



# CALIFORNIA STATEWIDE UTILITY CODES AND STANDARDS PROGRAM

*2016 Title 24 Codes & Standards Enhancement (CASE) Proposal*

## Nonresidential Lighting – Outdoor Lighting LPA

Pre-rulemaking Meeting, June 24, 2014

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## Proposed Code Change History

- Outdoor Lighting was first introduced in the 2005 Title 24 Standards
- LPA values are based on:
  - IES design recommendations, mapped to the Lighting Zones for each application
  - Current light source technology
  - Current luminaire technology
  - Standard design practice



## Proposed Code Change Overview

- **Nonresidential Lighting – Outdoor LPA**

Revise the basis of design from Metal Halide light sources to LED, project the efficacy of LED in 2017, and establish new LPA values for all outdoor lighting allowances.

- **No philosophical change to design criteria matrix as established in the 2005 code revision cycle.**
- All outdoor lighting is impacted.
- This will be a change to Mandatory requirements.



## Proposed Code Change Overview

- **Nonresidential Lighting – Outdoor LPA**

Add language in the code to establish allowances for ATM locations, tunnels, and bridges.

- impacts just these conditions, but also includes ATM locations in parking garages (which is classified as unconditioned interior space).
- change to Mandatory requirements.



## Proposed Code Change Overview

Impacts LPA values in the General Hardscape Allowance (Table 140.7-A) and Additional Allowance for Specific Applications (Table 140.7-B).

- General allowance values apply to all outdoor spaces.
- Specific applications apply only to certain circumstances.



# Current Code Requirements

## Existing Title 24 Requirements

### – Table 140.7-A General Hardscape Allowance

*TABLE 140.7-A GENERAL HARDCAPE LIGHTING POWER ALLOWANCE*

Type of Power Allowance	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Area Wattage Allowance (AWA)	0.035 W/ft <sup>2</sup>	0.045 W/ft <sup>2</sup>	0.090 W/ft <sup>2</sup>	0.115 W/ft <sup>2</sup>
Linear Wattage Allowance (LWA)	0.25 W/lf	0.45 W/lf	0.60 W/lf	0.85 W/lf
Initial Wattage Allowance (IWA)	340 W	510 W	770 W	1030 W



# Table 140.7-B Additional Lighting Power Allowance for Specific Applications

**TABLE 140.7-B ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS**  
*All area and distance measurements in plan view unless otherwise noted.*

Lighting Application	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
<b>WATTAGE ALLOWANCE PER APPLICATION.</b> Use all that apply as appropriate.				
<b>Building Entrances or Exits.</b> Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	30 watts	60 watts	90 watts	90 watts
<b>Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities.</b> Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	45 watts	80 watts	120 watts	130 watts
<b>Drive Up Windows.</b> Allowance per customer service location. Luminaires qualifying for this allowance shall be within 2 mounting heights of the sill of the window.	40 watts	75 watts	125 watts	200 watts
<b>Vehicle Service Station Uncovered Fuel Dispenser.</b> Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within 2 mounting heights of the dispenser.	120 watts	175 watts	185 watts	330 watts
<b>WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft).</b> May be used for one or two frontage side(s) per site.				
<b>Outdoor Sales Frontage.</b> 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 qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	No Allowance	22.5 W/linear ft	36 W/linear ft	45 W/linear ft
<b>WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft<sup>2</sup>).</b> May be used for any illuminated hardscape area on the site.				
<b>Hardscape Ornamental Lighting.</b> Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130.0(d), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	No Allowance	0.02 W/ft <sup>2</sup>	0.04 W/ft <sup>2</sup>	0.06 W/ft <sup>2</sup>



