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Title 24 Chapter 6 Exterior Lighting

Additional submitted attachment is included below.

Title 24 Chapter 6

Introduction

Title 24 addresses the importance of uniformity (low contrast ratios) by requiring the use of zones and BUG ratings. However, Title 24 ignores the importance of uniformity within a hardscape area by stating that a hardscape area is illuminated even in areas where there may be virtually no illumination!

Title 24 also includes the requirement that BUG ratings be used. But then it sabotages their use by exempting powerful luminaires from the requirement.

Title 24 also provides for a greater wattage allowance for areas that benefit from brighter lights. But it often does not require the luminaires to be close enough to the targeted areas to make full use of the additional illumination.

Because of the above, Title 24 misses many opportunities to provide better illumination while using less energy.

The Benefit of High Uniformity

High levels of uniformity are critical to reducing the energy used. Click on the link below to read an article that discusses the importance of uniformity

ParkingLotLightingGuide.pdf (rpi.edu)

The above parking lot guide found that a uniformity ratio of 2:1 at 6 lux was rated the same in terms of safety as one of 20 lux with a 15:1 uniformity ratio. Therefore, with less than one third the amount of illumination, one can achieve the same perception of safety.

To achieve 2:1 uniformity will likely involve more luminaires. Therefore, a standard that considers installation cost versus the benefits from high uniformity would be good to have.

If greater uniformity results in higher perceived safety, would an increase in uniformity serve the same purpose as more illumination but with fewer watts? Perhaps we should have two standards. One would be a uniformity standard where perceived safety is less important and a higher standard for areas where perceived safety is more critical. For example, areas with ATM machines could be required to have better uniformity rather than greater illumination. An area surrounding an ATM machine may also require greater uniformity than a grocery store parking lot.

Uniformity Recommendations

In the link below, the IEEE and the International Darksky Organization's recommendations regarding footcandles and uniformity can be found. Should this be part of the standards?

Recommended Footcandles and Uniformity

Isolux Diagrams

Isolux diagrams often show that even modern luminaires can have light distribution that varies over very short distances. Many of these diagrams show that in a matter of fifteen or twenty feet there may be a twenty-fold or more difference in footcandles under a single luminaire. However, by matching complementary luminaires, greater uniformity is possible.

Types I through VS

Title 24 implies that luminaires distribute light in a square pattern and five times their height in four directions. However, luminaires can distribute light in circles, rectangles, and other shapes and often do not emit significant light in four directions simultaneously or in a square pattern or five times their height. That means that much of the area that is

considered illuminated by Title 24 standards may not be lit or be very poorly lit. See some of the distribution patterns in the link below.

Optical Distribution Types I-V | Rayon Lighting Group

By taking advantage of these types, one can often create a pattern with a high level of uniformity and limit the light to well-defined boundaries. This may virtually eliminate traditional shielding and reduce the number of lumens used.

Title 24 Exceptions for BUG Ratings

In Title 24, luminaires that emit less than 6200 lumens are exempted from BUG requirements. This exemption could easily create light trespass and wasted energy if exempted luminaires are used inappropriately or there are many of them. This is especially true in lighting zones where little light is permitted. These exemptions should be constrained so that light trespass is minimized.

General Hardscape LPA- Initial Allowance

According to Title 24, an initial wattage allowance may only be used for a single illuminated hardscape area for a site. However, if the initial wattage allowance is important in one area, then why would a separate illuminated area not be eligible for this allowance?

On the other hand, with better light distribution of modern luminaires, it may make sense to limit the use of initial wattage allowances. In their place may the option to reduce the proportion of light that is required to fall within hardscape boundaries or reduce the uniformity required in small areas.

Specific Applications Allowances

I often wonder what the justification is for the extreme brightness of car outdoor sales lots and vehicle service stations. This excess may interfere with their neighbors' interests and harm the natural environment. If high levels of illumination are required to best illuminate a car, this could be done in a small area of the car lot.

One could argue that the permitted level of illumination in car sales lots and service stations presents a threat to visibility and safety due to the dramatic difference in the light levels of these and their surrounding areas. For instance, a driver that is exposed to the light from a service station will take time to get used to the relative darkness of city streets once he leaves the station.

Outdoor Sales Frontage

The outdoor sales frontage application allowance for Zone 3 is 19 watts per linear foot. This is in addition to the lighting power allowance for the perimeter of an illuminated area and the area allowance. That means that for every eight linear feet there is the equivalent of as much as an additional 21,000-lumen luminaire. Wouldn't this bright light result in very low uniformity between an illuminated area and the area immediately next to it? Isn't it ironic that an area that is most likely to result in light trespass is provided with additional wattage (lumens). One would have thought that the opposite would be the case.

Guard Houses and Vehicle Lanes

"There is an allowance of up to 1000 square feet per vehicle lane. Qualifying luminaires shall be within two mounting heights of a vehicle lane or the guard house".

Luminaires usually distribute most of their light within two heights of the luminaire. Therefore, if the distance from the closest boundary of the lane or guard station is twice the height of the luminaire, only a small portion of the light may be seen inside the boundary. A better metric than the wattage of a nearby luminaire would be to require adequate footcandles in the area that needs greater illumination.

According to Title 24, for primary entrances to senior care facilities luminaires must be within 100 feet of a primary entrance. In many instances, that may be too far. For instance, if the luminaires are fifteen feet tall, then the luminaires must be within eight times their height from the entrance. The result would be virtually no illumination near the entrance. Other specific applications have similar problems.

Proposed Standard

One would think that the following factors would be most important when selecting luminaires and illuminating a hardscape area.

The average footcandles appropriate for the zone and for the function that will occupy the illuminated area.

The uniformity of illumination within each illuminated hardscape area.

The proportion of lumens that fall within the illuminated hardscape area.

Additional footcandles within a subsection of an illuminated area if needed.

The BUG ratings of Luminaires.

Constraints on luminaires where the BUG ratings are exempted.

The current standards are very different to the ones mentioned above.

To properly illuminate an area, the zone should be identified and the number of lumens that would be appropriate for the zone determined. Then any additional lumens, if needed, would be added to arrive at the total number of lumens needed. Finally, the illuminated areas should meet the following conditions.

“90 percent of the lumens must fall within the illuminated area and should average between 3 and 4 footcandles with a uniformity ratio of less than 4:1. "

(The above numbers are meant to represent approximate amounts and will vary depending on circumstances)

Then, if required, an additional statement providing additional wattage for specific applications could be added.

To ensure that this will be energy efficient, the luminaires would need to deliver their luminance with a specified minimum number of lumens per watt.