

# Successful Lighting Of Decks Focuses On Type And Placement

*Proper selection of light fixtures and bulbs, as well as efficient distribution, are keys to offering safe and efficient overall illumination in precast structures*



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Providing proper lighting in precast parking decks is a critical but often downplayed element in designing the structure. Traffic must be able to move safely and locate open spaces easily, while pedestrians must feel safe, secure, and comfortable as they find their way through the facility. Selecting the proper luminaires, specifying an adequate number, and placing them in the most-effective locations can make the difference between a successful parking garage and one that doesn't meet its potential.

"Regardless of the type of construction for the structure you are lighting, there are some basics that you must adhere to," says Jim Nelson, national sales manager for Kenall Manufacturing Co. of Chicago. "There must be a sufficient quantity of light; it must be uniform; it must be comfortable, with no glare; and there should be no dark spots. What you are trying to achieve is a general feeling of safety and security."

## Distribution Is Critical

Nelson points out that the most important factor to be considered is the fixtures' ability to distribute illumination where it is needed most. Because of the confined nature of the facility and the intersection of pedestrian and vehicle paths, illumination levels vary with the type of activity in the area. Too often, lighting focuses on floor surfaces at the expense of other key elements.

Four critical areas exist within covered parking decks, according to *Lighting Handbook: Reference & Application*, published by the Illuminating Engineer-

ing Society of North America (IES). These four are the general parking and pedestrian areas, ramps and corners, entrance areas, and stairways.

IES also has established illumination criteria for general areas within a parking structure. They include:

- a minimum horizontal or vertical illumination at any point in the structure of 1.25 footcandles.
- an average horizontal illumination on the pavement at critical vehicle/pedestrian junctures of at least 5 footcandles.
- an average vertical illumination of at least 5 footcandles, measured at six feet above the pavement.
- a maximum uniformity ratio, which is the proportion of average illuminance to minimum illuminance, of 4:1.

"The location at which the illuminance is calculated or measured is an important issue," says Donald R. Monahan, vice president of the Denver office of Carl Walker Engineers, Inc., and an expert on lighting parking decks. Writing in *The Dimensions of Parking*, a book published by the Urban Land Institute and the National Parking Association, Monahan states, "In the past, most designs have considered only the horizontal illumination on the pavement. However, it is the vertical illumination of objects, vehicles, and pedestrians that is most important in a parking structure."

Measurements in new parking facilities, he adds, indicate that the IES's vertical-illumination criterion often is ignored or overlooked. He credits this to the difficulty of obtaining adequate

vertical illumination at six feet above the pavement at low mounting heights in a covered parking facility. "It is important to understand which luminaire designs are appropriate for parking structure lighting."

## Two Types Of Luminaire

There are two basic types of luminaires to consider, he writes in the report: cutoff or noncutoff. To obtain the needed vertical illumination at six feet above the pavement, cutoff luminaires generally are recommended when mounting heights will be higher than 12 feet from the floor, while noncutoffs usually are specified at heights of 10 feet or less. Since most covered parking structures feature ceilings of 10 feet, noncutoff styles will be the type most often specified. (For examples of each, see Figures 1 and 2.)

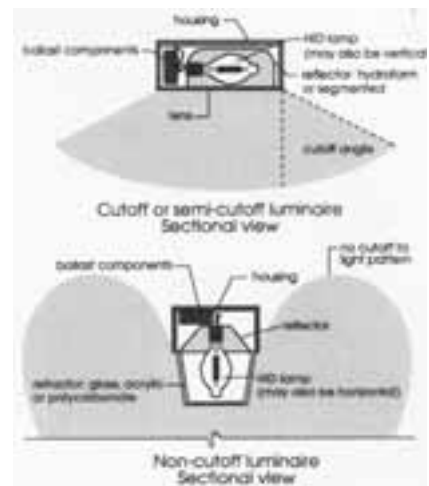


Figure 1 and 2: Cutoff or semi-cutoff luminaire sectional views. Source: Carl Walker Inc.



