuser.com, and participate in online forum
3. Submit feedback survey; supply PDF of your survey/confirmation of completion with credit documentation

Credit Specific:

NC, CS, Schools, Retail, Healthcare

Exterior Lighting – provide the following:
- A site plan showing all sign locations and exterior light fixtures with designations and an associated fixture schedule with brief descriptions including lamp information for all fixtures

- A description with drawings and/or images of the site and all immediately adjacent properties, documenting a lighting zone for each of these. Any lighting zone 4 designations should include a document from the local zoning authority showing that they have authorized that zone designation for that site.
- A list of all exempt exterior luminaires and which exemption they qualify under.
- Signage: Narrative and drawings describing the luminance levels of the signs during hours of darkness and hours of daylight. Daylight hours are between 30 minutes after sunrise and 30 minutes before sunset. Nighttime hours are between 30 minutes after sunset and 30 minutes before sunrise.

Uplight

Option 1 BUG Rating Method:

- The lighting zone designation used for this option
- A lighting schedule documenting the three-dimensional orientation (plan/ elevation) of each non-exempt exterior fixture and it's U-Rating in that orientation (identical luminaires in the same orientation may be grouped).

Option 2 Calculation Method:

- The lighting zone designation used for this option
- A spreadsheet showing the following for each non-exempt luminaire (including summations where appropriate): (identical luminaires in the same orientation may be grouped)
    a. Catalog #
    b. Quantity of this luminaire
    c. The three dimensional orientation of the luminaire (plan/ elevation)
    d. The lumens emitted by the luminaire in that orientation
    e. The lumens emitted by the luminaire in that orientation above the horizon
- A summation calculation showing compliance based on the data presented above.

Light Trespass

Option 1 BUG Rating Method:

- The lighting zone designation used for this option
- Where appropriate, a narrative justifying extending the lighting boundary line past the property line in accordance with the credit requirements.
- a spreadsheet showing the following for each non-exempt luminaire: (identical luminaires in the same orientation may be grouped)
    a. Catalog #
    b. The three dimensional orientation of the luminaire (plan/ elevation)
    c. The orientation of the luminaire relative to the nearest lighting boundary line
    d. The backlight and glare ratings of the luminaire in the defined position
    e. An statement of compliance

Option 2 Calculation Method:

A point-by-point calculation showing initial vertical illuminances. Each vertical plane shall include:

- The maximum vertical illuminance encountered

- The lighting zone for this plane
- A statement of compliance

Multitenant Complex Projects:

- Include a narrative that describes:
  - How the safety/security issues, comfort, and economic activity were addressed and enhanced,
  - The shared exterior lighting amenities,
  - How light pollution and energy consumption was minimized, and
  - How specific projects fit into the overall design.

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Interior Lighting- provide the following:

- Narrative and drawings showing control locations, describing the lighting controls used on the interior lighting, the sequence of operation, and how these controls comply with this credit and section 9 of the ANSI/ASHRAE/IES Standard 90.1-2010.

Exterior Lighting

Option 1:

- A luminaire schedule identifying those luminaires where the sum of the mean lamp lumens exceeds 2,500
- A photometric report of those luminaires demonstrating that no light is emitted above 90 degrees from straight down in their final installed position(s).

Option 2:
Provide proof that the project complies with NC, CS, Schools, Retail, Healthcare above.

Option 3:

- A plan showing the location of the measurement points used to measure the night illumination levels.
- A description of the measurement results.

Additional Questions

1. Were you able to understand and comply with the credit language as written?

2. Were there barriers to implementing the strategies used under this credit?

3. Do the criteria associated with quality exterior lighting align with your project's productivity, safety, and quality needs?