## Table 140.7-B (continued)

WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft <sup>2</sup> ). Use as appropriate provided that none of the following specific applications shall be used for the same area.				
<b>Building Facades.</b> 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.	No Allowance	0.18 W/ft <sup>2</sup>	0.35 W/ft <sup>2</sup>	0.50 W/ft <sup>2</sup>
<b>Outdoor Sales Lots.</b> 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 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.	0.164 W/ft <sup>2</sup>	0.555 W/ft <sup>2</sup>	0.758 W/ft <sup>2</sup>	1.285 W/ft <sup>2</sup>
<b>Vehicle Service Station Hardscape.</b> 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.	0.014 W/ft <sup>2</sup>	0.155 W/ft <sup>2</sup>	0.308 W/ft <sup>2</sup>	0.485 W/ft <sup>2</sup>
<b>Vehicle Service Station Canopies.</b> Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	0.514 W/ft <sup>2</sup>	1.005 W/ft <sup>2</sup>	1.300 W/ft <sup>2</sup>	2.200 W/ft <sup>2</sup>
<b>Sales Canopies.</b> Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	No Allowance	0.655 W/ft <sup>2</sup>	0.908 W/ft <sup>2</sup>	1.135 W/ft <sup>2</sup>
<b>Non-sales Canopies.</b> Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	0.084 W/ft <sup>2</sup>	0.205 W/ft <sup>2</sup>	0.408 W/ft <sup>2</sup>	0.585 W/ft <sup>2</sup>
<b>Guard Stations.</b> Allowance 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, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.	0.154 W/ft <sup>2</sup>	0.355 W/ft <sup>2</sup>	0.708 W/ft <sup>2</sup>	0.985 W/ft <sup>2</sup>
<b>Student Pick-up/Drop-off zone.</b> Allowance for the area of the student pick-up/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 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.	No Allowance	0.12 W/ft <sup>2</sup>	0.45 W/ft <sup>2</sup>	No Allowance
<b>Outdoor Dining.</b> 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.	0.014 W/ft <sup>2</sup>	0.135 W/ft <sup>2</sup>	0.240 W/ft <sup>2</sup>	0.400 W/ft <sup>2</sup>
<b>Special Security Lighting for Retail Parking and Pedestrian Hardscape.</b> 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.	0.007 W/ft <sup>2</sup>	0.009 W/ft <sup>2</sup>	0.019 W/ft <sup>2</sup>	No Allowance



# Typical Practices

## Current practices

- When outdoor lighting is employed, designers typically use “up to” the available LPA allowance.
- General outdoor lighting is tradable within spaces with some limitations, so any remaining allowance in one area can be “banked” for use in other areas.
- Alternatively, a designer can over-design a space to meet the LPA, resulting in higher light levels than needed, per IES criteria.



