

Table of Contents

6. Outdoor Lighting	1
6.1 Overview	1
What's New for the 2019 California Energy Code?	1
6.2 Scope, Approach and Applications	1
6.2.1 Outdoor Lighting Approach	2
6.2.2 Trade-offs.....	2
6.2.3 Outdoor Lighting Applications Not Regulated by §140.7	4
6.3 Outdoor Lighting Zones.....	4
6.3.1 Determining the Lighting Zone for an Outdoor Lighting Project	6
6.3.2 Lighting Zone Adjustments by Local Jurisdictions.....	8
6.3.3 Lighting Zone Examples of Using Physical Boundaries	9
6.4 Mandatory Requirements.....	9
6.4.1 Luminaire Cutoff Requirements.....	10
6.4.2 Requirements of Outdoor Lighting Controls	13
6.4.3 Lighting Control Functionality	17
6.5 Prescriptive Measures.....	18
6.5.1 Outdoor Lighting Power Compliance.....	18
6.5.2 General Hardscape Lighting Power Allowance	20
6.5.3 Additional Light Power Allowances and Requirements, by Application.....	29
6.5.4 Further Discussion about Additional Lighting Power Allowance for Specific Applications	35
6.6 Alterations and Additions for Outdoor Lighting.....	44
6.6.1 Outdoor Lighting Alterations – With an Increase of Lighting Loads	45
6.6.2 Outdoor Lighting Alterations – With no Increase of Lighting Loads, and small changes to existing luminaires.....	45
6.6.3 Outdoor Lighting Alterations – With no Increase of Lighting Loads, and sizable changes to existing luminaires.....	46
6.6.4 Outdoor Lighting Alterations – With no Increase of Lighting Loads, and other small changes to existing luminaires	47
6.6.5 Outdoor Lighting Additions– Mandatory and Lighting Power Requirements	47

6.6.6 Outdoor Lighting Additions and Alterations– More Examples	48
6.7 Outdoor Lighting Compliance Documents and Acceptance Tests	50
6.7.1 Overview	50
6.7.2 Compliance Documentation and Numbering Scheme	50
6.7.3 Certificate of Installation Documents	51
6.7.4 Certificate of Acceptance	51
6.7.5 Acceptance Tests	52

6. Outdoor Lighting

This chapter covers the requirements for nonresidential outdoor lighting systems for compliance to Title 24 California Code of Regulations, Part 6 (California Energy Code, or the Energy Standards) and it is related to lighting design and installation, luminaires and lighting controls.

It is addressed primarily to lighting designers, electrical engineers, installers, manufacturers and building officials responsible for lighting.

Chapter 5 addresses nonresidential indoor lighting requirements and covers lighting in parking garages.

Chapter 7 addresses sign lighting requirements.

6.1 Overview

What's New for the 2019 California Energy Code

The significant changes for outdoor lighting systems in the 2019 update to the Energy Standards include:

- Changes to outdoor lighting power allowances with the allowance values based on LED lighting technologies. Revisions to the general hardscape lighting values in Tables 140.7-A and the specific lighting application values in Table 140.7-B for all Lighting Zones (LZ) – Lighting Zone 1 thru Lighting Zone 4.
- Add separate lighting power allowance values for concrete-surfaced and for asphalt-surfaced hardscape lighting application in Table 140.7-A.
- Add new lighting power allowances for narrow band spectrum light sources used in applications for minimizing outdoor lighting impacts on professional astronomy and nocturnal habitat. (Table 140.7-A)
- Revision and streamlining outdoor lighting control requirements. (§130.2(c))
- Healthcare facilities overseen by the California Office of Statewide Health Planning and Development (OSHPD) have to comply with the Energy Standards including the outdoor lighting requirements for all outdoor areas of healthcare facilities.

6.2 Scope, Approach and Applications

This chapter applies to all outdoor lighting, whether attached to buildings, poles, structures or self-supporting- including but not limited to: lighting for hardscape areas such as parking lots, lighting for building entrances; lighting for all outdoor sales areas; and lighting for building facades.

The outdoor lighting part of the Energy Standards sets minimum control requirements, maximum allowable power levels, minimum efficacy requirements, and cutoff (uplight and glare) zonal lumen limits for outdoor luminaires.

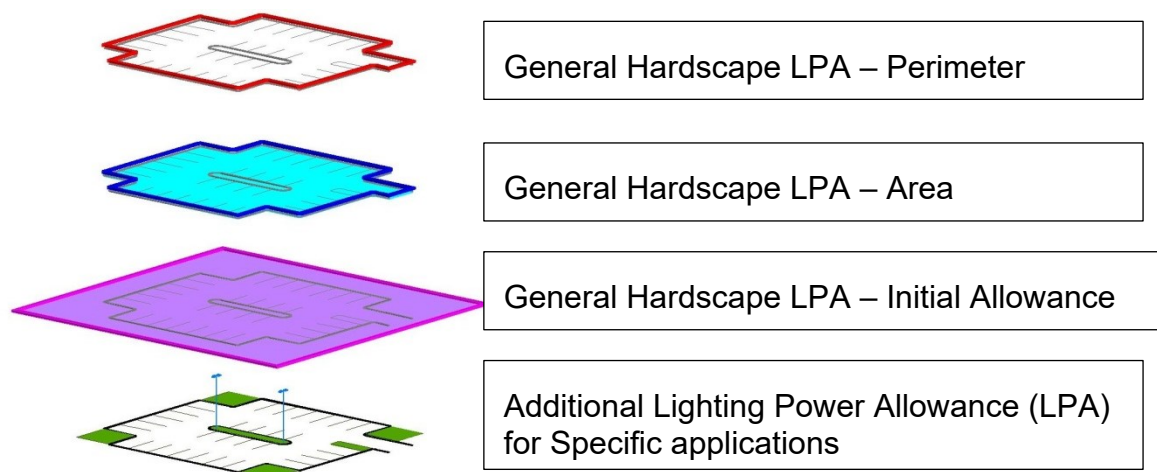
The Energy Standards only permit one type of trade-offs on outdoor lighting power. Refers to Section 6.2.2.1 for details.

All Section (§) and Table references in this Chapter refer to sections and Tables contained in the Energy Standards or California Energy Code.

6.2.1 Outdoor Lighting Approach

Outdoor lighting power densities are structured using a layered lighting approach. With the layered approach, the first layer of allowed lighting power is general hardscape for the entire site. After the allowed lighting power has been determined for this first layer, additional layers of lighting power are allowed for specific applications when they occur on the site. For example, the total allowed power for a sales lot with frontage is determined by layering the General Hardscape, Outdoor Sales Lot and Outdoor Sales Lot Frontage allowances, with specific restrictions associated with the location of the power used for frontage and sales lot lighting.

Figure 6-1: Concept of a layered lighting approach for outdoor lighting - Lighting Power Allowance (LPA)



The outdoor lighting applications that are addressed by the Energy Standards are shown in the first two columns of Table 6-1. The first column is general site illumination applications, which allow trade-offs within the outdoor portion only. The second column is specific outdoor lighting applications, which do not allow trade-offs, and are considered “use it or lose it”. The lighting applications in the third column are not regulated. The Energy Standards include control requirements as well as limits on installed lighting power.

6.2.2 Trade-offs

The Energy Standards do not allow trade-offs between outdoor lighting power allowances and indoor lighting, sign lighting, heating, ventilation, and air-conditioning (HVAC) system, building envelope, or water heating [(§140.7(a))].

There is only one type of trade-off permitted for outdoor lighting power. Allowed lighting power determined according to §140.7(d)1 for general hardscape lighting may be traded to specific applications in §140.7(d)2, provided the luminaires used to determine the illuminated area are installed as designed. This means that if luminaires used to determine the total illuminated area are removed from the design, resulting in a smaller illuminated area, then the general hardscape lighting power allowance must also be reduced accordingly.

Allowed lighting power for specific applications shall not be traded between specific applications, or to hardscape lighting in §140.7(d)1. This means that for each and every specific application, the allowed lighting power is the smaller of the allowed power determined for that specific application according to §140.7(d)2, or the actual installed lighting power that is used in that specific application. These additional power allowances are “use it or lose it” allowances.

Table 6-1: Scope of the Outdoor Lighting Requirements

Lighting Applications Covered General Hardscape (trade-offs permitted)	Lighting Applications Covered Specific Applications (trade-offs not permitted)	Lighting Applications Not Regulated (only as detailed in §140.7)
The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s) and other improved area(s) that are illuminated.	Canopies: Sales and Non-sales Tunnels Drive-Up Windows Emergency Vehicle Facilities Building Entrances or Exits Building Facades Guard Stations Hardscape Ornamental Lighting Outdoor Dining Primary Entrances for Senior Care Facilities, Police Stations, Healthcare Facilities, Fire Stations, and Emergency Vehicle Facilities Outdoor Sales Frontage and Lots Special Security Lighting for Retail Parking and Pedestrian Hardscape Student Pick-up/Drop-off zone Vehicle Service Station: Canopies, Hardscape, and Uncovered Fuel Dispenser ATM Machine Lighting	Temporary outdoor lighting Required and regulated by FAA Required and regulated by the Coast Guard. For public streets, roadways, highways, and traffic signage lighting, and occurring in the public right-of-way For sports and athletic fields, and children’s playground For industrial sites For public monuments Signs regulated by §130.3 and §140.8 For stairs and wheelchair elevator lifts For ramps that are not parking garage ramps Landscape lighting For themes and special effects in theme parks For outdoor theatrical and other outdoor live performances For qualified historic buildings

Other outdoor lighting applications that are not included in Energy Standards Tables 140.7-A or 140.7-B are assumed to be not regulated by these Standards. This includes decorative gas lighting and emergency lighting powered by an emergency source as defined by the California Electrical

Code. The text in the above list of lighting applications that are not regulated has been shortened for brevity. Please see Section 6.2.2.2 for details about unregulated lighting applications.

6.2.3 Outdoor Lighting Applications Not Regulated by §140.7

When a luminaire is installed only to illuminate one or more of the following applications, the lighting power for that luminaire shall be exempt from §140.7(a). Refers to the rightmost column of Table 6-1 for a quick reference to the lighting applications that are exempted. Also, the Energy Standards clarify that at least 50 percent of the light from the luminaire must fall within an application in order to qualify as being installed for that application.

6.3 Outdoor Lighting Zones

The basic premise of the Energy Standards is to base allowable outdoor lighting power on the brightness of the surrounding conditions. The Energy Standards contain lighting power allowances for new lighting installations and specific alterations that are dependent on the lighting zone in which the project is located.

Five categories of outdoor lighting zones are defined, and they are LZ0, LZ1, LZ2, LZ3 and LZ4. Lighting zones with lower numbers are darker from LZ0 which is in national parks and other areas intended to be very dark at night to LZ4 for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels. The eyes adapt to darker surrounding conditions and less light is required to properly see; when the surrounding conditions get brighter, more light is needed to see. Providing greater power than is needed potentially leads to debilitating glare and an increasing spiral of brightness as over-bright projects populate surrounding conditions causing future projects to unnecessarily require greater power resulting in wasted energy. The least power is allowed in Lighting Zone 1 and increasingly more power is allowed in Lighting Zones 2, 3, and 4. Lighting Zone 0 is intended for undeveloped spaces in parks and wildlife preserves and is very low ambient illumination.

The following summarizes the default locations for outdoor lighting zones as specified in §10-114:

- Lighting Zone 0 areas are undeveloped areas of government designated parks, recreation areas, and wildlife preserves;
- Lighting Zone 1 areas are developed portions of government designated parks, recreation areas and wildlife preserves;
- Rural areas are Lighting Zone 2;
- Urban areas are Lighting Zone 3;
- Lighting Zone 4 is a special use district that may be created by a local government through application to the Energy Commission.

Details of the options allowed under §10-114 are as follows:

A. Parks, Recreation Areas and Wildlife Preserves

The default for undeveloped portions of government designated parks, recreation areas, and wildlife preserves is Lighting Zone 0.

The default for developed portions of government designated parks, recreation areas, and wildlife preserves is Lighting Zone 1.

The local jurisdiction having authority over the property will know if the property is a government designated park, recreation area, or wildlife preserve. However, a Lighting Zone 2 designation can be adopted if the area is surrounded by rural areas (as defined by the U.S. Census Bureau). Similarly, when a park, recreation area, wildlife preserve, or portions thereof, are surrounded by urban areas (as defined by the U.S. Census Bureau), such areas may be designated as Lighting Zone 3 by adoption of the local jurisdiction. All adjustments in lighting zone designation must be reviewed by the CEC for approval.

B. Rural Areas

The default for rural areas as defined by the U.S. Census Bureau is Lighting Zone 2. However, local jurisdictions may designate certain areas as either Lighting Zone 3 or Lighting Zone 4 if it is determined that ambient lighting levels are higher than typical for a rural area. Examples of areas that might be designated Lighting Zone 3 are special commercial districts or areas with special security considerations. All adjustments in lighting zone designation must be reviewed by the CEC for approval.

Local jurisdictions also may designate default Lighting Zone 2 areas as Lighting Zone 1, which would establish lower lighting power for outdoor areas with lower surrounding brightness. An example of an area that might be changed to Lighting Zone 1 would include an underdeveloped, environmentally sensitive or predominately residential area within a default Lighting Zone 2 area.

