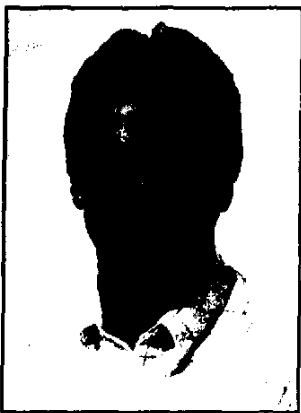


# Understanding Parking Lot Fixtures

Adapted by Robert G. Davis  
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**A** well-lighted parking lot is an important feature of a shopping center, a business park, an apartment complex or a factory. As with any lighting design, incorporating the right fixture in a parking lot lighting system is vitally important. The ability to select and specify a fixture requires knowledge of fixture types and components. Lighting management professionals should also be aware of how these distinctions impact the cost, maintenance and performance of the lighting system they install for their customers.

## Fixture types

Fixtures used for parking lot lighting can be grouped into several distinct categories, each having its own advantages and disadvantages. Following is information about each category to aid the contractor in selecting an appropriate fixture.

### Reflector (cobrahead) fixture

The reflector fixture is one of the most commonly used fixtures for street lighting applications, often used for parking lot lighting. The optical system usually consists of a horizontal mounted lamp, a hydro-formed aluminum reflector and a prismatic glass refractor. A cobrahead reflector fixture is available for most lamp wattages. Usually, lamps of 250 watts or greater are used in parking facilities at mounting heights of 20 feet or higher. These units are generally mounted on long arms off the pole in single, twin and quad configurations for maximum flexibility.

The reflector fixture produces a fairly wide distribution of light. The non-cutoff or semi-cutoff distribution of the reflector-type fixture is generally efficient. However, this type of fixture can cause glare. As a result, cutoff-type cobrahead fixtures that

use optical systems without refractors have been developed.

### Flat-lensed fixture

Typically referred to as a "shoebox" or a "sharp-cutoff" fixture, a flat-lensed fixture has a clear, flat glass lens. It achieves various light patterns using a faceted reflector. Flat-lensed fixtures usually have horizontal-mounted lamps and are available with various wattage lamps in different-sized housings. Smaller, low-wattage units (150 watts and less) can be mounted as low as 10 or 12 feet, while larger units (250 watts and greater) are mounted to typical parking lot poles at heights of 30 to 50 feet. These units have short, horizontal mounting arms and can be arranged in single, twin and quad configurations.

The luminous efficiency of a flat-lensed fixture is comparable to the efficiency of the refractor fixture. However, the flat-lensed fixture minimizes glare. Originally designed with square rectangular housings, flat-lensed fixtures are also available in round and domed shapes in a variety of colors and finishes.

### Vertical downlight fixtures

The reflector and the flat-lensed fixture types utilize a horizontally-mounted lamp. Vertical downlight fixtures operate the lamp in a vertical position. This fixture type produces a wide light distribution with minimal light directly below the unit. The vertical downlight fixture is available with a prismatic refractor or with a flat lens. The flat lens type provides better glare control than the refractor type. The most common light distributions available for vertical downlight fixtures are circular or almost square distributions.

Lamp wattages and mounting heights of the vertical downlight fixture are similar to those of the flat-lensed fixture. Vertical downlight fixtures often are categorized with the flat-lensed fixture since their outward appearance is similar. The primary

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functional difference is the wider light distribution normally provided by vertical downlight fixtures.

#### *Redirected reflector fixture*

The redirected reflector fixture has an optical system that consists of an upper reflector which directs the light onto a lower reflector. This lower reflector redirects the light out and toward the ground. The lower reflector element is enclosed in a clear plastic housing that is shaped as either a cylinder or a cube. The upper reflector is enclosed in an opaque housing.

The light distribution pattern of the redirected reflector fixture is circular, but asymmetry is achieved in some units by using internal baffles. These fixtures conceal the lamp from direct view which minimizes glare.

#### *Post-top functional fixture*

Depending on the lamp orientation and the optical system used, the post-top functional fixture can be similar in performance to the refractor, flat-lensed or vertical downlight fixture. Rather than being mounted on a horizontal arm, these fixtures are mounted in a yoke configuration on top of a pole.