*Emerald Mall Parking Garage.*

*Photo: ©Unistress*

On the roof level, cutoff luminaires are recommended to minimize light trespass and hide the light source from adjacent properties, he writes in the book. “The mounting height should be equal to approximately half the horizontal distance to be illuminated,” he says. For instance, there should be a 30-foot mounting height to achieve a 60-foot horizontal throw.

The 4:1 uniformity ratio recommended by IES ensures that the contrast between light and dark zones at the eye levels of the driver and pedestrian is not too high for both parties to adjust their eyes as they travel from one area to another, Monahan explains. This contrast is highest at the entrance, when moving between bright sunlight and the structure’s darker environment. On a sunny day, the exterior illumination can reach 1,000 footcandles, while even on a cloudy day it can register 500 footcandles. As a result, these areas need to have illumination adjusted so the changes are not abrupt.

### **Sodium Vs. Halide**

The type of bulb to be used also affects many elements, including overall perception of the facility and its maintenance costs, Monahan told ASCENT during an interview. “For the most cost-effective lighting, the choice should be a bulb that gives a high-density discharge,” he says.

Three possible alternatives are high-pressure sodium, metal halide, and fluorescent. Fluorescent fixtures are a potential source only in warmer areas of the country, he says. “Above the Mason-Dixon line, the cold affects the light output of fluorescent. As the temperature drops, so does

the output.” As a result, he says, high-pressure sodium and metal halide offer better alternatives in colder climates.

The biggest difference between these two in terms of lighting capabilities is that high-pressure sodium emits a yellow light source, while metal halide is white. “Some people are put off by the color of high-pressure sodium,” he says. “But in a parking garage, that should not be as big a factor as if you were working in a textile plant where the color of the material is critical. All you want is to be able to recognize your car when you are looking for it.” High-pressure sodium does not distort the color to the extent where that becomes a major problem, he adds.

Why is high-pressure sodium the popular choice? Basically, these bulbs offer a lower initial cost—about \$20 apiece as opposed to \$30 to \$35 for metal halide. Also, Monahan says, high-pressure sodium bulbs have a life expectancy of 24,000 hours as opposed to 10,000 hours for metal halide.

He cautions, however, that there might be places where the white light of metal halide would be preferred. “When graphics become important, such as when parking levels are color coded to guide the driver around the garage, it might be

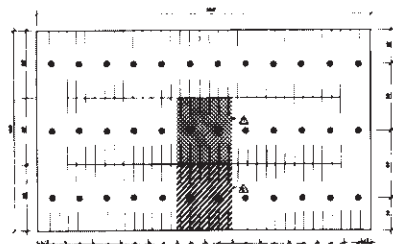
desirable to have a white light source.” A key location for these lights would be in stair towers and elevator lobbies, he says. In fact, he points out that lighting these areas with a different color light actually can be an asset, since the white light provides the garage patrons with visual cues for directions.

### **Patterns Impact Visibility**

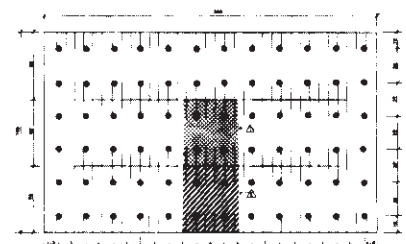
Both Nelson and Monahan point out that the pattern in which light fixtures are placed also impacts visibility, especially for the critical element of illuminating pedestrians from the waist up. The two most-used lighting patterns employ either a single row of lights down the center of the space or two rows at either side of the space. (For examples, see Figures 3 and 4.)

A case can be made for either pattern, the two men say. “If you use a single row of fixtures, spaced closer together, you must select fixtures that will project the light horizontally to both edges of the space you are lighting,” Nelson says.

Monahan makes a case for the double row of fixtures. “Using a double row offset from the center line significantly reduces the possibility of glare,” he says. “If the light source is as little as two degrees outside the line of sight, however,



*Figure 3: Single-fixture light distribution configuration.*



*Figure 4: Double-fixture light distribution configuration.*

the glare problem becomes negligible.”