Background Information
The Light Pollution Reduction credit has been rewritten to make it easier to understand while maintaining both flexibility for lighting designers and applicability to different kinds of light pollution. The exterior requirements are split into two areas: uplight and light trespass. For both requirements, an optional path allows teams to demonstrate compliance

by selecting luminaires with an appropriate BUG rating and placing them appropriately. These optional paths do not require point-by-point calculations. The calculation path has also been simplified and now requires calculations for fewer locations. Many projects can achieve the credit by simply complying with ASHRAE 90.1–2010 and selecting luminaires with an appropriate BUG rating. This revision also introduces a new term, *lighting boundary.* All light trespass requirements are met relative to the Lighting Boundary, rather than the LEED site boundary. Uplight requirements are still met based on all non-exempt exterior luminaires located within the LEED site boundary.

Definitions:

BUG Rating: A luminaire classification system that classifies luminaires in terms of backlight (B), uplight (U) and glare (G) (taken from IES/IDA Model Lighting Ordinance). For this credit, the BUG ratings supersede the former cutoff ratings.

Lighting Boundary: The Lighting Boundary is located at the property lines of the property, or properties, that the LEED project is within. The Lighting Boundary can be modified under the following conditions:

- When the Lighting Boundary abuts a public area that is a walkway, bikeway, plaza, or parking lot, the Lighting Boundary may be moved to 5 feet (1.5 meters) beyond the Property Line;
- When the Lighting Boundary abuts a public roadway or public transit corridor, the Lighting Boundary may be moved to the center line of that roadway or corridor;
- When there are additional properties owned by the same entity that are contiguous to the property, or properties, that the LEED project is within and have the same or higher MLO lighting zone designation as the LEED project, the Lighting Boundary may be expanded to include those properties.

A multi-tenant complex is defined as a site that that was master-planned for the development of stores, restaurants and other businesses. Retailers may share one or more services and/or common areas.

Changes from last version:

Changes made 11/01/2010:

- Credit language updated based on committee feedback
- Modeled Lighting Ordinance (MLO) path added

Changes made 1/11/2011:

- Changed term “Light Trespass” to “Glare”
- Changed Maximum uplight ratings in Table 1
- Changed Lighting Zones in Table 3
- Specified section 9.4.1 in ASHRAE 90.1-2010.
- Modifications to final paragraph language

Changes made for 2nd Public Comment (08/01/2011):

NC, CS, Schools, Retail, Healthcare

- Modified language based on Public Comment feedback
- Added Healthcare to the applicable rating system types
- Removed Path 2, Modeled Lighting Ordinance (MLO)
- Incorporated signage requirements into the language from the former Path 2
- Added an exemption from the Interior Lighting requirements for Hospitals
- Clarified the exterior and garage lighting power density requirements
- Clarified the how to meet the uplight and light trespass/ glare requirements
- Clarified the terms "LEED Project Boundary," "Lighting Zones," and "Lighting Boundary"
- Corrected errors in Table 3- the Maximum backlight and glare ratings table and notes
- Removed directional signage from, and added hospital emergency departments to, the Exterior Lighting Requirements exemptions list

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- Modified language based on Public Comment feedback
- Removed the requirement that all interior lighting be turned off by the cleaning staff, and replaced it with "appropriate nighttime personnel" (now Option 1)
- Added Option 2 for interior lighting that allows for automatic shutoff
- Broke out the Establishment and Performance requirements
- Clarified the exterior and garage lighting power density requirements

Changes made for 3rd Public Comment (03/01/2012):

NC, CS, Schools, Retail, Healthcare

- Modified language based on Public Comment feedback
- Removed Interior requirements (already covered in EA prerequisite)
- Included signage in the exterior lighting requirements
- Incorporated MLO definitions
- Streamlined the credit: identified and removed language that is not a requirement, but an explanation of a requirement (including definitions such as the one for Lighting Boundary)
- Added an exemption for national flag lighting
- Incorporated global language into the requirements
- Copy edit corrections
- Updated submittals- removed the Interior Lighting submittals

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- Modified language based on Public Comment feedback
- Removed Interior Lighting Option 1
- Incorporated 2009 requirements to give EB projects more options
- Incorporated global language into the requirements
- Updated submittals- Removed Interior Option 1 submittals, added submittals for new Options