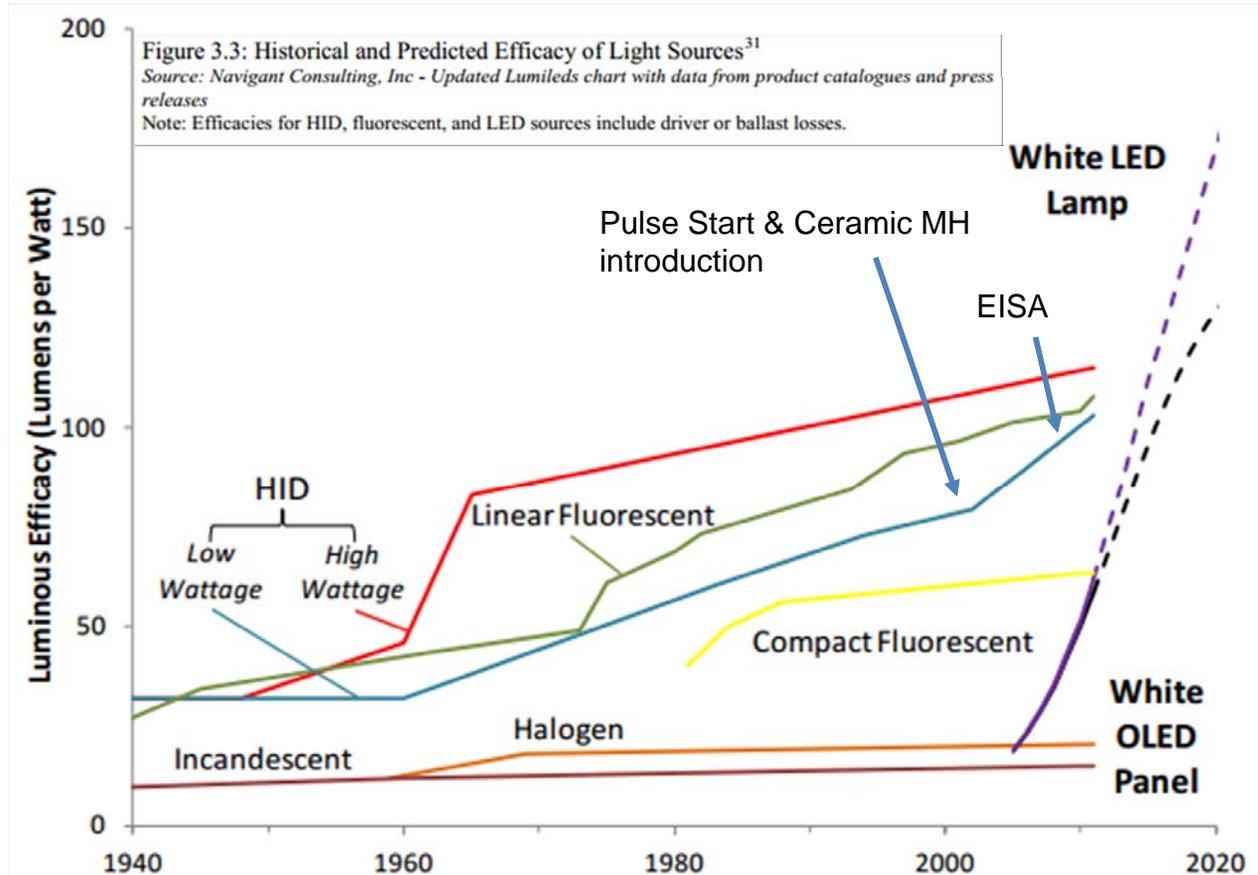
## Typical Practices

- Trends
  - Light technology is improving. Pulse Start Metal Halide (PSMH) lamps are better than probe start lamps used as the basis in the past, and LEDs are rapidly improving.
  - Due to EISA the basis of design is now PSMH lamps.
  - LED is expected to be the primary market technology for white light products in a few years.
- The LPA limits will become increasingly less restrictive if LPA values remain unchanged while new light sources improve (LED).