Nelson agrees, stressing that, “Vertical planes must be illuminated, including cars, walls, columns, and people. If they are not, depth perception is affected, and that’s when accidents occur. Those scrape marks on the wall are there because somebody could not judge how close they were to that wall.”

Operating costs can be affected by the pattern of fixtures as well. For example, while double rows of fixtures are spaced further apart than a single center row, the number of fixtures required is greater, creating a higher initial cost. However, a single row of fixtures requires a higher-wattage bulb to achieve the same light levels, which creates a higher operating cost per lamp. Each installation should be analyzed for both initial cost and life-cycle costs to determine which type of installation would prove the most economical.


### Designing In Precast Structures

In precast parking garages built with double tees, special attention should be paid to the placement of the fixtures to ensure effective illumination. Both Monahan and Nelson agree that the lighting fixtures need to be located as close to the bottom of the double tee stems as possible to provide the proper light. This permits the fixture to distribute the light effectively without the stems casting shadows.

“You don’t want to tuck the fixture between the double tee stems against the ceiling,” Monahan says. “Ideally, you should locate the fixture level with the bottom of the stems,” to ensure that the proper illumination is reached at the six-foot level. But he also points out that the fixture should not be dropped below the tee stem, or it will create glare or subject the fixture to potential damage from high car antennas and other protrusions. He recommends locating the bottom of the fixture up to four inches above the bottom of the tee stem, and centered in the width of the tee.

Both men agree that in any parking facility, there are precautions that can be taken to minimize fixture damage. “It’s probably a good idea to consider the use of high-abuse fixtures, which can withstand not only the elements, but wanton physical damage as well,” Nelson says. “You need to protect against dirt, moisture, vibration, and insects as well as the potential for assault.”

Nelson adds that lighting fixtures should be enclosed and gasketed. He



**Recommended Maintained Horizontal Illuminances  
For Covered Parking Facilities**

Day		Lux (Avg. on Pavement)*	Footcandles (Avg. on Pavement)*
AREA			
General parking and pedestrian areas		54	5
Ramps and corners		110	10
Entrance areas		540	50
Stairways		100-150-200	10-15-20

\* Sum of electric lighting and daylight.

Night			
AREA	Lux (Avg. on Pavement)	Footcandles (Avg. on Pavement)	Uniformity Ratio (Avg. : Min.)
General parking and pedestrian areas	54	5	4:1
Ramps and corners	54	5	4:1
Entrance areas	54	5	4:1
Stairways	100-150-200	10-15-20	4:1

Source: Roadway Lighting chapter of "Lighting Handbook: Reference & Application," 8th edition, published by the Illuminating Engineering Society of North America.

also suggests that the lenses be fashioned from a high-strength material, such as injection-molded polycarbonate or a high-impact acrylic. Additionally, refractor prisms should be located on the inside of the lenses. “A smooth exterior makes it easier to keep clean,” he points out.

### Security Plays Key Role

Another key consideration in addition to providing enough illumination for safety reasons is the role played by security in the lighting decision, Nelson says. “People want to feel as safe as possible when they use parking structures. They want to be able to see someone who steps around a corner or out from behind a car or van.” The number of columns, when combined with inadequate lighting, produces a feeling of unease which better lighting can eliminate.

The color of the wall surfaces can add to this perception of safety, Monahan adds. “Painting the walls or floor a light color provides a psychological advantage. It may not significantly increase visibil-

ity, but if the pedestrian feels that he will be able to better view someone silhouetted against the wall, he will feel more secure.” He points out that a study at University of California at Berkeley suggests that while white surfaces do not necessarily increase visual performance, they give the illusion of greater brightness.

Security is another reason to select the high-impact fixtures, Nelson says. “You don’t want a mugger to be able to render an area dark by breaking a fixture,” he points out, “When that happens, you’ve lost your safety edge.”

Keeping your edge—whether its in maintenance costs, security perceptions, or general safety, is critical to designing effective parking garages today. Paying close attention to the type of luminaire selected, its special features, the lamp specified, and the fixture-distribution pattern can pay handsome dividends in customer—and owner—satisfaction. ■

— Wayne A. Endicott