C. Urban Areas

Lighting Zone 3 is the default for urban areas, as defined by the U.S. Census Bureau. Local jurisdictions may designate areas as Lighting Zone 4 for high intensity nighttime use, such as entertainment, commercial districts, or areas with special security considerations requiring very high light levels. All adjustments in lighting zone designation must be reviewed by the CEC for approval.

Local jurisdictions also may designate areas as Lighting Zone 2 or even Lighting Zone 1 if deemed appropriate.

Table 6-2: Lighting Zone Characteristics and Rules for Amendments by Local Jurisdictions

Zone	Ambient Illumination	Statewide Default Location	Moving Up to Higher Zones	Moving Down to Lower Zones
LZ0	Very Low	Undeveloped areas of government designated parks, recreation areas, and wildlife preserves.	Undeveloped areas of government designated parks, recreation areas, and wildlife preserves can be designated as LZ1 or LZ2 if they are contained within such a zone.	Not applicable
LZ1	Low	Developed portion of government designated parks, recreation areas, and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.	Developed portion of a government designated park, recreation area, or wildlife preserve, can be designated as LZ2 or LZ3 if they are contained within such a zone.	Not applicable.
LZ2	Moderate	Rural areas, as defined by the 2010 U.S. Census.	Special districts within a default LZ2 zone may be designated as LZ3 or LZ4 by a local jurisdiction. Examples include special commercial districts or areas with special security considerations located within a rural area.	Special districts and government designated parks within a default LZ2 zone maybe designated as LZ1 by the local jurisdiction for lower illumination standards, without any size limits.
LZ3	Moderately High	Urban areas, as defined by the 2010 U.S. Census.	Special districts within a default LZ3 may be designated as a LZ4 by local jurisdiction for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.	Special districts and government designated parks within a default LZ3 zone may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None	Not applicable.	Not applicable.

Energy Standards Table 10-114-A

6.3.1 Determining the Lighting Zone for an Outdoor Lighting Project

Permit applicants may determine the lighting zone for a particular property using the following steps:

- Local jurisdiction – Check with the local jurisdiction having authority over permitting of the property. The local jurisdiction will know if the property is a government designated park, recreation area, or wildlife preserve, and therefore in default Lighting Zone 0 or 1. The local jurisdiction also may know if the property is contained within the physical boundaries of a lighting zone for which a locally-adopted change has been made. However, verify through the CEC website whether or not a locally adopted change has been submitted to the Commission.

U.S. Census – The outdoor lighting zones of urban and rural areas as well as the legal boundaries of wilderness and park areas are based on the 2010 U.S. Census Bureau boundaries.

- Look at the U.S. Census website to determine if the property is within a rural (statewide default Lighting Zone 2) or urban (statewide default Lighting Zone 3) census block.
 - According to the US Census Bureau, there are two types of urban designations, Urbanized Areas (UAs) of 50,000 or more people and Urban Clusters (UCs) of at least 2,500 and less than 50,000 people. Furthermore, “Rural” encompasses all population, housing, and territory not included within an urban area.
 - There is an address search tool provided by the US Census Bureau. Enter the address to look up geography results indicating whether the entered address is urban or rural (under geography type).
(<http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=addr&refresh=t>)
 - A ‘Geography Results’ window will display a number of geographies within which the address is located. If you are in an urban area, one of the results will designate this; otherwise you are in a rural geography.
- Energy Commission website – Check CEC website to determine if the property is contained within the physical boundaries of a lighting zone that has been changed through a local jurisdiction adoption process.

Figure 6-2: Example of US Census Bureau Information

U.S. Department of Commerce
United States Census Bureau
AMERICAN FactFinder

Search - Use the options on the left (topics, geographies, ...) to narrow your search results

Your Selections
Your Selections is empty
load search | save search

Search using the options below:

- Topics (age, income, year, dataset, ...)
- Geographies (states, counties, places, ...)
- Race and Ethnic Groups (race, ancestry, tribe)
- Industry Codes (NAICS industry, ...)
- EEO Occupation Codes (executives, analysts, ...)

To search for tables and other files in American FactFinder:
Enter search terms and an optional geography and click GO

Select Geographies

Enter a street address, city and state, or a street address and ZIP code. Click 'Go'.

Note: address search will use the latest available address data beginning with 2014 and working backwards, based on the contents of 'Your Selections.'

street address: 1516 Ninth Street city: Sacramento state: California zip: GO

Geographies containing 1516 9th St, SACRAMENTO, CA, 95814:
Select geographies to add to Your Selections

Geography Results:

Geography Name	Geography Type	Geography Code
California	State	040
Sacramento County, California	County	050
Sacramento CCD, Sacramento County, California	County Subdivision	060
Block 1077, Block Group 1, Census Tract 11.01, Sacramento County, California	Block	100
Census Tract 11.01, Sacramento County, California	Census Tract	140
Block Group 1, Census Tract 11.01, Sacramento County, California	Block Group within Census Tract	150
Sacramento city, California	Place within State	160
Sacramento-Roseville-Arden-Arcade, CA Metro Area	Metro/Micro Statistical Area	310
Sacramento-Yolo, CA MSA	MSA/MSA	380
Sacramento, CA PMSA, Sacramento-Yolo, CA MSA	PMSA within CMSA	385
Sacramento, CA Urbanized Area (2010)	Urban Area	400
Congressional District 5 (111th Congress), California	Congressional District	500
Congressional District 6 (113th Congress), California	Congressional District	500
State Senate District 6 (2010), California	State Legislative District (Upper)	610
Assembly District 9 (2010), California	State Legislative District (Lower)	620
Voting Districts not defined, Sacramento County, California	Voting District Remainder	700

6.3.2 Lighting Zone Adjustments by Local Jurisdictions

§10-114

Energy Standards Table 10-114-A

The CEC sets statewide default lighting zones. However, jurisdictions (usually a city or county), may change the zones to accommodate local conditions. Local governments may designate a portion of Lighting Zones 2 or 3 as Lighting Zone 3 or 4. The local jurisdiction also may designate a portion of Lighting Zone 3 to Lighting Zone 2 or even Lighting Zone 1. When a local jurisdiction adopts changes to the lighting zone boundaries, it must follow a public process that allows for formal public notification, review, and comment about the proposed change. The local jurisdiction also must provide the CEC with detailed information about the new lighting zone boundaries and submit a justification that the new lighting zones are consistent with the specifications in §10-114.

The CEC has the authority to disallow lighting zone changes if it finds the changes to be inconsistent with the specification of §10-114 including Table 10-114-A.

6.3.3 Lighting Zone Examples of Using Physical Boundaries

Using metes and bounds is a good method to use for defining the physical boundaries of an adopted lighting zone.

Metes and bounds is a system that uses physical features of the local geography, along with directions and distances, to define and describe the boundaries of a parcel of land. The boundaries are described in a running prose style, working around the parcel of the land in sequence, from a beginning point and returning back to the same point. The term “metes” refers to a boundary defined by the measurement of each straight run, specified by a distance between the terminal points, and an orientation or direction. The term “bounds” refers to a more general boundary description, such as along a certain watercourse or public roadway.

The following examples use metes and bounds to define the physical boundaries of an adopted lighting zone:

- Properties with frontage on Kennedy Memorial Expressway, between First Avenue and Main Street to a depth of 50 ft. from each frontage property line.
- The area 500 ft. east of Interstate 5, from 500 ft. north of Loomis Ave to 250 ft. south of Winding Way.
- The area of the Sunrise Bike Trail starting at Colfax Avenue and going east to Maple Park, the width of a path which is from the edge of the South Fork of the American River on one side, to 100 ft. beyond the paved bike trail, or to private property lines, whichever is shorter, on the other side.
- The area that is bounded by the Truckee River on the West, Grizzly Lane on the south, Caddis Road on the east, and the boundary of Placer County on the north.

Note: The physical boundaries of a changed lighting zone are not required to coincide with the physical boundaries of a census tract.

Example 6-1 Changing the Default Lighting Zone

Question

I want to have the default outdoor lighting zone for a particular piece of property changed. How do I accomplish that?

Answer

Check with the local jurisdiction having authority over the property and ask them how to petition to have the default outdoor lighting zone officially adjusted.

6.4 Mandatory Requirements

The mandatory features and devices must be included in all outdoor lighting projects when they are applicable. Mandatory requirements for outdoor lighting are specified

in §110.9, §130.0, and §130.2. These are similar to the mandatory requirements for indoor lighting.

Even if the design has errors and has specified incorrect features and devices, the installer is responsible to meet all of the applicable requirements that he or she installs. The installer is also required to sign the appropriate Installation Certificate to verify correct installation. The Certificate of Acceptance document for outdoor lighting controls shall also be submitted to the local enforcement agency to prove the installed outdoor lighting controls pass the acceptance test.

6.4.1 Luminaire Cutoff Requirements

§130.2(b)

The 2019 Standards include a new threshold metric based on initial luminaire lumens for the BUG rating requirement. All outdoor luminaires that emit 6,200 lumens or greater must comply with Backlight, Uplight, and Glare ("BUG") requirements contained in Section 5.106.8 of the CalGreen Code (Title 24, Part 11).

The BUG ratings assume that the light emitted from the luminaire is providing useful illuminance on the task surfaces rather than scattering the light in areas where the light is not needed or intended, such as toward the sky. These BUG ratings also increase visibility because high amounts of light shining directly into observer's eyes are reduced, thus decreasing glare. Additionally, light pollution into neighbors' properties is reduced. The BUG requirements vary by outdoor lighting zones and outdoor lighting zones are described in Section 6.2.2.

Luminaire manufacturers are aware of the technical details of the BUG ratings and can typically provide to designers and contractors the BUG ratings for their luminaires. In the rare occasions where the luminaire manufacturer cannot provide the BUG rating, the BUG rating of the luminaire can be calculated with outdoor lighting software if the luminaire photometric data is available.

Luminaires are exempted from the BUG rating requirements for the following applications as these applications are desirable to project light sideways or upwards.

- Signs
- Lighting for building facades, public monuments, statues, and vertical surfaces of bridges
- Lighting required by a health or life safety statute, ordinance, or regulation that may fail to meet the uplight and glare limits due to application limitations
- Temporary outdoor lighting that does not persist beyond 60 consecutive days or more than 120 days per year.
- Replacement of existing pole mounted luminaires that are spaced more than 6 times the mounting height of the existing luminaires and the replacement luminaire wattage is less than the wattage of the original luminaires. In addition:
 - Where the existing luminaire does not meet the luminaire uplight and glare zonal lumen limits.

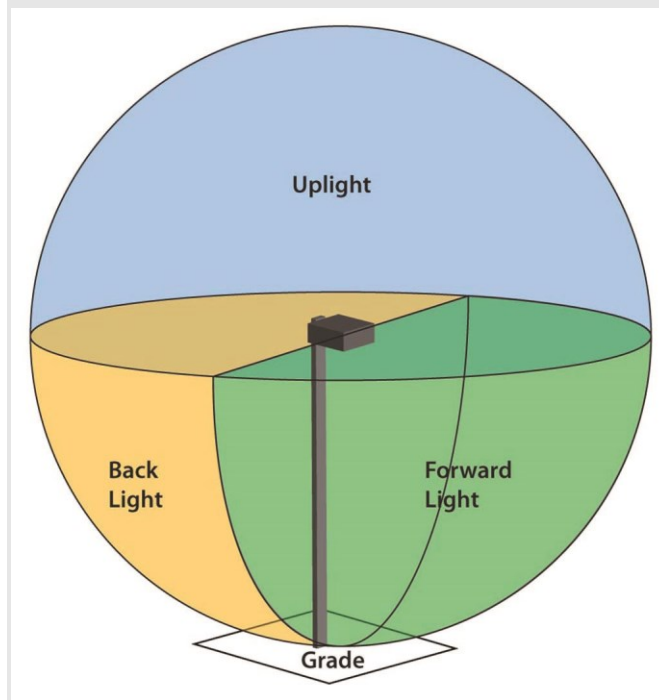
- Where no additional poles are being added to the site.
- Where new wiring to the luminaires is not being installed.
- Luminaires that are intended to light the right of way on publicly maintained roads, sidewalks, or bikeways.

Example 6-2 Luminaire Classification for Outdoor Luminaires**Question**

What is the IES BUG system for outdoor luminaires?

Answer

Illuminating Engineering Society (IES) published the technical memorandum 'Luminaire Classification for Outdoor Luminaires' in 2011 (TM-15-11). This document defines three-dimensional regions of analysis for exterior luminaires and further establishes zonal lumen limits for these regions as part of a larger method of categorizing outdoor lighting equipment into Backlight, Uplight, and Glare components. Collectively, the three components are referred to as the BUG system.



Luminaire Classification System for Outdoor Luminaires as defined in IES TM-15-11

Image Credit: From ANSI/IES RP-8-14 Roadway Lighting with permission from the Illuminating Engineering Society

The zonal lumen limits per secondary solid angles for uplight and glare are based upon the methodology found in TM-15. The lighting zone that the project is located in determines the maximum zonal lumens for both uplight and glare. There are no separate zonal lumen limits for the Backlight component in the Energy Standards, regardless of the lighting zone. This component is intended for property boundary conditions and is intended to help determine the suitability of specific products to mitigate light trespass and is therefore outside the purview of Title 24.