#### *Post-top decorative fixture*

The post-top decorative fixture ranges from a simple sphere to an elaborate lantern in a historical design. Low-wattage lamps (150 watts and less) are commonly used in these fixtures and are vertically mounted. Optical systems range from minimal (bare lamp) to prismatic cylindrical lenses, which completely enclose the lamp.

In the post-top decorative fixture, light distribution is circular or partially asymmetric. This type of fixture is designed for pedestrian pathways and is often used to create or reinforce a particular design motif. As such, it typically would not be used to light a general parking area, but rather would be employed to light walkways and malls.

#### **Fixture components reflectors**

Except for fixture types, the construction of the reflector constitutes the chief distinguishing factor in a fixture's performance and cost. Most reflectors used in parking lot fixtures are made from anodized aluminum that can be hydro-formed, fabricated or spun. The hydro-formed or deep-drawn aluminum reflector is one of the most common reflectors used for outdoor fixtures. Once the tooling for a particular optical system is designed and built, these reflectors can be manufactured economically and with consistent performance. These one-piece reflectors have to be mechanically polished if a specular finish is required. A more economical process used by many manufacturers is to electro-chemically brighten these reflectors. This process results in a semi-specular finish. A reflector with a semi-specular finish provides less precise optical control than one with a specular finish.

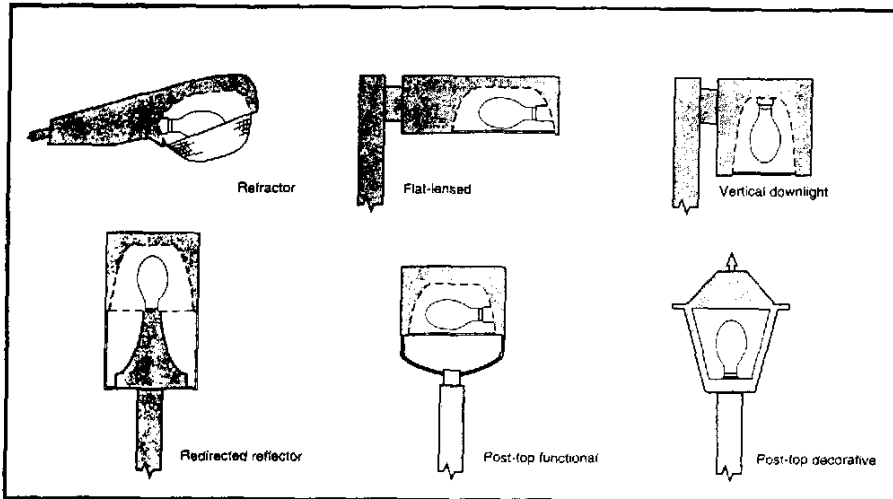
Other parking lot fixtures utilize a segmented reflector system fabricated from specially-designed specular aluminum strips that are bent and oriented to provide the desired light distribution. Manufacturing costs for fixtures that use segmented reflectors are higher than those for fixtures that use hydro-formed reflectors. Producing reflectors with consistent photometric performance is more difficult than with one-piece reflectors. Segmented reflectors provide a greater variety of precise light distributions, making it easier to create uniform illuminance on the ground.

Spun reflectors are the least expensive type, but are limited to circular distribution and to the vertical downlight fixture. The finishes available for spun reflectors are the same as those for hydro-formed reflectors. Spun reflectors sometimes redirect energy back into the lamp's arc tube. This increases the operating temperature of the lamp and may reduce its life.

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**Understanding parking lot luminaires**

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**Figure 1: Types of parking lot luminaires.**

*Housing*

Fixtures used for lighting parking lots are exposed to high levels of solar radiation, saltwater spray, temperature extremes, wind-driven sand, automobile fumes, rain and vibration. Consequently, the materials used for these fixtures must be able to withstand these conditions. Fixture housings generally are constructed of extruded aluminum, cast aluminum, fabricated aluminum sheet, spun aluminum, fabricated steel sheet or stainless steel. Aluminum housings survive well in most outdoor applications, even in corrosive saltwater environments. Steel sheet housings are common in lower-cost equipment, but are susceptible to corrosion and deterioration. Although a protective coating often is applied to the housing, some exposed edges may be uncoated, and the coating sometimes is scratched during installation and maintenance. More expensive fixtures typically use extruded aluminum or stainless steel housings. Stainless steel housings provide superior corrosion protection for extreme environmental conditions. Extruded aluminum housings are

almost seamless and are durable in all environments.

