

MULTIFAMILY PERFORMANCE PROGRAM

Technical Topic – Existing Buildings

Parking Garage Lighting

Several energy savings opportunities are available for parking garage lighting:

- ◆ Install energy-efficient fixtures
- ◆ Install lighting controls: occupancy sensors and/or daylighting
- ◆ Reduce illumination in overlit areas
- ◆ Lower fixtures toward the floor

Install energy-efficient fixtures

The most common fixtures in parking garages are metal halide, high-pressure sodium, and linear fluorescent. Of these, linear fluorescent fixtures with electronic ballasts are the most energy-efficient, with the most consistent color rendition and the lowest life-cycle cost. Many linear fluorescent fixtures and bulb/ballast combinations are available, with different installed watts, lumens, and rated lifetimes.

175-watt metal halide fixtures (205 watts including ballast, ~9000 lumens) can be replaced with three-lamp fixtures using Super T8 lamps and electronic ballast (111 watts including ballast, ~9900 lumens).

Install lighting controls: occupancy sensors and/or daylighting

NFPA's Life Safety Code allows the use of occupancy sensors to control all fixtures, even those in stairwells. Fixtures on emergency circuits are usually left on 24/7, but there are even devices available that can turn the emergency circuit on and off in coordination with the activity of the occupancy sensors. We recommend installing occupancy sensors on all fixtures that are not on emergency circuits. Fixtures controlled by occupancy sensors should have programmed rapid-start ballasts to avoid problems from frequent cycling. Occupancy sensor layout must be carefully planned, proper operation should be tested after installation, and the timed on-time should be kept to a minimum, preferably 5 minutes or less.

Above-ground parking garages with perimeter openings can use daylighting controls (photosensors) to reduce lighting "on" time.

Reduce illumination in overlit areas

The Illuminating Engineering Society of North America (IESNA) recommends minimum illumination levels of 1 foot-candle (FC) on horizontal surfaces and 0.5 FC on vertical surfaces. Higher illumination levels are required during the daytime and near entrances to help drivers adapt to the transition from bright outdoor conditions. Vertical illumination is important for safety, so pedestrians and drivers can see obstacles and identify faces.

Research has shown that face recognition and obstacle identification are not significantly improved at illumination levels above 4 FC; however, many designs are more conservative. A recent NYSERDA study of Albany-area parking garages that replaced fixtures, installed controls, and reduced light levels to 5 FC (measured on horizontal surfaces) achieved 20%-30% reductions in electric bills.

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Lower fixtures toward the floor

Lowering fixtures toward the floor increases illumination and so allows removing fixtures. By code, the minimum fixture height is 7'-0" above the floor, 8'-2" in handicapped parking areas and in access lanes that lead to those handicapped spaces.

Fixture selection

Cold weather operation is the biggest challenge for fluorescent fixtures. Cold weather ballasts are needed for temperatures below 60F, and wrap-around lenses (enclosed fixtures) should be used where temperatures fall below 50F. Light fixtures in parking garages should be UL listed for damp locations at a minimum, and preferably listed for wet locations. The gasketing used to prevent moisture entry will also reduce insect and bug infiltration. Tamper-proof hardware and impact-resistant lenses combat vandalism.

Parking garage lighting design basics

ASHRAE 90.1-2004 requires parking garage lighting in new buildings to use less than 0.3 watts per square foot. According to Donald R. Monahan¹, a maximum floor area of 1200 square feet can be illuminated to IESNA's minimum standard using one eight-foot long fixture with four 4'-0" linear fluorescent bulbs. For more uniform light distribution, use two fixtures, each with two 4'-0" T8 bulbs, instead of a single eight foot fixture with four bulbs.

Typical parking garage designs use 52 to 62-foot wide parking modules, each module consisting of parking spaces along both sides of a central driving lane.

Assuming a 60-foot wide parking module 200 feet long, Monahan says a typical design would use two rows of fixtures, one row on either side of the central driving lane, 15 feet from the wall and 15 feet from the center of the driving lane, oriented parallel to the driving lane. Following the rule of thumb stated above (one fixture per 1200 square feet), ten eight-foot linear fluorescent fixtures as described above could be placed a maximum of 40 feet apart, center to center, for a total of ten fixtures to illuminate this 12,000 square foot space. With electronic ballasts, each fixture would each draw 113 watts, for a total of 1,130 watts, 0.09 watts per square foot. Alternatively, 20 four-foot fixtures, each with two bulbs, would achieve the same effect.

The simplified design described above appears to meet IESNA standards. In an actual building, however, other considerations will probably lead to installation of additional light fixtures. For example:

- ◆ As previously mentioned, IESNA requires higher illumination during daylight hours-- at least 50FC near entrances, at least 2 FC for ramps. Stairways should have at least 2 FC at all times.
- ◆ Additional fixtures may be needed to prevent dark areas behind pillars and other structural obstacles.
- ◆ Lumen output drops as fixtures age. Many building owners do not replace bulbs until they burn out, so a conservative design will include a safety factor.

¹ Chrest, Smith, Bhuyan, Monahan, and Iqbal, *Parking Structures: Planning, Design, Construction, Maintenance, and Repair*, Third Edition, 2001, Kluwer Academic Publishers, Norwell, MA