To comply with this mandatory measure, the luminaire must not exceed the maximum zonal lumen limits for each secondary solid angle region (within both the Uplight and Glare component) per lighting zone. The zonal lumen values in a photometric test report must include any tilt or other non-level mounting condition of the installed luminaire.

The BUG rating for luminaires may be determined with outdoor lighting software or by contacting the manufacturer. There is also software available to produce a BUG rating for a tilted luminaire condition (which is not a typical circumstance for most applications). Since the California BUG limits and calculation procedures match the IES, no deviation from the IES BUG rating is necessary.

Example 6-3 Wallpacks and Zonal Lumen Limits

Question

A new parking lot adjacent to a building is being designed to be illuminated by wall packs rated at 7,000 initial luminaire lumens. The wall packs are mounted on the side of the building and their main purpose is for parking lot illumination. But they are also illuminating the façade of the building. Do these wall packs have to meet the backlight, uplight and glare (BUG) rating limits?

Answer

Yes, these 7000-lumen wall packs will have to meet the BUG rating requirements because their main purpose is for parking lot illumination. Luminaire mounting methods or locations do not necessarily determine the purpose of the illumination. Define the function of the luminaire by determining what the majority of the light is striking. In the case of a typical wallpack, 80% or more of the light is likely striking the parking lot or sidewalk in front of the building, and only 20% or less on the façade, so BUG rating will be required for verification of the zonal limits.

Each luminaire must be appropriately assigned to the function area that it is illuminating, whether it is mounted to a pole, building, or other structure. Only luminaires that are rated less than 6,200 initial luminaire lumens are not required to meet the Backlight, Uplight and Glare (BUG) requirements in the Energy Standards.

Example 6-4 Tilted Luminaires meeting the BUG Requirements

Question

If a low BUG rating luminaire is mounted at a tilt does it still meet the BUG requirements?

Answer

It depends. Luminaires that meet the zonal lumen limits when mounted at 90° to nadir may or may not comply with the BUG rating limits when they are mounted at a tilt.

In order for a tilted luminaire to meet this requirement a photometric test report must be provided showing that the luminaire meets the zonal lumen limits at the proposed tilt. There are lighting design software available to produce a BUG rating for a tilted luminaire, or this can be provided by the manufacturer.

Example 6-5 Defining the Property Line for the Purpose of BUG Rating Compliance**Question**

Where is the property line if the area under construction is located next to a public road?

Answer

For property line that abuts a public roadway or transit corridor, the property line may be considered to be the centerline of the public roadway or transit corridor.

For property lines about public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line.

Example 6-6 Mounting Height from the Property Line**Question**

How are the BUG rating of a luminaire determined by mounting height from the property line?

Answer

If the luminaire is mounted more than 2 mounting heights away from the property line, then there is no limit on the backlight rating. Otherwise, for locations less than 2 mounting height away, the luminaire must meet backlight ratings listed in Table 5.106.8 (N).

For instance, a 6,600-lumen parking lot luminaire rated with a B2-U0-G1 BUG rating is installed on a 20-foot pole. If this luminaire is located 2 mounting heights (40 feet) away from the closest property line, it is acceptable for use in a lighting zone 2 (LZ2) or higher lighting zone (LZ3 or higher) location.

The luminaire lumen output and BUG ratings can be obtained from the manufacturer or may be calculated from photometric data.

6.4.2 Requirements for Outdoor Lighting Controls

§130.2(c)

The primary requirements for outdoor lighting controls are as follows:

1. **Lights Off During Daytime:** All outdoor lights shall be automatically controlled so that lights are turned off when daylight is available. [§130.2(c)1]
2. **Scheduling Controls:** All outdoor lights shall be automatically controlled by a time-based scheduling controls. [§130.2(c)2]
3. **Motion Sensing Controls:** Outdoor luminaires greater than 40 watts and mounted less than 24 ft. and above the ground shall be motion controlled, so that the lighting power of each luminaire shall be automatically reduced by at least 50 percent. This applies to luminaires providing general hardscape lighting, outdoor sales lot lighting, vehicle service station hardscape lighting, or vehicle service station canopy lighting. [§130.2(c)2]

Exceptions to all outdoor lighting controls. All lighting control requirements do not apply to any of the following lighting applications:

1. Lighting where a health or life safety status, ordinance, or regulation prohibits outdoor lighting to be turned OFF or reduced.
2. Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

Example 6-7 Circuiting of Non-outdoor Lighting Load**Question**

Can irrigation controllers be on the same power circuit as lighting?

Answer

Maybe, it depends.

If there is any outdoor lighting load on the same power circuit, the outdoor lighting load must be independently controlled from all other non-outdoor lighting loads.

More information of each lighting controls are laid out in the following sections.

A. Daylight Availability**§130.2(c) 1**

All installed outdoor lighting must be controlled by a photocontrol, astronomical time-switch control, or other controls that automatically turns off the outdoor lighting when daylight is available.

- A photocontrol measures the amount of ambient light outdoor and when the light level outside is high enough to indicate it is daytime, the control turns the lights off.
- Astronomical time clocks require an initial setup of the time clock device and the setup may include the entry of the current date and time (and time zone), site location (by longitude and latitude) and others (daylight saving time). The clock calculates sunrise and sunset times (which vary by factors such as day of the year), turns the lights off near sunrise and keeps them off until sunset.
- A part-night outdoor lighting control has a light sensor and a timing mechanism to control lights relative to measured sunrise and sunset times.

The appropriate product of astronomical time clocks or part-night outdoor lighting controls can be used for both daylight availability and scheduling control.

B. Automatic Scheduling Controls**§130.2(c) 2**

All installed outdoor lighting shall be controlled by an automatic scheduling control that reduces lighting power according to a schedule.

Further, automatic scheduling controls are required to have the capability of programming at least two nighttime periods (a scheduled occupied period and a scheduled unoccupied period) with different light levels (lighting power of 40 to 90 percent from full power) if desirable by the building design and operation. More than two nighttime periods are allowed for a building, as desirable for its activities or operations.

For the scheduled unoccupied period, the scheduling controls shall have the capability of reducing power between 50 percent and 90 percent and can also turn the lights off. Automatic scheduling controls are flexible to suit changes in building activities. If new activities warrant different operation schedules or different amounts of light is needed for the period, the building operator can adjust the settings of the automatic scheduling controls. The intent is to require the automatic scheduling controls to be capable of providing different amounts of outdoor lighting depending upon time of night. This also provides the capability to reduce lighting power when the outdoor space is not occupied or in use.

There are applications in which there are benefits to employ both motion sensing controls and automatic scheduling controls. It is the intent to allow both types for meeting the outdoor lighting control requirements. See example below.

Example 6-8 Using Automatic Scheduling Controls Plus Some Other Controls**Question**

Can motion sensing controls be used together with automatic scheduling controls?

Answer

Some applications require the installation of motion controls. For these applications, automatic scheduling controls are required in addition of motion sensing controls. During the occupied period, motion sensing controls can detect vacancy of an outdoor space and the controls can reduce the lights to a reduced state, per the initial setup.

Example 6-9 Using Automatic Scheduling Controls for Buildings of 24x7 operation**Question**

Is the automatic scheduling control requirement applicable to a building occupied 24 hours per day, seven days per week?

Answer

Yes, automatic scheduling controls are required for buildings that are occupied 24 hours per day, seven days per week.

Business activities can change over time as business models and hours of operation evolve. The required nighttime periods of a scheduled occupied period and a scheduled unoccupied period are decided by the building owner or the building operator, as appropriate, to suit the business needs.

Acceptance Tests Required for Automatic Scheduling Controls

Outdoor automatic scheduling controls are required to have acceptance test conducted to confirm the appropriate schedules are programmed and controls have been enabled. The acceptance test procedures are detailed in Reference Nonresidential Appendix NA7.8.7 and NA7.8.8. Refer to Section 6.6.5 of this manual for details about outdoor lighting controls acceptance test.

C. Motion Sensing Controls**§130.2(c) 3**

Outdoor luminaires greater than 40 watts, where the bottom of the luminaire is mounted 24 ft. or less above the ground, shall be operated with motion sensing controls if they are used in the following applications:

1. General hardscape lighting including parking lot lighting
2. Vehicle service station hardscape lighting and canopy lighting
3. Wall pack lighting installed for building façade, ornamental hardscape, or outdoor dining lighting

The motion sensing controls shall:

1. Be capable of reducing the lighting power of each luminaire by at least 50 percent and no more than 90 percent, and separately be capable of turning the luminaire off during unoccupied periods.
2. Be capable of reducing the lighting to the dim or off state within 15 minutes of vacancy detection and turning the lighting back on upon occupancy.
3. Control no more than 1,500 watts of lighting power by a single sensor.

Exceptions to All Motion Sensing Control Requirements

The motion control requirements do not apply to applications listed as exceptions to Section 140.7(a). These applications exempted from the motion controls requirements of Section 130.2(c)3 when more than 50 percent of the light fails in the application. The applications include temporary outdoor lighting, lighting for public roadways, and lighting for public monuments – the complete listing can be found in Section 140.7(a). A short version of the listing is also provided on the rightmost column of Table 6-1.

In addition, luminaires serving the following applications are not required to have motion sensing controls:

1. Lighting for Outdoor Sales Frontage, Building Facades, Ornamental Hardscape and Outdoor Dining;
2. Luminaires rated 40 watts or less;
3. Lighting subject to health or life safety statute, ordinance or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent.

Acceptance Tests Required for Motion Sensing Controls

Motion sensing controls are required to have an acceptance test conducted to confirm the sensor can sense activity within the detection zone and turn the lights to their occupied lighting power levels within the timeout period. The acceptance test procedures are detailed in Reference Nonresidential Appendix NA7.8.1 and NA7.8.2. Refer to Section 6.6.5 of this manual for details about outdoor lighting controls acceptance test.

6.4.3 Lighting Control Functionality

§110.9(b)

All installed lighting controls listed in §110.9(b) shall comply with the requirements listed below. In addition, all components of the system considered together as installed shall meet all applicable requirements for the application for which they are installed as required in §130.0 through §130.5, §140.6 through §140.8, §141.0, and §150.0(k).

Designers and installers are advised to review features of their specified lighting control products for meeting the requirements of Section 110.9(b) as part of the code compliance process.

A. Time-Switch Lighting Controls

Time-switch lighting control products shall provide the functionality listed in Section 110.9(b)1 of the Energy Code.

B. Daylighting Controls

Daylighting control products shall provide the functionality listed in Section 110.9(b)2 of the Energy Code.

C. Dimmer

Dimmer products shall provide the functionality listed in Section 110.9(b)3 of the Energy Code.

D. Occupant Sensing Controls

Occupant sensing control products (including occupant sensors, partial-ON occupant sensors, partial-OFF occupant sensors, motion sensors, and vacancy sensor controls) shall provide the functionality listed in Section 110.9(b)4 of the Energy Code.

One important functionality is the capability to automatically turn lights either off or down within 20 minutes after the area has been vacated.

EXCEPTION to the requirement: Occupant Sensing Control systems may consist of a combination of single or multi-level Occupant, Motion, or Vacancy Sensor Controls, provided that components installed to comply with manual-on requirements shall not be capable of conversion by occupants from manual-on to automatic-on functionality.

E. Part-Night Outdoor Lighting Controls

Part-night outdoor lighting control products shall provide the functionality listed in Section 110.9(b)5 of the Energy Code.

Example 6-10 Manufacturer Responsibility for Certified Controls

Question

What is the responsibility of the manufacturer with regard to using lighting control products that are certified by the CEC and listed in the Commission's directories?

Answer

It is the responsibility of the manufacturer to certify its lighting control products as required by the applicable California Appliance Efficiency Standards (also known as Title 20 Standards). The approved products will be listed in the CEC's directories or in an appliance efficiency database.

Example 6-11 Designer Responsibility for Certified Controls**Question**

What is the responsibility of the designer with regard to using lighting control products that are certified by the CEC and listed in the Commission's directories?

Answer

It is the responsibility of the designer to specify only lighting control products that have been certified and listed in Energy Commission directories.

Example 6-12 Installer Responsibility for Certified Controls**Question**

What is the responsibility of the installer with regard to using lighting control products that are certified by the CEC and listed in the Commission's directories?

Answer

It is the responsibility of the installer to only install lighting control products that are certified by the CEC and listed in the Commission's directories. It is also the responsibility of the installer to sign the Installation Certificate.

6.5 Prescriptive Measures

6.5.1 Outdoor Lighting Power Compliance

An outdoor lighting installation complies with the Energy Standards if the actual outdoor lighting power is no greater than the allowed outdoor lighting power. This section describes the procedures and methods for complying with §140.7.

The area of the lighting application must be defined exclusive of any areas on the site that are not illuminated.

The allowed lighting power is determined by measuring the area or length of the lighting application and multiplying this area (in W/ sq. ft.) or length (in W/sq. ft. by the Lighting Power Allowance (in W) to arrive the allowed lighting power. The allowed lighting power must be calculated for the general hardscape lighting of the site and for specific applications if desired. (See §140.7(d))

The allowed outdoor lighting power is calculated by lighting zone as defined in §10-114. Local governments may amend lighting zones in compliance with §10-114. See Section 6.4.1 for more information about amending outdoor ordinances by local jurisdictions.