# Trends – Light Source Technology

## LEDs Are Improving Rapidly...

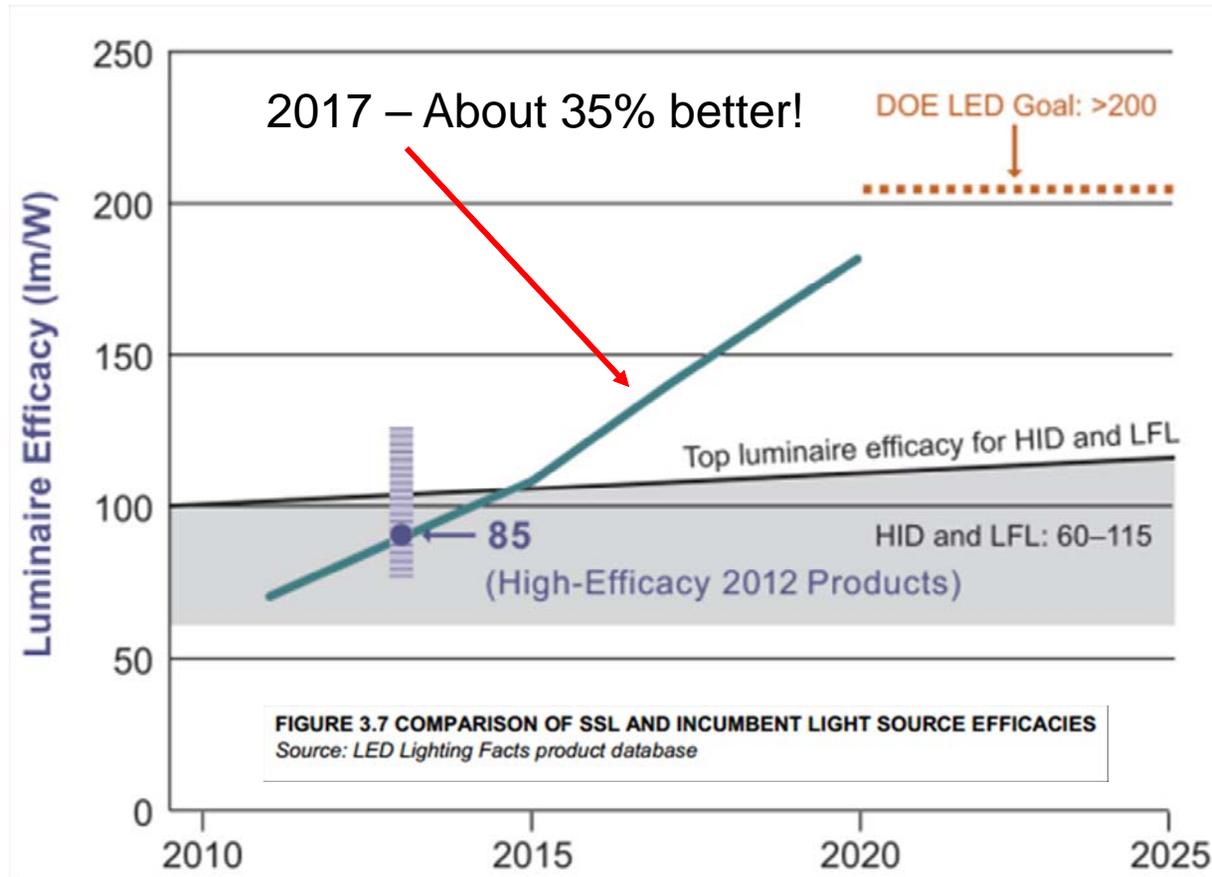


... While Others Are Slowly Improving



## Trends – Luminaire Technology

LEDs are going to be the Best Source...



... Possibly Sometime This Year!



# Methodology for Analysis

1. Apply Existing Lighting Design Criteria
2. Determine Reasonable Baseline Conditions
  - Light source baseline (LED for most applications)
  - Luminaire baseline (mostly commodity-grade products)
  - Light Loss Factors (based on LED maintenance data @ 15 years, 65,000 hours and reasonable luminaire factors)
3. Use Point-by-Point calculations to establish LPAs associated with general illuminance design criteria.
4. Use Point-by-Point calculations and luminaire efficacy adjustments to establish LPAs associated with specific application design criteria, when using the layering approach for allowances.



# Methodology for Savings Analysis

## Energy and Demand Impacts

- Spreadsheet analysis (not building simulation)
- Determining LPA reductions (W/sf) compared to current Title 24 (2013)
- Statewide energy and demand impacts (kWh/kW)
  - for new/retrofit systems
  - impacted area following 2013 update approach
- TDV values (energy and demand) vary by climate zone due to construction forecasts, but are not CZ dependent.



## Initial Data and Findings

### Outdoor Lighting Power Allowances:

- All LPA values in all tables will be impacted!
- The range of reductions is from ~15% to over 50%
- The average reduction is approximately 40% for the General Table (140.7-A)



## Additional Items to be addressed

1. Title 24 does not include a suitable accommodation for pedestrian tunnels and flyovers or bridges (currently exempted).
  - Recommend associating them with canopies (tunnels), and general hardscape (when uncovered bridges).
2. Title 24 does not have a suitable accommodation for ATM locations (currently exempted).
  - Recommend establishing LPA values and adding to the tables.



# Proposed Code Requirements

## Proposed Title 24 Requirements

- No substantial changes to code language sections.
- Minor language edits to Sections 140.6 and 140.7



# Proposed Code Requirements

## Section 140.6(a)3 edits:

3. **Lighting wattage excluded.** The watts of the following indoor lighting applications may be excluded from actual indoor Lighting Power Density. (Indoor lighting not listed below shall comply with all applicable nonresidential indoor lighting requirements in Part 6.):

- A. In theme parks: Lighting for themes and special effects.
- B. Studio lighting for film or photography provided that these lighting systems are in addition to and ~~generally switched from a general lighting system~~

...