A number of finishes are used for parking lot fixture housings. Anodized aluminum is one of the most permanent finishes available. However, it is available only in natural, bronze or black colors. A less permanent and less expensive finish is the dye-anodized finish. In this process, an organic dye is used to produce the required colors. Because the dyes used are organic, they will fade over time with exposure to ultraviolet radiation. Painted finishes such as the polyester powder coat or baked-enamel finish, are available in many colors. Painted finishes will also fade over time and are more easily scratched than the anodized finishes. Frequently, the manufacturer offers a warranty on the housing finish.

*Lens materials*

Lens materials used in parking lot fixtures include tempered glass, borosilicate glass, polycarbonate and acrylic. Tempered glass lenses are extremely durable and do not deteriorate during their long life. Borosilicate glass lenses are less durable, but are able to survive the thermal shocks that might occur when used in high intensity discharge fixtures. Polycarbonate lenses are used for applications where vandalism is a problem because polycarbonate has extremely high impact resistance. However, this material turns yellow and becomes brittle over time upon exposure to ultraviolet (UV) radiation and to heat from HID lamps or sunlight. Special UV inhibitors can slow this process and extend the life of the polycarbonate lens. Acrylic and high-impact acrylic lenses have excellent resistance to ultraviolet radiation and degradation. However, acrylic cannot be used in many higher-wattage HID fixtures because the temperatures in the fixture exceed those recommended for acrylic materials.

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#### **Gasketing**

A well-designed gasketing system is essential to keep the fixture's optical system clean. Poor gasketing that allows dirt penetration can result in reduced light levels in the parking area. It may also increase maintenance or operating costs over the life of the system. Commonly used gasketing materials are felt, sponge neoprene and high-compliance silicone. Foam rubber gasketing is occasionally used, but is not as durable as other materials. Silicone gaskets generally are more expensive, but because silicone does not permanently deform with use, these gaskets maintain their effectiveness over time. Felt and neoprene materials can become deformed with use which may create a gap for insect or dirt penetration. Stiff or non-compliant gasketing may make it difficult to close and clamp the lens frame to the fixture housing.

Gasketing must be continuous and permanently attached to one surface so it will not come loose or fall off during lamp maintenance. A fixture should also have a high seal against water infiltration. Generally, when water leakage occurs, the heat from the operating lamp and ballast causes the moisture to evaporate. However, the evaporated water often leaves a stain on the glass lens which reduces the light output of the fixture. Excessive moisture within the fixture can cause corrosion of metal components and electrical malfunctions of the ballast, capacitor and starter.

#### **Maintenance**

Maintenance costs for parking lot lighting systems can be high, since the mounting heights often require special equipment to access the fixtures. Easy replacement of lamps, ballasts and optical components will minimize labor costs. The ballast and associated electrical parts can be mounted on a separate tray or compartment for easy removal and

replacement. Electrical plug-in modules also referred to as "quick disconnects," can minimize the potential for incorrectly reconnecting the electrical circuits.

#### **Energy considerations**

The energy used by a parking lot lighting system is a function of the lamp type, the fixture and the control strategy. Older installations that utilize incandescent or mercury vapor lamps can be replaced with systems that use more efficient lamps, such as high-pressure sodium, low-pressure sodium or metal halide. With these lamp types, the total wattage needed for the system to provide a given illuminance can be greatly reduced.

The use of "dusk-to-dawn" lighting controls which commonly incorporate a photocell or time clock, ensures that the lighting system is only consuming energy when lighting is needed. When fixtures are used in a twin or quad mounting configuration, some of the fixtures may be switched off with a time clock during hours when no usage of the parking lot is expected. This strategy saves energy and maintains a minimal illuminance for security purposes. A similar control strategy is to use a bi-level control system which reduces the power to the lamps by 50 percent during non-usage hours.

#### **Summary**

With an understanding of the various types of parking lot fixtures and the components used in those fixtures, the lighting management professional can ask the right question of the fixture manufacturer and can assist the end user in developing an effective parking lot lighting system. The final result will hopefully be a lighting system that not only attracts customers and creates a sense of personal security, but also is energy-efficient and easily maintained. ♦