The actual power of outdoor lighting is the total watts of all of the non-exempt lighting systems (including ballast, driver or transformer loss) (See §140.7(c)).

A. Maximum Outdoor Lighting Power

The Energy Standards establish maximum outdoor lighting power that can be installed. The allowed outdoor lighting power must be determined according to the outdoor lighting zone in which the site is located. See Section 6.4.1 for more information about outdoor lighting zones.

The wattage of outdoor luminaires must be determined in accordance with §130.0(c) or Reference Nonresidential Appendix NA8. See Section 5.3 for more information about determining luminaire wattage.

The total allowed lighting power is the combined total of all of the allowed lighting power layers. There are lighting power allowances for general hardscape lighting and lighting power allowances for specific applications. An outdoor lighting installation complies with the lighting power requirements if the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under §140.7(d) and complies with certain stipulations associated with specific special application allowances. The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with §140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with §140.7(d)2.

See Section 6.4.3 for a detailed explanation in determining the total allowed lighting power.

B. Illuminated Area

With indoor lighting applications, the entire floor area is considered to be illuminated for the purpose of determining the allowed lighting power. However, for outdoor lighting applications, the number of luminaires, mounting heights and layout affect the presumed illuminated area and therefore the allowed lighting power.

The area of the lighting application may not include any areas on the site that are not illuminated. The area beyond the last luminaire is considered illuminated only if it is located within 5 mounting heights of the nearest luminaire.

In plan view of the site, the illuminated area is defined as any hardscape area within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height, with the luminaire in the middle of the pattern. Another way to envision this is to consider an illuminated area from a single luminaire as the area that is 5 times the mounting height in four directions.

Illuminated areas shall not include any area that is obstructed by any other structure, including a sign, within a building, or areas beyond property lines.

The primary purpose for validating the illuminated area is to exclude any areas that are not illuminated. Areas that are illuminated by more than one luminaire shall not be double counted. An area is either illuminated or it is not illuminated.

When luminaires are located further apart (more than 10 times their mounting height apart), then the illuminated area stops at 5 times the mounting height of each luminaire.

Planters and small landscape areas are included within the general hardscape area as long as the short dimension of the inclusion is less than 10 ft. wide, and the inclusion is bordered on at least three sides.

Landscape areas that are greater than 10 ft. wide in the short dimension are excluded from the general hardscape area calculation, but the perimeter of these exclusions may be included in the linear wattage allowance (LWA) calculation.

6.5.2 General Hardscape Lighting Power Allowance

The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with §140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with §140.7(d)2.

A. Calculation of Allowed Lighting Power - General Hardscape Lighting Allowance

Hardscape is defined in §100.1 as an improvement to a site that is paved and has other structural features, including but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

General Hardscape lighting allowance = (Hardscape Area x AWA) + (Perimeter Length of Hardscape Area x LWA) + IWA

Determine the general hardscape lighting power allowances as follows:

1. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines, or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the Area Wattage Allowance (AWA) from Table 6-4 (Table 140.7-A) for the appropriate lighting zone.
2. Determine the perimeter length of the general hardscape area. The total hardscape perimeter is the length of the actual perimeter of the illuminated hardscape on the property. It shall not include portions of hardscape that are not illuminated according to §140.7(d)1A. Multiply the hardscape perimeter by the Linear Wattage Allowance (LWA) for hardscape from Table 6-4 (Table 140.7-A) for the appropriate lighting zone. Generally, if there is an enclosed

exclusion in the area AWA calculation, the perimeter may be included in the LWA calculation.

The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:

- a. Landscaped areas completely enclosed within the hardscape area, and with a width or length a minimum of 10 feet wide, shall have the perimeter of the landscaped areas or permanent planter added to the hardscape perimeter length.
 - b. Landscaped areas completely enclosed within the hardscape area, and with a width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
 - c. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.
3. Determine the Initial Wattage Allowance (IWA). The IWA is allowed to be used one time per site. The purpose is to provide additional watts for small sites, or for odd hardscape geometries. Add the IWA for general hardscape lighting from Table 6-4 (Table 140.7-A) for the appropriate lighting zone.

The general hardscape lighting allowance shall be the sum of the allowed watts determined from (1), (2) and (3) above.

(Refer to Figure 6-1 for a concept layout of the general hardscape lighting allowance for area, and perimeter, as well as initial wattage allowance.)

Table 6-3: General Hardscape Lighting Power Allowance

Type of Power Allowance	Lighting Zone 0³ Asphalt/Concrete	Lighting Zone 1³ Asphalt/Concrete	Lighting Zone 2³ Asphalt.	Lighting Zone 2³ Concrete ²	Lighting Zone 3³ Asphalt	Lighting Zone 3³ Concrete ²	Lighting Zone 4³ Asphalt/Concrete
Area Wattage Allowance (AWA)	No allowance ¹	0.018 W/sq. ft.	0.023 W/sq. ft.	0.025 W/sq. ft.	0.025 W/sq. ft.	0.03 W/sq. ft.	0.03 W/sq. ft.
Linear Wattage Allowance (LWA)	No allowance ¹	0.15 W/lf	0.17 W/lf	0.4 W/lf	0.25 W/lf	0.4 W/lf	0.35 W/lf
Initial Wattage Allowance (IWA)	No allowance ¹	180 W	250 W	250 W	350 W	350 W	400 W

¹ Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumen limits as specified in 130.2(b).

² Where greater than 50% of the paved surface of parking lot is finished with concrete. This does not extend beyond the parking lot and does not include any other General Hardscape area.

³ Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact, active professional astronomy or nocturnal habitat of special local fauna, shall be allowed a 2.0 lighting power allowance multiplier.

Table 140.7-A from the Energy Standards

The allowed lighting power for general hardscape lighting is calculated using the following components:

1. Area Wattage Allowance (AWA), which is the area of the illuminated hardscape, and is expressed in watts per sq. ft.
2. Linear Wattage Allowance (LWA), which is the length of the perimeter of the illuminated hardscape and is expressed in watts per linear foot.
3. Initial Wattage Allowance (IWA), which is a flat allowance for each property, and is expressed in watts.

To determine the total allowed power for general hardscape lighting, use the equation: (Hardscape area x AWA) + (Hardscape perimeter x LWA) + (IWA).

Example 6-13 Outdoor Lighting for Healthcare Facilities

Question

Is the parking lot outside of a healthcare facility ("I" occupancy) regulated by the Energy Standards?

Answer

Healthcare facilities overseen by the California Office of Statewide Health Planning and Development (OSHPD) have to comply with California Energy Standards including the outdoor lighting requirements for all outdoor areas of healthcare facilities. For outdoor lighting, a licensed healthcare facility has to meet the outdoor lighting power requirements as specified in Section 140.7, as well as the outdoor lighting control requirements in Section 130.2.

Example 6-14 Hardscape Materials for Parking Lots

Question

Our overflow parking lot is covered with gravel. Is this parking lot considered "hardscape," and must it comply with the Energy Standards?

Answer

Yes, parking lots covered with gravel, or any other material used to enhance the surface to accommodate parking or travel, such as pavers, asphalt, cement, or other pervious or non-pervious materials are considered hardscape and must comply with the requirements for hardscape areas.

Example 6-15 Power Allowance for a Parking Lot

Question

In a parking lot in front of a retail store, we are not using the full lighting power allowed according to Table 140.7-A. Can we use the remaining allowance to illuminate the building entrance and the walkways near the store to a higher level?

Answer

Yes. Because hardscape power densities are tradable, you may use the unused portion of the power allowance in the parking lot to increase the illumination levels for other lighting applications, including building entrance and walkway areas.

Example 6-16 Calculating the Illuminated Area of a Parking Lot**Question**

A parking lot is only illuminated from a series of 5 cut-off wall packs mounted on an adjacent building. The parking lot extends 100 ft. from the building. The luminaires are mounted at a height of 15 ft. above the ground and spaced 50 ft. apart. How large is the illuminated area?

Answer

The illuminated area extends a distance equal to 5 times the mounting height in three directions (the fourth direction is not counted because it is covered by the building). The illuminated area therefore extends from the building a distance of 75 ft. The total illuminated area is 75 ft. x 350 ft. or 26,250 sq. ft.

Example 6-17 Calculating the Illuminated Area**Question 1**

If a pole has a height of 15 ft., what are the dimensions of the square pattern used for power calculations?

Answer 1

The illuminated area is defined as any area within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height, with the luminaire in the middle of the pattern. It does not include any area that is within a building, under a canopy, beyond property lines, or obstructed by a sign or structure. Therefore, for a 15 ft. pole, the area will be described by a square that is 150 ft. (15 ft. x 10) on each side, or 22,500 sq. ft. (150 ft. x 150 ft.), minus areas that are beyond the property line or other obstructions.

Question 2

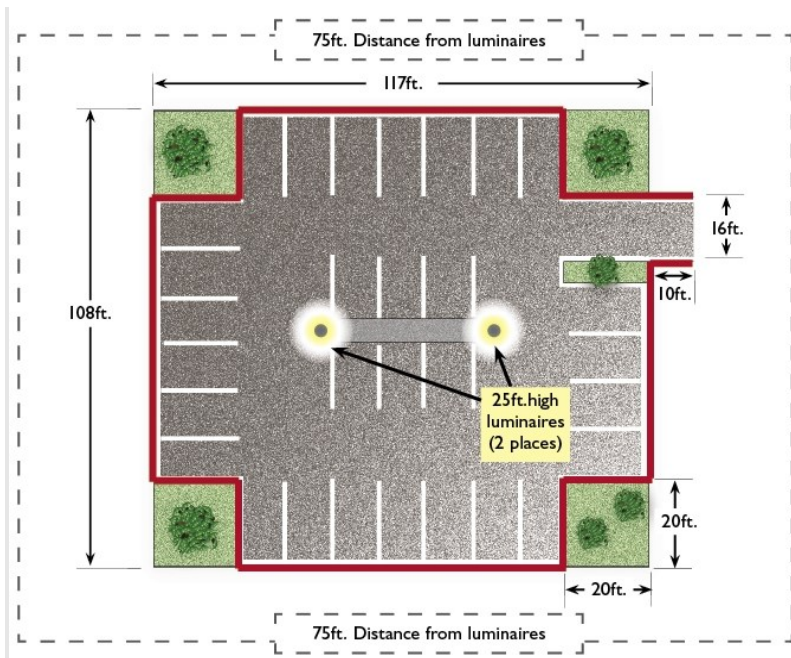
If two poles in the center of an illuminated area are separated by a distance greater than 10 times the mounting height, will all of the square footage between them be included in the area?

Answer 2

In most applications, such as parking lots, these square patterns will typically overlap, so the entire area of the parking lot between poles will typically be included when determining the lighting power budget. However, if the poles are so far apart that they exceed 10 times the mounting height of the luminaires on the poles, and the coverage squares do not overlap, then the non-illuminated areas between poles cannot be included in determining illuminated hardscape area.

Example 6-18 Calculating the Power Allowance for a Parking Lot**Question**

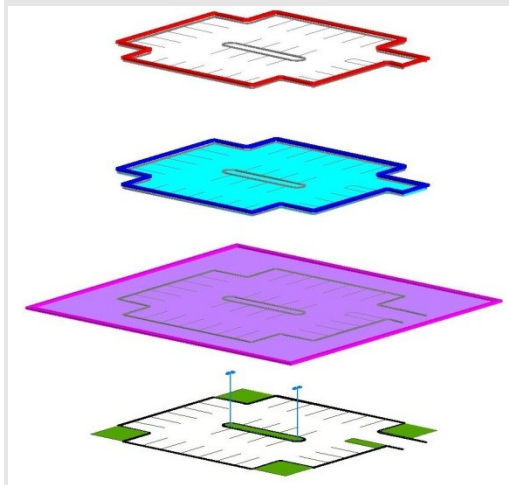
The parking lot with concrete surface as illustrated below has two luminaires that are mounted at a height of 25 ft. What is the illuminated hardscape area and what is the allowed lighting? The lot is located in Lighting Zone 3.



Poles are 40 ft. apart

Answer

The poles are 40 ft. apart, and using the 10 times mounting height rule, the illuminated area can be as large as 250 ft. by 290 ft. The boundary of this maximum illuminated area extends beyond the edges of the parking lot as well as the entrance driveway, so the entire paved area is considered illuminated. The landscaped island in middle and peninsula below the entrance driveway are less than 10 ft. wide, so they are included as part of the illuminated area, but not part of the hardscape perimeter. The landscaped cutouts (20 x 20 ft.) in the corners of the parking lot are bound by pavement on only two sides so they are not included. The total paved area is 11,196 sq. ft. $[(12,636 \text{ sq. ft.} + 160 \text{ sq. ft. (driveway)} - 1,600 \text{ sq. ft (cutouts)})]$. The perimeter of the hardscape is 470 ft. $[(2 \times 77 \text{ ft.}) + (2 \times 68 \text{ ft.}) + (8 \times 20 \text{ ft.}) + (2 \times 10 \text{ ft.})]$.



Perimeter

Area

Illuminated Area

Site Plan

Three allowances make up the total power allowance: Area, Linear, and Initial. All allowances are based on a concrete surface of Lighting Zone 3 and found in Table 6-4 (Table 140.7-A of the Energy Standards).

The area wattage allowance is equal to 335.9 W.

The linear wattage allowance is equal to 188 W.