PROVISIONS OF SECTION 140.6(A).

- S. Lighting for signs: Lighting for signs shall comply with Section 140.8.
- ~~T. Lighting for automatic teller machines that are located inside parking garages.~~
- U. Lighting in refrigerated cases less than 3,000 square feet. (Lighting in refrigerated cases less than 3,000 square feet shall comply with the Title 20 Appliance Efficiency Regulations).



# Proposed Code Requirements

## Section 140.6(a) edits:

**EXCEPTIONS to Section 140.7(a):** When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 140.7:

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways, and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children's playgrounds.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
- ~~6. Lighting specifically for Automated Teller Machines as required by California Financial Code Section 13040, or required by law through a local ordinance.~~
7. Lighting of public monuments.
8. ~~Lighting of signs complying with the requirements of Sections 130.3 and 140.8.~~
9. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.

## Edit the above portion of the Item List:

9. Lighting of ~~tunnels, bridges~~, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.



# Proposed Code Requirements

*Table 140.7-B edits:*

**TABLE 140.7-B ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS**  
*All area and distance measurements in plan view unless otherwise noted.*

Lighting Application	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
<b>WATTAGE ALLOWANCE PER APPLICATION.</b> Use all that apply as appropriate.				
<b>Building Entrances or Exits.</b> Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	30 watts	60 watts	90 watts	90 watts
<b>Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities.</b> Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	45 watts	80 watts	120 watts	130 watts

*Add to the above portion of the Table:*

Lighting Application	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
<b>ATM Locations.</b> Allowance per ATM. Luminaires qualifying for this must be within 50 feet of the ATM location.	250 watts for first ATM, 70 watts for each additional ATM			



# Proposed Code Requirements

Table 140.6-C edits:

	≤ 250 square feet	1.0
Parking Garage Area	Parking Area <sup>10</sup>	0.14
	Dedicated Ramps	0.3
	Daylight Adaptation Zones <sup>9</sup>	0.6
Religious Worship Area		1.5 <sup>3</sup>

<p>FOOTNOTES FOR TABLE 140.6-C:          See Section 140.6(c)2 for an explanation of additional lighting power available for specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes in this table. The smallest of the added lighting power listed in each footnote below, or the actual design wattage, may be added to the allowed lighting power only when using the Area Category Method of compliance.</p>		
Footnote number	Type of lighting system allowed	Maximum allowed added lighting power. (W/ft <sup>2</sup> of task area unless otherwise noted)
1	Specialized task work	0.2 W/ft <sup>2</sup>
2	Specialized task work	0.5 W/ft <sup>2</sup>
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6(c)2.	0.5 W/ft <sup>2</sup>

Footnote number	Type of lighting system allowed	Maximum allowed Lighting power (W/ft <sup>2</sup> of task area unless otherwise noted)
10	Additional allowance for ATM locations in Parking Garages. Allowance per ATM.	200 watts for first ATM location, 50 watts for each additional ATM location.



# Proposed Code Requirements

Table 140.7-B edits:

the canopy.				
<del>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.</del>	No Allowance	0.655 W/ft <sup>2</sup>	0.908 W/ft <sup>2</sup>	1.135 W/ft <sup>2</sup>
<del>Non-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.</del>	0.084 W/ft <sup>2</sup>	0.205 W/ft <sup>2</sup>	0.408 W/ft <sup>2</sup>	0.585 W/ft <sup>2</sup>
<del>Guard Stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and inspect vehicles and vehicle occupants, including identification.</del>	0.154 W/ft <sup>2</sup>	0.355 W/ft <sup>2</sup>	0.708 W/ft <sup>2</sup>	0.985 W/ft <sup>2</sup>

Change the above to:

**Non-sales Canopies and Tunnels.** Allowance for the total area within the dripline of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.



# Proposed Code Requirements

## Section 140.7 edits:

1. **General Hardscape Lighting Allowance.** Determine the general hardscape lighting power allowances as follows:
  - A. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(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 10 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 140.7-A for the appropriate Lighting Zone.