The initial wattage allowance (IWA) is 350 W for the entire site.

The sum of these three allowances gives a total wattage allowance for the site of 873.9 W.

The calculation can also be tabulated as below.

<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Initial	350 W	-	350 W
Area	0.03 W/sq. ft.	11,196 sq. ft.	336 W
Perimeter	0.4 W/LF	470 ft.	188 W
TOTAL POWER ALLOWANCE			874 W

Example 6-19 Calculating the Illuminated Area of a Parking Lot

Question

In the parking lot layout shown above, what would the illuminated area be and what would the maximum allowed lighting power be if much smaller pedestrian style poles were used at 8 ft. high and placed 30 ft. apart?

Answer

If the mounting height is reduced to 8 ft., and the spacing to 30 ft. (and using the 10 times mounting height rule), the illuminated area can be a rectangle as large as 80 ft. by 110 ft. The hardscape area that intersects the maximum allowed illuminated area is now 8,524 sq. ft. $[(80 \text{ ft.} \times (80 \text{ ft.} + 30 \text{ ft.}) - 2 \times (6 \text{ ft.} \times 6 \text{ ft. cutouts}) - 2 \times (6 \text{ ft.} \times 17 \text{ ft. cutouts})]$. The new hardscape perimeter is 380 ft. $[(2 \times 88 \text{ ft.}) + (2 \times 68 \text{ ft.}) + (4 \times 6 \text{ ft.}) + (2 \times 16 \text{ ft.})]$.

Using the same allowances as in the previous example, the total wattage allowance for the site is 993.96 W (340.96 area W + 133 perimeter W + 520 initial W).

<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Initial	520W	-	520 W
Area	0.040 W/ sq. ft.	8524 sq. ft.	341 W
Perimeter	0.35 W/LF	380 ft.	133 W
TOTAL POWER ALLOWANCE			994 W

Example 6-20 Calculating the Power Allowance for a Roadway

Question

A 300 ft. long, 15 ft. wide roadway leads through a wooded area to a hotel entrance in Lighting Zone 2, and the owner wants to light the roadway with luminaires mounted at a height of 20 ft. What is the allowed lighting power for this roadway with asphalt surface?

Answer

The hardscape area for the roadway must first be calculated. If the entire roadway will be lit, then the 20 ft. poles will not be spaced more than 200 ft. apart and not more than 100 ft. from the ends of the roadway.

(Lighted area is 10 times the pole height.) The hardscape area therefore is 15 ft. x 300 ft. or 4500 sq. ft. The linear perimeter of this hardscape is the sum of the sides (not including the side that connects to the larger site) 300 ft. + 15 ft. + 300 ft. or 615 ft.

Three allowances make up the total power allowance: Area, Linear, and Initial. However, the initial wattage allowance applies one time to the entire site. It is not considered for usage for this roadway piece which would only be one small part of the site. All allowances are based on an asphalt surface in Lighting Zone 2 and can be found in Table 6-4 (Table 140.7-A of the Energy Standards).

The area wattage allowance is equal to 103.5 W.

The linear wattage allowance is equal to 104.6 W.

The sum of these allowances gives a total wattage allowance for the roadway of 208.1 W.

The calculation can also be tabulated as below.

<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Initial	250W	-	not used
Area	0.023 W/sq. ft	4500 sq. ft.	103.5 W
Perimeter	0.17 W/LF	615 ft.	104.6 W
TOTAL POWER ALLOWANCE			208.1 W

B. Calculation of Allowed Lighting Power - Narrow Band Spectrum Light Source Applications

The 2019 Standards includes a lighting power provision for narrow band spectrum light source application to minimize the impact of electric light on local, active professional astronomy or nocturnal habitat of specific local fauna. The provision is in the format of lighting power multiplier as specified on the footnote of Table 140.7-A (footnote 3) which reads, "Footnote 3: Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna, shall be allowed a 2.0 lighting power allowance multiplier."

Example 6-21 Calculating the Illuminated Area of a Parking Lot

Question

The lighting system for an asphalt parking lot in Lighting Zone 2 is being designed next to an active, professional astronomical observatory. The parking lot is 800 sq. ft. with a perimeter of 280 linear feet. All lighting within 10 miles of the observatory is required by a local ordinance to use a narrow band spectrum light source with a wavelength above 580 nm to be compatible within the telescopes' ability to filter out stray light while capturing most of the wavelengths of light from the night sky. Spectral power distributions of two amber light sources are shown in the two images in Figure 6-21a.

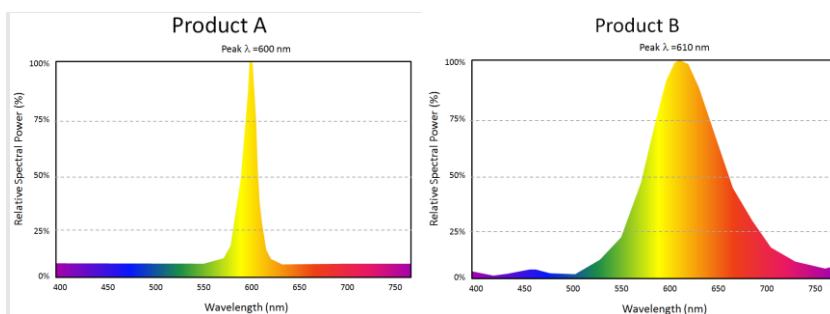


Figure 6-21a Spectral Distribution of Light Source Product A and B

Question 1: Which of these products meet criteria for “narrow band spectrum” light sources?

Question 2: What is the allowed lighting power for this parking lot with and without the use of a narrow band spectrum light source?

Answer

Answer 1: Narrow band spectrum light sources are those which have a spectral power distribution closely distributed around the wavelength of peak spectral power. There are no spectral power limitations on the wavelengths that are within 20 nm of the peak wavelength. As the spectrum diverges from the peak wavelength, the allowed relative spectral power declines rapidly.

Between 20 to 75nm from peak wavelength, the spectral power shall be no greater than 50% of the peak spectral power.

Beyond 75 nm the spectral power shall be no greater than 10% of the peak spectral power. This distribution is reflected in the narrow band spectrum criteria line centered around the peak wavelength in Figure 6-21b.

As shown in the figure, Product A is a narrow band spectrum light source as it fits within the spectral power criteria, whereas Product B does not comply as the spectral power exceeds the narrow band criteria.

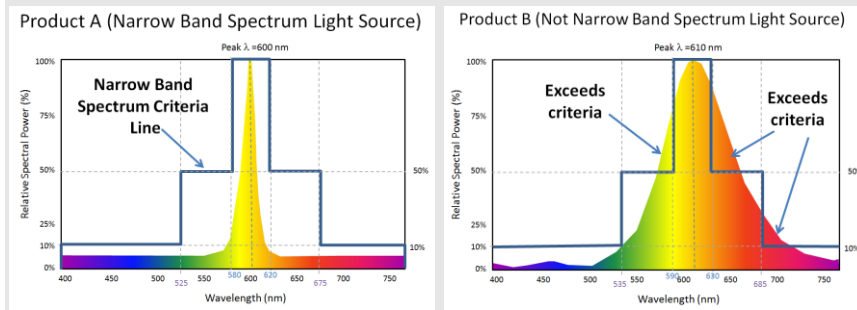


Figure 6-21b Spectral Distribution with Narrow Band Criteria Superimposed

Answer 2: To claim the two times multiplier for narrow band spectrum light sources, as described in footnote 3 to Table 140.7-A, the project has to comply with all three of the following criteria:

1. The light source has to have a narrow band spectrum (true for product A).
2. The dominant peak wavelength has to be greater than 580 nm (true for product A with a peak wavelength of 600 nm).
3. The narrow band spectrum and dominant peak wavelength of the light source has to be greater than 580 nm as mandated by local, state, federal agencies, to minimize the impact on local, active professional astronomy or on the nocturnal habitat of specific local fauna. (The credit is not available unless the ordinance specifically calls out a requirement for a narrow band spectrum.)

The allowed wattage without the narrow spectrum multiplier calculated as follows:

Allowed Wattage = (Area Wattage Allowance) x (Area, sq. ft.) + (Linear Wattage Allowance) x (Perimeter Length, linear ft.) + (Initial Wattage Allowance)

The asphalt parking lot is 800 sf with a perimeter of 280 linear feet and is in Lighting Zone 2. From Table 140.7-A in the asphalt column of Lighting Zone 2, the power allowance factors are:

Area Wattage Allowance = 0.023 W/sq. ft., Linear Wattage Allowance = 0.17 W/lf, and Initial Wattage Allowance = 250 Watts.

Allowed Wattage = (0.023 W/sq. ft) x (800 sq. ft.) + (0.17 W/lf) x (280 lf) + (250 W) = 316 Watts

If the design makes use of narrow band light sources and meets all three criteria of footnote 3 to table 140.7-A, the allowed wattage is allowed a 2.0 lighting power allowance multiplier.

Narrow Band Allowed Wattage = Allowed Wattage x 2 = 316 Watts x 2 = 632 Watts.

Example 6-22 Low Blue Content Light Source Design

Question

A lighting system is being designed for a similar parking lot as in Example 6-21 except that it is next to a wildlife refuge and all outdoor lighting near the refuge is required by a local ordinance to use low blue content light sources to minimize the lighting impact on nocturnal animals.

If the designer specifies a narrow band spectrum light source (such as Product A in Example 6-21), can the designer make use of the narrow band spectrum lighting power allowance multiplier in determining the lighting power allowance?

Answer:

To claim the two-times multiplier for narrow band spectrum light sources, as described in footnote 3 to Table 140.7-A, the project must comply with all three of the following criteria:

1. The light source has to have a narrow band spectrum.
2. The dominant peak wavelength has to be greater than 580 nm.
3. The narrow band spectrum and dominant peak wavelength of the light source be greater than 580 nm, as mandated by local, state, federal agencies to minimize the impact on local, active professional astronomy or on the nocturnal habitat of specific local fauna (The credit is not available unless the ordinance specifically calls out a requirement for a narrow band spectrum.)

For this example, the narrow band spectrum credit is not available since the local ordinance called for low blue light content without specifying this had to be accomplished with narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm. As a result, the two-times multiplier for narrow band spectrum light sources cannot be used in calculating the lighting power allowance for this project.

6.5.3 Additional Light Power Allowances and Requirements, by Application

The lighting power for Specific Applications provides additional lighting power that can be layered in addition to the General Hardscape lighting power allowances as applicable.

Most of a site will be classified as 'General Hardscape' and will be calculated using Table 6-4 (Table 140.7-A of the Energy Standards) as the only source of allowance.

Some portions of the site may fit use categories that permit the inclusion of an additional lighting allowance for that portion of the site. These Specific Applications are detailed in Table 6-5 (Table 140.7-B of the Energy Standards). Not all of these allowances are based on area.

The single exception to this is the allowance for Hardscape Ornamental Lighting, which is calculated independent of the rest of the Specific Applications, and no regard to the overlap of this Application is made. See Section E for more information about the Hardscape Ornamental Lighting allowance.

Table 6-4: Additional Lighting Power Allowance for Specific Applications

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Building Entrances or Exits. Allowance per door. Luminaires must be within 20 feet of the door.	Not applicable	15 watts	25 watts	35 watts	45 watts
Primary Entrances to Senior Care Facilities, Police Stations, Healthcare Facilities, Fire Stations, and Emergency Vehicle Facilities. Allowance per primary entrance(s) only. Primary entrances are entrances that provide access for the general public. This allowance is in addition to the	Not applicable	20 watts	40 watts	57 watts	60 watts

building entrance or exit allowance above. Luminaires must be within 100 feet of the primary entrance.					
Drive Up Windows. Allowance per customer service location. Luminaires must be within 2 mounting heights of the sill of the window.	Not applicable	16 watts	30 watts	50 watts	75 watts
Vehicle Service Station Uncovered Fuel Dispenser. Allowance per fueling dispenser. Luminaires must be within 2 mounting heights of the dispenser.	Not applicable	55 watts	77 watts	81 watts	135 watts
ATM Machine Lighting. Allowance per ATM machine. Luminaires must be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM machine, 35 watts for each additional ATM machine.	100 watts for first ATM machine, 35 watts for each additional ATM machine	100 watts for first ATM machine, 35 watts for each additional ATM machine	100 watts for first ATM machine, 35 watts for each additional ATM machine
Lighting Application WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft.). May be used for one or two frontage side(s) per site.	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Outdoor Sales Frontage. Allowance for 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. Luminaires must be located between the principal viewing location and the frontage outdoor sales area.	Not applicable	No Allowance	11 W/linear ft.	19 W/linear ft.	25 W/linear ft.
Lighting Application WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/sq. ft.). May be used for any illuminated hardscape area on the site	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires must be rated for 100 watts or less and be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	Not applicable	No Allowance	0.007 W/sq. ft.	0.013 W/sq. ft.	0.019 W/sq. ft.
Lighting Application WATTAGE ALLOWANCE PER SPECIFIC AREA (W/sq. ft.). May be used as appropriate provided that only one is used for a given area (i.e., provided that two allowances are not applied to the same area).	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Building Facades. Only areas of building façade that are illuminated qualify for this allowance. Luminaires	Not applicable	No Allowance	0.100 W/sq. ft.	0.170 W/sq. ft.	0.225 W/sq. ft.

must be aimed at the façade and capable of illuminating it without obstruction or interference by permanent building features or other objects.					
Outdoor Sales Lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas are considered hardscape areas even if these areas are completely surrounded by sales lots on all sides. Luminaires must be within 5 mounting heights of the sales lot area.	Not applicable	0.060 W/sq. ft.	0.210 W/sq. ft.	0.280 W/sq. ft.	0.485 W/sq. ft.
Vehicle Service Station Hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. 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.	Not applicable	0.006 W/sq. ft.	0.068 W/sq. ft.	0.138 W/sq. ft.	0.200 W/sq. ft.
Vehicle Service Station Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	0.220 W/sq. ft.	0.430 W/sq. ft.	0.580 W/sq. ft.	1.010 W/sq. ft.
Sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires must be located under the canopy.	Not applicable	No Allowance	0.470 W/sq. ft.	0.622 W/sq. ft.	0.740 W/sq. ft.
Non-sales Canopies and Tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires must be located under the canopy or tunnel.	Not applicable	0.057 W/sq. ft.	0.137 W/sq. ft.	0.270 W/sq. ft.	0.370 W/sq. ft.
Guard Stations. Allowed up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentations, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting height of a vehicle lane or the guardhouse.	Not applicable	0.081 W/sq. ft.	0.176 W/sq. ft.	0.325 W/sq. ft.	0.425 W/sq. ft.
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off, with or without canopy, for preschool through 12 th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are	Not applicable	No Allowance	0.056 W/sq. ft.	0.200 W/sq. ft.	No Allowance

picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.					
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	Not applicable	0.004 W/sq. ft.	0.030 W/sq. ft.	0.050 W/sq. ft.	0.075 W/sq. ft.
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for 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.	Not applicable	0.004 W/sq. ft.	0.005 W/sq. ft.	0.010 W/sq. ft.	No Allowance

Table 140.7-B from the Energy Standards

Assigned lighting applications must be consistent with the actual use of the area. Outdoor lighting definitions in §100.1 must be used to determine appropriate lighting applications.

Specific Applications that are based on specific instances on the site are the cumulative total of those instances on the site, with the allowance being accumulated per instance.

Specific Applications that are based on the length of an instance on the site are calculated by multiplying the total length of the instance by the allowance per linear foot for the Application.

A. General Hardscape Power Trade-Offs

Allowed lighting power determined according to §140.7(d)1 for general hardscape lighting may be traded to specific applications in §140.7(d)2, as long as the hardscape area from which the lighting power is traded continues to be illuminated in accordance with §140.7(d) 1A.

B. Specific Allowances Power Trade-Offs Not Allowed

Allowed lighting power for specific applications shall not be traded between specific applications, or to hardscape lighting in §140.7(d)1. This means that for each and every specific application, the allowed lighting power is the smaller of the allowed power determined for that specific application according to Table 140.7-B, or the actual installed lighting power that is used in that specific application.

C. Wattage Allowance per Application

The applications in this category are provided with additional lighting power, in watts (W) per instance, as defined in Table 6-5 (Table 140.7-B of the Energy

Standards). Use all that apply as appropriate. Wattage allowances per application are available for the following areas:

- Building entrances or exits.
- Primary entrances of senior care facilities, police stations, healthcare facilities, fire stations, and emergency vehicle facilities.
- Drive-up windows. See Section 6.4.5F for additional information about drive-up windows
- Vehicle service station uncovered fuel dispenser. See Section 6.4.5C for additional information about vehicle service stations.
- ATM machine lighting

D. Wattage Allowance for Outdoor Sales Frontage Application

The wattage allowance per linear foot is available only for outdoor 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. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor. The outdoor sales frontage allowance is calculated by multiplying the total length of qualifying sales frontage by the outdoor sales frontage lighting allowance in Table 6-5 (Table 140.7-B of the Energy Standards). See Section 6.4.5B for additional information about sales frontage.

E. Wattage Allowance per Hardscape Ornamental Lighting Application

The ornamental lighting allowance on the site is calculated by multiplying the total illuminated hardscape for the site by the hardscape ornamental lighting allowance in Table 6-5 (Table 140.7-B of the Energy Standards), in watts per square foot (W/ft^2). Luminaires qualifying for this allowance shall be rated for 100 W or less as determined in accordance with §130.0(c), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers. This additional wattage allowance may be used for any illuminated hardscape area on the site. See Section 6.4.5E, Ornamental Lighting, for additional information about ornamental lighting.

F. Wattage Allowance per Specific Area

Applications in this category are provided with additional lighting power, in watts per square foot ($W/ sq. ft.$), as defined in Table 140.7-B of the Energy Standards (Table 6-5). Wattage allowances per specific area are available for the following areas:

1. Building Facades

Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects. See Section 6.4.5A for additional information about building facades.

2. Outdoor Sales Lots

Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas shall be considered hardscape areas, not outdoor sales lots, even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within 5 mounting heights of the sales lot area. See 6.4.5B for more information.

3. Vehicle Service Station Hardscape

Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.

4. Vehicle Service Station Canopies

Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy. See Section 6.4.5C for additional information about vehicle service stations.

5. Sales Canopies

Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy. See Section 6.4.5D for additional information about lighting under canopies.

6. Non-sales Canopies and Tunnels

Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel. See Section 6.4.5D for additional information about lighting under canopies.

7. Guard Stations

Allowance up to 1,000 sq. ft. per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse. See Section 6.4.5G for additional information about guarded facilities.

8. Student Pick-up/Drop-off zone

Allowance for the area of the student pickup/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 ft., multiplied by the smaller of the actual length or 250 ft. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.

9. Outdoor Dining

Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.

10. Special Security Lighting for Retail Parking and Pedestrian Hardscape

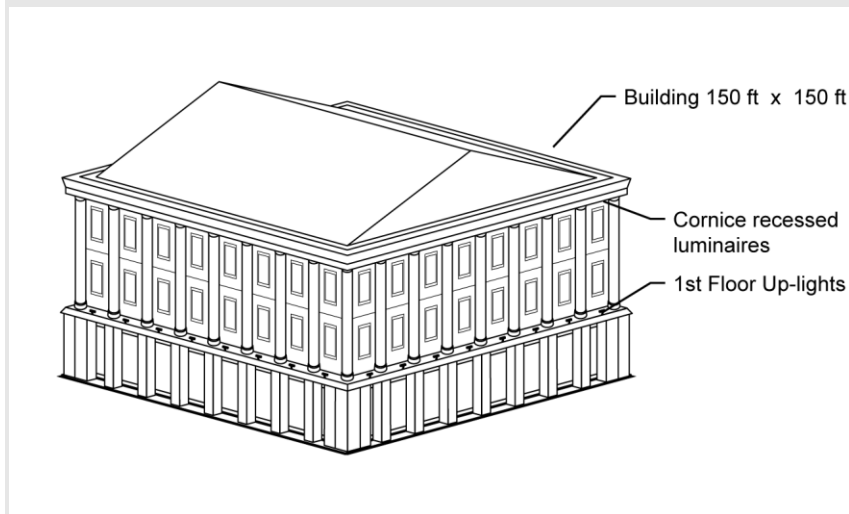
This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.

6.5.4 Further Discussion about Additional Lighting Power Allowance for Specific Applications

A. Building Facades

Building façade is defined in §100.1 as the exterior surfaces of a building, not including horizontal roofing, signs, and surfaces not visible from any public viewing location. Only areas of building façade that are illuminated should qualify for this allowance. Luminaires qualifying for this allowance should be aimed at the façade and should be capable of illuminating it without obstruction or interference by permanent building features or other objects.

Building façades and architectural features may be illuminated by flood lights, sconces or other lighting attached to the building. Building façade lighting is not permitted in Lighting Zone 0 and Lighting Zone 1. Façade orientations that are not illuminated and façade areas that are not illuminated because the lighting is obstructed shall not be included. General site illumination, sign lighting, and/or lighting for other specific applications can be attached to the side of a building and not be considered façade lighting. Wall packs mounted on sides of the buildings are not considered façade lighting when most of the light exiting these luminaires lands on areas other than the building façade.

Example 6-23 Calculating the Allowance for a Projected Area**Question**

(Lighting Zone 3) A city wants to illuminate its city hall on two sides (two façades). The structure is a three-story building with a colonnade on the second and third floors and a cornice above. The columns are considered important architectural features and the principal goal of the lighting project is to highlight these features. The columns are 30 ft. tall x 3 ft. in diameter and are spaced at 8 ft. For the purposes of determining the lighting power allowance for the building, what is the surface area to be illuminated? What is the lighting power allowance? The columns will be illuminated by downlights at the cornice and uplights above the first floor.

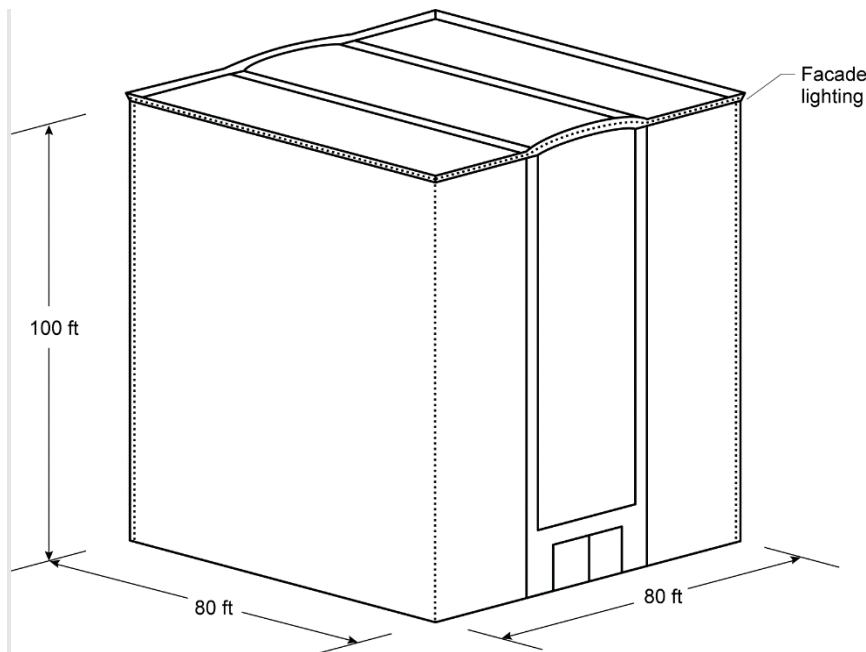
Answer

The area of the façade for the purposes of calculating the lighting allowance is the projected area of the illuminated façade. Architectural features such as columns, recesses, facets, etc. are ignored. The illuminated area for each façade is therefore 30 ft. x 150 ft. or 4,500 sq. ft. The façade allowance for Lighting Zone 3 is 0.17 W/sq. ft., so the total power allowed is 765 W per façade, or 1,530 W total.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Facade	0.17 W/ sq. ft.	^{B.} 4,500 sq. ft.	765 W per facade
TOTAL POWER ALLOWANCE			1,530 W

Example 6-24 Permanent vs. Temporary Façade Lighting**Question**

I am designing a high-rise building and permanently mounted marquee lights will be installed along the corners of the building. The lights will be turned on at night, but only for the holiday season, roughly between mid-November and mid-January. The lights consist of a series of 7 W LED luminaires spaced at 12 inches on-center (OC) along all the corners of the building and along the top of the building. Essentially, the lights provide an outline of the building. For the purposes of the Outdoor Lighting Standards, are these considered façade lighting? Because they will only be used for about two months of the year, are they considered temporary lighting and exempt?

**Answer**

The lighting is permanent lighting and must comply with the Energy Standards. Temporary lighting is defined in §100.1 as is a lighting installation with plug-in connections that does not persist beyond 60 consecutive days or more than 120 days per year. Anything that is permanently mounted to the building is considered permanent lighting, and the hours of intended use do not affect its status as permanent lighting.

Because this lighting is primarily used to accent the architectural outline of the building, it may be considered façade lighting. And because all corners of the building are illuminated, all four facades may be considered to be illuminated. The area on each façade is 80 ft. x 100 ft. or 8,000 sq. ft. The total illuminated area is four times 8,000 sq. ft. or 32,000 sq. ft. The Lighting Zone 3 allowance for façade lighting is 0.17 W/sq. ft. and the total power allowance for façade lighting is 5,440 W.

There are 100 ft. x 4 plus 80 ft. x 4 lamps (a total of 720 luminaires) on the building. Each luminaire is 7 W. The installed power is 720 luminaires times 7 W/luminaire or 5,040 W. The installed power is less than the allowance, so the façade lighting complies. If this building were in Lighting Zone 2, the allowance would be 0.1 W/sq. ft. or a total of 3,200 W. The lighting design would not comply in Lighting Zone 2.

<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Facade	0.17 W/ sq. ft.	32,000 sq. ft.	5,440 W
TOTAL POWER ALLOWANCE			5,440 W

Example 6-25 Power Allowance for Facades

Question

Portions of the front façade of a proposed wholesale store in Lighting Zone 3 are going to be illuminated. The front wall dimensions are 120 ft. by 20 ft. There is 250 ft.² of fenestration in the front wall that is illuminated by the façade lighting. Signs cover another 500 ft.² of the front wall, and another 400 sq. ft. is not illuminated at all. What is the allowed front façade lighting power?