*Change the above to:*

*The general hardscape area of a site shall include parking lots(s), roadway(s), walkway(s), bikeway(s), plaza(s), tunnel(s)...*



# Proposed Code Requirements

Allowance		Units	Title 24-2013 Values				2016 Proposed Values			
			Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
General Hardscape Allowance	Area Wattage Allowance (AWA)	W/s	0.035	0.045	0.090	0.115	0.020	0.030	0.040	0.050
	Linear Wattage Allowance (LWA)	W/lf	0.25	0.45	0.60	0.85	0.15	0.25	0.35	0.45
	Initial Wattage Allowance (IWA)	W	340	510	770	1030	340	450	520	640
Wattage Allowance per Application	<b>Building Entrances or Exits</b>	W	30	60	90	90	15	25	35	45
	<b>Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities</b>	W	45	80	120	130	20	40	60	80
	<b>Drive Up Windows</b>	W	40	75	125	200	30	40	60	100
	<b>Vehicle Service Station Uncovered Fuel Dispenser</b>	W	120	175	185	330	80	100	140	160
	<b>Automated Teller Machines</b>	W	Not Included				250W + 70W per add'l ATM			
Wattage Allowance per Unit Length (W/lf)	<b>Outdoor Sales Frontage</b>	W/lf	No allowance	22.5	36	45	No allowance	15	25	30
Wattage Allowance per Hardscape Area	<b>Hardscape Ornamental Lighting</b>	W/sf	No allowance	0.020	0.040	0.060	No allowance	0.015	0.030	0.045
Wattage Allowance per Specific Area (W/sf).	<b>Building Facades</b>	W/sf	No allowance	0.18	0.35	0.50	No allowance	0.15	0.25	0.35
	<b>Outdoor Sales Lots</b>	W/sf	0.164	0.555	0.758	1.285	0.100	0.250	0.500	1.000
	<b>Vehicle Service Station Hardscape</b>	W/sf	0.014	0.155	0.308	0.485	0.010	0.100	0.150	0.200
	<b>Vehicle Service Station Canopies</b>	W/sf	0.514	1.005	1.300	2.200	0.400	0.700	0.900	1.200
	<b>Sales Canopies</b>	W/sf	No allowance	0.655	0.908	1.135	No allowance	0.500	0.800	1.000
	<b>Non-sales Canopies</b>	W/sf	0.084	0.205	0.408	0.585	0.080	0.160	0.300	0.400
	<b>Guard Stations</b>	W/sf	0.154	0.355	0.708	0.985	0.100	0.300	0.500	0.750
	<b>Student Pick-up/Drop-off zone</b>	W/sf	No allowance	0.15	0.45	No allowance	No allowance	0.10	0.25	No allowance
	<b>Outdoor Dining</b>	W/sf	0.014	0.135	0.240	0.400	0.010	0.100	0.150	0.200
<b>Special Security Lighting for Retail Parking and Pedestrian Hardscape</b>	W/sf	0.007	0.009	0.019	No allowance	0.005	0.007	0.012	No allowance	



# Proposed Code Requirements

## Analysis of Reduction in General Allowances

Allowance		Units	Title 24-2013 Values				2016 Proposed			
			Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
General Hardscape Allowance	Area Wattage Allowance (AWA)	W/s	0.035	0.045	0.090	0.115	0.020	0.030	0.040	0.050
	Linear Wattage Allowance (LWA)	W/lf	0.25	0.45	0.60	0.85	0.15	0.25	0.35	0.45
	Initial Wattage Allowance (IWA)	W	340	510	770	1030	340	450	520	640

43%	33%	56%	57%
40%	44%	42%	47%
No Change	12%	32%	38%



## Proposed Code Requirements - Assessment

- The proposed LPAs are conservative.
  - possible to meet the design criteria with these values *using current LED technology*
  - The values have 30% or greater allowance for imperfect site conditions.
  - **By 2017, LEDs will be approx. 30% better than today!**
- The proposed LPAs will make it difficult to meet design criteria for many applications when using ‘traditional’ (incumbent) light source technology.
- **While the values are a considerable reduction, they will be achievable in 2017, and represent a ‘maintenance’ change in the code based on the rapid advance of light source technology.**



# Questions?

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