Answer

The gross wall area is 2,400 sq. ft. (120 x 20). However, we must subtract all those areas that are not illuminated. Note that because the 250 sq. ft. of fenestration is intended to be illuminated by the façade lighting, this area may be included in the total area eligible for power calculations.

The areas not eligible for power calculations include:

500 sq. ft. of signs + 400 sq. ft. of unlighted façade = 900 sq. ft.

Net wall area used for façade lighting: 2,400 sq. ft. – 900 sq. ft. = 1,500 sq. ft.

From Table 6-5 (Table 1407-B of the Energy Standards), the allowed façade lighting power density in Lighting Zone 3 is 0.17 W/ sq. ft.

The calculated allowed power based on net wall area is 1,500 sq. ft. x 0.17 W/ sq. ft. = 255 W.

The allowed power is therefore the smaller of actual wattage used for façade lighting or 255 W.

<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Facade	0.17 W/ sq. ft.	1,500 sq. ft.	255 W
TOTAL POWER ALLOWANCE			255 W

Example 6-26 Sign Lighting

Question

Is sign lighting part of my façade lighting?

Answer

The sign area must be subtracted from the façade area so that the area is not double counted. The sign lighting must meet the requirements of the Energy Standards for sign lighting. See Chapter 7 for more information about sign lighting.

Example 6-27 Ornamental vs. Façade Lighting**Question**

Is the lighting of my parapet wall with small wattage decorative lighting considered ornamental or façade lighting?

Answer

In this example, the lamps attached to the building façade are considered façade lighting. This cannot be considered ornamental lighting because ornamental lighting is defined in Table 140.7-B of the Energy Standards as post-top luminaires, lanterns, pendant luminaires, chandeliers.

Example 6-28 Hardscape vs. Façade Lighting**Question**

If I mount a luminaire on the side of my building to illuminate an area is it considered façade lighting or hardscape lighting?

Answer

It depends on the primary intent of the luminaire. For example, if the luminaire is primarily illuminating the walls (such as a sconce), then it should be considered part of the building façade lighting. If on the other hand, the luminaire is primarily illuminating the parking lot beyond (most wall packs), then it should be part of the hardscape lighting. It should be noted that lighting power tradeoffs are not allowed between building façade and hardscape areas.

C. Sales Frontage

This additional allowance is intended to accommodate the retailers need to highlight merchandise to motorists who drive by their lot. Outdoor sales frontage includes car lots but can also include any sales activity.

Outdoor sales frontage must be 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. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor. The outdoor sales frontage allowance is calculated by multiplying the total length of qualifying sales frontage by the outdoor sales frontage lighting allowance in Table 147-B of the Energy Standards.

When a sales lot qualifies for the sales frontage allowance, the total sales lot wattage allowance is determined by adding the following three layers:

- General hardscape lighting power allowance
- Outdoor sales frontage
- Outdoor sales lot

D. Vehicle Service Stations

According to the definition in §100.1, vehicle service station is a gasoline, natural gas, diesel, or other fuel dispensing station. In addition to allowances for building entrances and exits, hardscape ornamental lighting, building façade, and outdoor dining allowances, as appropriate; the total wattage allowance specifically applying to vehicle service station hardscape is determined by adding the following layers, as appropriate:

- General hardscape lighting power allowance
- Vehicle service station uncovered fuel dispenser (allowance per fueling dispenser, with 2 mounting heights of dispenser)
- Vehicle service station hardscape (less area of buildings, under canopies, off property, or obstructed by signs or other structures)
- Vehicle service station canopies (within the drip line of the canopy)

The lighting power allowances are listed in Table 140.7-B of the Energy Standards.

Figure 6-3: Service Station Hardscape Areas



Source: AEC Photographer: Tom Bergstrom

Example 6-29 Calculating Canopy Lighting Area and Hardscape Area

Question

Where does canopy lighting area end and hardscape area start?

Answer

The horizontal projected area of the canopy on the ground establishes the area for under canopy lighting power calculations. This area also referred to as the “drip line” of the canopy.

E. Under Canopies

According to the definition in §100.1, a canopy is a permanent structure, other than a parking garage, consisting of a roof and supporting building elements, with the area beneath at least partially open to the elements. A canopy may be freestanding or attached to surrounding structures. A canopy roof may serve as the floor of a structure above.

The definition of a canopy states that a canopy is not a parking garage. A parking garage is classified as an unconditioned interior space, whereas a canopy is classified as an outdoor space.

The lighting power allowance for a canopy depends on its purpose. Service station canopies are treated separately (see the previous section). The two types of canopies addressed in this section are those that are used for sales and those that are not. Non-sales canopies include covered walkways, and covered entrances to hotels, office buildings, convention centers and other buildings. Sales canopies specifically cover and protect an outdoor sales area, including garden centers, covered automobile sales lots, and outdoor markets with permanent roofs. The lighting power allowances are listed in Table 140.7-B of the Energy Standards.

The area of a canopy is defined as the horizontal projected area, in plan view, directly underneath the canopy. This area is also referred to as the “drip line” of the canopy. Canopy lighting, either sales or non-sales shall comply separately, e.g. trade-offs are not permitted between other specific lighting applications or with general site illumination.

General site lighting or other specific applications lighting, and/or sign lighting that are attached to the sides or top of a canopy, cannot be considered canopy lighting. For example, internally illuminated translucent panels on the perimeter of a canopy are considered sign lighting, while the lighting underneath the canopy and directed towards the ground is canopy lighting.

Figure 6-4: Canopy Lighting



Source: AEC Photographer: Tom Bergstrom

Example 6-30 Power Allowance Under Canopies

Question

The first floor of an office tower in Lighting Zone 3 is setback 20 ft. on the street side. The width of the recessed façade is 150 ft. The primary purpose of the setback (and canopy) is to provide a suitable entrance to the office tower; however, space under the canopy is leased as news-stand, a flower cart and a shoeshine stand. These commercial activities occupy about half of the space beneath the canopy. What is the allowed lighting power?

Answer

The total canopy area is 20 ft. x 150 ft. or 3,000 sq. ft. The General Hardscape allowance for the site will need to be separately determined. The canopy allowance is an additional layer allowed only for the canopy

area. The 1,500 ft.² used for the flower cart, news-stand and shoeshine stand is considered a sales canopy and the allowance is 0.622 W/ sq. ft. or a total of 933 W. The other 1,500 sq. ft. is a non-sales canopy and the allowance is 0.270 W/ft.² or a total of 405 W. Trade-offs are not permitted between the sales portion and the non-sales portions.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Non-Sales Canopy	0.270W/ sq. ft.	1,500 sq. ft.	405 W
Sales Canopy	0.622 w/ sq. ft.	1,500 sq. ft.	933 W
TOTAL POWER ALLOWANCE			1,338 W

F. Ornamental Lighting

Ornamental lighting is defined in §100.1 as post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting. However, marquee lighting does not qualify for the ornamental lighting allowance. The allowances for ornamental lighting are listed in Table 140.7-B of the Energy Standards.

The ornamental lighting allowance on the site is calculated by multiplying the total illuminated hardscape for the site by the hardscape ornamental lighting allowance in Table 140.7-B. This allowance is calculated separately and is not accumulated into the other allowances. This additional wattage allowance may be used for any illuminated hardscape area on the site.

Luminaires used for ornamental lighting as defined in Table 140.7-B shall have a rated wattage, as listed on a permanent, pre-printed, factory-installed label, of 100 W or less.

Figure 6-6: Ornamental Lighting



Source: Ted Walson Photographer

(The cobra head luminaires shown in the above figure are not ornamental lighting. However, if the post-top acorn luminaires are rated 30 watts or less and not providing general and task lighting, they qualify as ornamental lighting)

Example 6-31 Bollard Luminaires

Question

Are bollard luminaires considered ornamental lighting?

Answer

No, Ornamental lighting is defined in Table 140.7-B of the Energy Standards as post-top luminaires, lanterns, pendant luminaires, chandeliers.

G. Drive-up Windows

Drive-up windows are common for fast food restaurants, banks, and parking lot entrances. In order to qualify, a drive-up window must have someone working behind the “window”. Automatic ticket dispensers at parking lots do not count.

The lighting power allowances are listed in Table 140.7-B of the Energy Standards as a wattage allowance per application.

The wattage allowance in Lighting Zone 3 is 125 W for each drive-up window.

Luminaires qualifying for this allowance must be within 2 mounting heights of the sill of the window.

Figure 6-6: Drive-up Windows



Source: AEC Photographer: Tom Bergstrom

Example 6-32 Power Allowance for Drive-up Window

Question

A drive-up window in Lighting Zone 2 has width of 7 ft. What is the allowed lighting power for this drive-up window?

Answer

The width of a drive-up window is not used for determining the allowed wattage. In Lighting Zone 2, 30 W is allowed for each drive-up window.

H. Guarded Facilities

Guarded facilities, including gated communities, include the entrance driveway, gatehouse, and guardhouse interior areas that provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants including, identification documentation, vehicle license plates, and vehicle contents.

There is an allowance of up to 1,000 sq. ft. per vehicle lane. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.

The power allowances for guarded facilities are listed in Table 140.7-B of the Energy Standards.

Example 6-33 Power Allowance for Guard Stations**Question**

A guard station to the research campus of a defense contractor consists of a guard station building of 300 ft.². Vehicles enter to the right of the station and exit to the left. What is the outdoor lighting power allowance? The guard station is located in Lighting Zone 2.

Answer

Since there are two vehicle lanes, the allowance for Lighting Zone 2 is two times of 300 ft.² times 0.176 W/ft.² is 105.6 W, in addition to the general hardscape lighting power allowance.

Example 6-34 Residential Guarded Facilities**Question**

Is the guarded facility at the entrance to a residential gated community covered by the Energy Standards?

Answer

Yes, residential guarded facilities are covered by the Energy Standards.

6.6 Alterations and Additions for Outdoor Lighting

§141.0(b)2L

The Energy Standards apply to alterations and additions to outdoor lighting systems, and the application of the Energy Standards to alterations depends on the scope of the proposed improvements.

Lighting alterations generally refers to replacing the entire luminaire.

Example 6-35 Requirements for Replacing Ballasts**Question**

I am going to change the ballasts in my façade lighting system. Will I be required to meet the new Outdoor Lighting Standards for façade lighting?

Answer

No, the replacement of only lamps or ballasts in outdoor lighting systems is not considered an alteration and does not trigger compliance with Outdoor Lighting Standards. Replacing entire luminaires will trigger mandatory requirements for the altered (replaced) luminaires only. Replacing more than 5 luminaires or 50 percent of the existing luminaires or adding to the connected lighting load for any outdoor lighting application will trigger the lighting power density requirements of the Energy Standards.

6.6.1 Outdoor Lighting Alterations – With an Increase of Lighting Loads

For alterations that increase the connected lighting load in a lighting application listed in Table 140.7-A or 140.7-B, the added or altered luminaires in the application zone must meet all the applicable requirements of §130.2(c) and §140.7.

Example 6-36 Requirements for Adding New Luminaires in a Parking Lot

Question

We are adding new luminaires to the existing lighting systems in a parking lot. Which Standards requirements are triggered by this alteration?

Answer

Because additional load is being added to the parking lot, which is part of the general hardscape lighting, the entire general hardscape area must comply with the lighting power density requirements for the given lighting zone. However, only the newly installed lighting system must comply with the applicable mandatory requirements, including control requirements and luminaire cutoff requirements.

6.6.2 Outdoor Lighting Alterations – With no Increase of Lighting Loads, and small changes to existing luminaires

For alterations in parking lots or outdoor sales lots that do not increase connected lighting load, but do replace the larger of 5 luminaires or 10 percent of the existing luminaires where the luminaire is mounted less than 24 feet above the ground, the replaced luminaires are required to meet the applicable controls requirements of §130.2(c)1 and §130.2(c)3.

For applications where the luminaire is mounted greater than 24 feet above the ground, the replaced luminaires are required to meet the applicable controls requirements of §130.2(c)1 and either comply with §130.2(c)2 or be controlled by lighting control systems (including motion sensors).

Example 6-37 BUG Requirements for Lighting Alterations

Question

We are replacing 20 percent of the existing HID luminaires in a parking lot. Does the BUG requirement apply to the new and existing luminaires?

Answer

Yes, new luminaires may be required to meet the luminaire cutoff (“BUG”) requirements; however, luminaires that are not being replaced are not required to be upgraded to meet the luminaire BUG requirement. §141.0 (b)2L specifies that all altered luminaires must meet applicable mandatory requirements, including the BUG requirements for replacements luminaires. Therefore, replacement luminaires that are greater than 6,200 initial luminaire lumens must meet the luminaire BUG requirements, even if less than 5 luminaires or 10 percent of the luminaires on site are replaced.

6.6.3 Outdoor Lighting Alterations – With no Increase of Lighting Loads, and sizable changes to existing luminaires

For alterations that do not increase connected lighting load, but do replace the larger of 5 luminaires or 50 percent of the existing luminaires in a lighting application listed in Table 140.7-A or 140.7-B, the replaced luminaires must also meet the requirements of §140.7 in addition to the control requirements mentioned in the previous paragraph.

Example 6-38 Requirements for Replacing more than 50 percent of Luminaires

Question

In a service station we are replacing more than 50 percent of under canopy luminaires. Does this trigger the alteration requirements for outdoor lighting? Do we need to bring non-canopy lighting such as hardscape lighting up to code as well?

Answer

Yes, §141.0(b)2Liii specifies that when more than 5 luminaires or 50 percent of luminaires are replaced in a given lighting application included in Energy Standards Tables 140.7-A and 140.7-B, the alteration requirements apply. So, in this example, all of the under-canopy luminaires must meet the requirements of §140.7 and the applicable control requirements of §130.2. Hardscape and other outdoor Lighting Applications other than the canopy need not meet these requirements even if they are included in the permit along with the canopy lighting.

There is an exception (to Section 141.0(b)2Liii) for the alteration in which the replacement luminaires are at least 40 percent more efficient in lighting power than the existing luminaires.

Example 6-39 Exemption from lighting power allowance requirements

Question

Fifty HID exterior pole fixtures in a parking lot are being replaced with 50 new LED fixtures. However, to improve poor coverage in one end of the lot an additional 3 pole fixtures are added, bringing the total new fixture count to 53. Despite the addition of 3 fixtures, the total connected load for the 53 fixtures was reduced by 42 percent compared to the original 50. Does this project have to meet the Outdoor LPAs in §140.7?

Answer

No, the project does not have to meet the lighting power allowances in §140.7. Even though the number of fixtures increased, the total wattage of the project is less than before, so the connected lighting load has decreased, not increased. Since the overall connected load was reduced by 40 percent or more compared to the original luminaires, Exception to §141.0(b)2Liii applies and the new fixtures are not required to comply with the LPAs in §140.7.

6.6.4 Outdoor Lighting Alterations – With no Increase of Lighting Loads, and other small changes to existing luminaires

For alterations that do not increase connected lighting load and replace less than 5 luminaires or less than 10 percent of the existing luminaires, the requirements to comply are minimal – comply with the luminaire cutoff (“BUG”) requirements of Section 130.2(b) and applicable installation and acceptance requirements of Section 130.4.

Example 6-40 Outdoor Lighting Alteration Triggers

Question

I am going to retrofit all of my HID parking lot lights with an LED retrofit kit. What requirements do I need to follow for the LED retrofits?

Answer

For outdoor lighting alterations that reduce lighting power such as LED retrofits, there are two options for demonstrating compliance with the Energy Standards. You can either calculate the lighting power allowance for the hardscape area, or you can list the quantity and wattage of the existing luminaires in the hardscape area.

In both cases, the requirements are the same: if fewer than 5 luminaires are being retrofitted, or the number of luminaires being retrofitted is less than 10 percent of the total number of luminaires in the hardscape area, then the requirements of the Energy Standards are not triggered and no compliance documentation is required. If more than 10 percent and less than 50 percent of the luminaires in the hardscape area are being retrofitted, then control requirements apply. If 50 percent or more of the luminaires in the hardscape area are being retrofitted, then control requirements apply, and the lighting must either meet current lighting power allowances per Section 140.7 or must achieve a 40 percent reduction in lighting power.

6.6.5 Outdoor Lighting Additions– Mandatory and Lighting Power Requirements

§141.0(a)1. §130.0, §130.2

Outdoor lighting additions are treated similarly as newly constructed buildings and must comply with all mandatory lighting control and lighting power requirements.

A. Mandatory Requirements

Additions to existing outdoor lighting must meet all of the mandatory measures for the added luminaires. The mandatory requirements include certification of any new lamps, light sources, ballasts and drivers that are installed if they are the type regulated by the Appliance Efficiency Regulations. Any new lighting controls must meet minimum performance requirements. In addition, outdoor luminaire and control requirements apply as follows:

- Outdoor luminaires that emit 6200 lumens or greater must comply with backlight, uplight and glare (“BUG”) requirement. (Refer to Section 6.3.1 for the outdoor luminaire BUG requirement.)
- Outdoor lighting control requirements including automatically turning off lighting when daylight is available. [§130.2(c)1]

- All outdoor lights shall be automatically controlled by a time-based scheduling controls. [§130.2(c)2]
- Outdoor luminaires greater than 40 watts and mounted less than 24 feet and above the ground shall be motion controlled, so that the lighting power of each luminaire shall be automatically reduced by at least 50 percent. This applies to luminaires providing general hardscape lighting, outdoor sales lot lighting, vehicle service station hardscape lighting, or vehicle service station canopy lighting. [§130.2(c)3].

B. Lighting Power Density Requirements

The outdoor lighting additions must also comply with lighting power allowances of §140.7, Energy Standards Tables 140.7-A and 140.7-B.

6.6.6 Outdoor Lighting Additions and Alterations– More Examples

Example 6-41 Power Allowance for Additional Outdoor Dining (Inside Illuminated Area)

Question

A strip mall in Lighting Zone 3 with a common parking lot has its lighting system already designed and installed. A restaurant moves into one of the buildings and designates 400 sq. ft. as outdoor dining. The outdoor dining area is within the illuminated area (5 mounting heights) of the pre-existing lighting. How is the allowable lighting calculated?

Answer

The allowable lighting power can be calculated in two ways:

Method 1

Calculate only the additional allowance layer for the outdoor dining area for specific applications (Outdoor Dining) as contained in Table 140.7-B of the Energy Standards. In this case the allowance is 0.050 W/sq. ft. Multiplying this allowance by 400 sq. ft. yields 20 W.

<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Outdoor Dining	0.050 W/sq. ft.	400 sq. ft.	20 W
TOTAL POWER ALLOWANCE			20 W

Method 2

One could have the permit cover all of the site lighting including the outdoor dining area. (This second compliance path would provide a greater power allowance but would require more work in the application process.) This only yields a higher allowance if the current lighting system serving hardscape areas for the rest of the site has less wattage than the calculated total site hardscape wattage allowance. Additional allowances would be possible if one upgraded to the current hardscape system for other parts of the site and reduced its wattage.

Example 6-42 Power Allowance for Additional Outdoor Dining (Outside Illuminated Area)**Question**

A strip mall in Lighting Zone 3 with a common asphalt parking lot has the parking lot lighting system designed and installed. A restaurant moves into one of the buildings and designates 400 ft.² as outdoor dining. The outdoor dining area is outside of the illuminated area of the pre-existing parking lot lighting. How is the allowable lighting calculated?

Answer

In addition to adding outdoor dining area, which is a specific application that is allowed more light, the illuminated general hardscape lighting area is also increasing in size by 400 sq. ft. Adding illuminated hardscape area results in increased general hardscape area wattage allowances (AWA) and increased linear wattage allowances (LWA) but it does NOT add an additional initial wattage allowance (IWA) because only one initial wattage allowance is allowed per site. The allowable lighting power can be calculated in two ways:

Method 1

Calculate the general hardscape area wattage allowances (AWA) and the increase to the general hardscape linear wattage allowances (LWA) and the additional allowance layer for the outdoor dining area for specific applications (Outdoor Dining) as contained in Table 140.7-B of the Standards. As discussed above, it is not permissible to also claim the general hardscape initial wattage allowance (IWA) as this is calculated only once per site. The linear wattage allowance applies only to the new perimeter length, which is not adjacent to previously illuminated area that is part of the site.

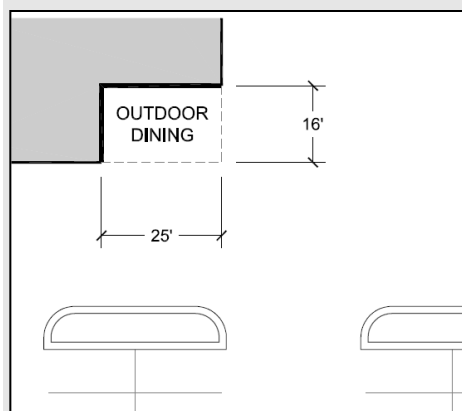
As shown in the figure below, the perimeter length is 41 ft. (25 ft. + 16 ft.). In LZ3 the asphalt AWA is 0.025 W/sq. ft. and the LWA is 0.25 W/ft. The additional allowance for the outdoor dining area for specific applications (Outdoor Dining) as contained in Table 140.7-B is 0.05 W/sq. ft. Thus, for a perimeter length of 41 ft. and an area of 400 sq. ft., the total lighting wattage allowance is:

Hardscape LWA of 0.25 W/ sq. ft. x 41 ft. = 10.3 W

Hardscape AWA of 0.025 W/sq. ft. x 400 sq. ft. = 10 W

Specific Allowance Outdoor Dining 0.05 W/sq. ft. x 400 sq. ft. = 20 W

Total allowance = 40.3 W



<i>Type of Allowance</i>	<i>Allowance</i>	<i>Area/Perimeter Value</i>	<i>Power Allowance</i>
Outdoor Dining	0.050 W/ sq. ft.	400 sq. ft.	20 W

Area	0.025 W/ sq. ft.	400 sq. ft.	10 W
Perimeter	0.25 W/LF	41 ft.	10.3 W
TOTAL POWER ALLOWANCE			40.3 W

Method 2

One could have the permit cover all of the site lighting including the outdoor dining area. (This second compliance path would provide a greater power allowance but would require more work in the application process.) This only yields a higher allowance if the current lighting system serving hardscape areas for the rest of the site has less wattage than the calculated total site hardscape wattage allowance.

6.7 Outdoor Lighting Compliance Documents and Acceptance Tests

This section contains information about the Certificate of Compliance, Certificate of Installation, and Certificate of Acceptance needed for compliance with the nonresidential outdoor lighting requirements of the Energy Standards.

6.7.1 Overview

At the time a building permit application is submitted to the enforcement agency, the applicant also submits plans and energy compliance documentation including the Certificate of Compliance. The enforcement agency plan checkers examine these documents for compliance with the Energy Standards.

The person responsible for the construction of the lighting system should submit the Certificate of Installation and Certificate of Acceptance to the local building department or the enforcement agency after the installation and before receiving the building occupancy permit.

6.7.2 Compliance Documentation and Numbering Scheme

Nonresidential outdoor lighting Certificate of Compliance documents are listed below:

- NRCC-LTO-E; Certificate of Compliance: Outdoor Lighting

Nonresidential outdoor lighting Certificate of Installation documents are listed below:

- NRCI-LTO-01-E; Certificate of Installation; Outdoor Lighting
- NRCI-LTO-02-E; Certificate of Installation: Energy Management Control System or Lighting Control System

Nonresidential outdoor lighting Certificate of Acceptance document:

- NRCA-LTO-02-A: Certificate of Acceptance, Outdoor Lighting Controls

The Energy Standards use the following numbering scheme for the nonresidential lighting compliance documents:

NRCC	Nonresidential Certificate of Compliance
NRCI	Nonresidential Certificate of Installation
NRCA	Nonresidential Certificate of Acceptance
LTI	Lighting, Indoor
LTO	Lighting, Outdoor
LTS	Lighting, Sign
01	The first set of compliance documents in this sequence
E	Primarily used by enforcement authority
A	Primarily used by acceptance tester

The paper prescriptive compliance documents have a limited number of rows per section for entering data. Some designs may need fewer rows, and some designs may need additional rows. If additional rows are required for a particular design, then multiple copies of that page may be used.

6.7.3 Certificate of Installation Documents

The Certificates of Installation is primarily used to declare that what was installed matches the plans on the Certificates of Compliance. The Certificate is signed by a person with an approved license.

A copy of the completed signed and dated Installation Certificate must be posted at the building site for review by the enforcement agency in conjunction with requests for final inspection for the building. See Section 2.2.3 for more information about the Installation Certificate.

6.7.4 Certificate of Acceptance

Before an occupancy permit is granted for a new building or space, or a new lighting system serving a building, space, or site is operated for normal use, all outdoor lighting controls serving the site shall be certified as meeting the Acceptance Requirements for Code Compliance. A Certificate of Acceptance shall be submitted to the enforcement agency under Administrative Regulations §10-103(a).

The acceptance requirements that apply to outdoor lighting controls include:

- Certifying plans, specifications, installation certificates, and operating and maintenance information to meet the requirements of the Energy Standards.
- Certifying that outdoor lighting controls meet the applicable requirements of §110.9 and §130.2.

Acceptance testing must be conducted, and a Certificate of Acceptance must be completed and submitted before the enforcement agency can issue the certificate of occupancy. See the following chapters about compliance and enforcement, and acceptance requirements.

- Chapter 2- Compliance and Enforcement

- Chapter 13 - Acceptance Requirements

6.7.5 Acceptance Tests

The primary purpose of outdoor lighting acceptance tests is to assure the lighting controls are configured properly and are functioning as expected in meeting the energy code requirements.

The procedures for performing the lighting acceptance tests are documented in Reference Nonresidential Joint Appendix. See the following sections for the outdoor lighting controls acceptance tests.

- NA7.8.1 and NA7.8.2 for Motion Sensor (aka Motion Sensing Controls)
- NA7.8.3 and NA7.8.4 for Photocontrol
- NA7.8.5 and NA7.8.6 for Astronomical Time-Switch Controls
- NA7.8.7 and NA7.8.8 for Automatic Scheduling Controls

Often, the building occupancy schedule is not known at the time the acceptance test is performed as it is before occupancy. If this is the case, a default schedule of midnight to 6 am - as the normally unoccupied period - could be used for the acceptance test of the installed automatic scheduling controls to verify that the outdoor lighting power could be reduced by at least 50 percent during the unoccupied period.