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## Parking Matters: The 14% Tenant

Managing Your Parking Asset to Boost Revenue,  
Save Money and Serve Your Customers

By Barbara Chance, Ph.D.,  
and Clyde Wilson

MANY BUILDING OWNERS AND MANAGERS literally sit atop one of their best revenue sources. Commercial parking facilities are hidden assets that often receive minimal attention until a maintenance crisis hits or someone wants to increase fees.

Parking facilities typically supply 10 to 14 percent of a building's total annual revenue if there is paid parking, but building owners and managers can lose up to 28 percent of this revenue due to deficient contracts with

private operators, inefficient operations, maintenance lapses, employee theft and financial irregularities. Beyond its revenue benefits, a well-run parking operation can significantly enhance your building's appeal to current and prospective tenants.

What can you do to maximize both revenue and customer service?

### Review and Update Contracts with Private Operators

If you contract with a private company for parking operations and management, perhaps the single most important step is to review and update

your contracts with your private operator. Far too often, contracts consist of a single-page agreement that fails to specify performance standards, responsibilities for each party, penalty clauses for non-performance, maintenance and capital improvement requirements and reporting and audit obligations.

Deficient contracts provide an opportunity for operational inefficiencies, theft and lost revenue. In one multi-building complex, each owner's agent had a different agreement with each tenant for parking spaces. There was no consistency to the agreements, nor was there accounting for the number of contract parking leases or a record of how many parking cards were issued. In another facility, the contract with the operator lacked terms covering how often the facility had to be cleaned (it never was) or how the operator was to handle abandoned vehicles left on-site (more than 100 discarded vehicles occupied parking stalls that could have been producing revenue). New contracts remedied the deficiencies and resulted in an instant increase in revenue.



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- Essential Elements of a Good Functional Design
- Sustainable (Green) Design for Parking
- Designing a Security Program For Lots and Garages
- Parking Area Trees – Urban Ecology, Green Laws, Challenges and Design
- Design-Build Project Delivery of Parking Structures
- Life Cycle Cost Analysis

## Consider a Comprehensive Parking Audit

Periodic audits, which should be included in all contracts with private operators, are designed to reveal irregularities and inefficiencies in operations and financial management. These audits also provide important revenue control information, such as an accounting of the number of spaces given out "free" and the number of paid monthly parking leases. Audits also determine whether the operator is complying with Payment Card Industry (PCI) regulations, including staff access to credit card information. Once, a parking operator kept customer credit card numbers on index cards in a small box—a clear PCI violation and an invitation to theft.


When you consider the value of a well-run parking operation to your bottom line, you may want to re-evaluate the expertise and pay scale of your parking operations manager. Should a multi-million dollar asset be the responsibility of a \$30,000-a-year employee with no parking experience?

## Take Advantage of New Technologies

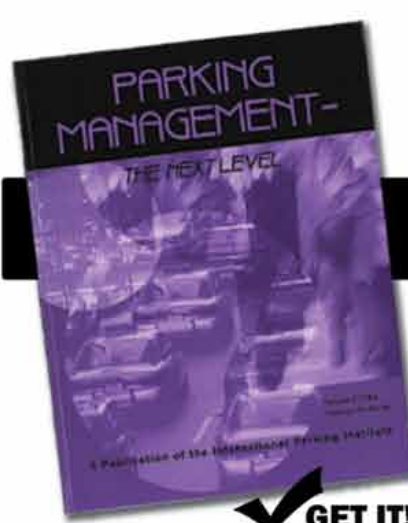
Parking technologies are advancing rapidly, with several offering new efficiencies, better revenue control, energy savings and improved customer service. Radio Frequency Identification (RFID) tags or key cards used for entrance to parking facilities. Smart cards and other e-payment devices, high-speed doors and self-service payment are all ways to improve customer service and operational efficiencies. Energy-efficient lighting, such as LED or fluorescent lights, has the potential to lower operating costs and provide tax credits. Fluorescent lighting consumes between 30- to 85-percent less energy than incandescent and high-intensity discharge (HID) lighting at equal or greater light levels.

## Add a Parking Professional to Your Team

Parking professionals have the skills and expertise to consult on the designs for exits, entries, circulation patterns

and parking capacity. They can also provide advice on facility lighting, energy efficiencies, parking rates, new technologies and PCI regulations. Finally, they are able to assist in developing Requests for Proposals and contracts with private operators. Their services are a smart investment that can boost revenue through new efficiencies and reduced expenses. And, best of all, this investment usually more than pays for itself, turning the "14-percent tenant" into a consistent profit center. 

**About the Authors:** *Barbara Chance, Ph.D.*, is a member of the International Parking Institute's Alliance for Advancing the Parking Profession and IPI's Advisory Council. She is president of CHANCE Management Advisors, Inc., which provides consulting services for owners in the areas of transportation, parking and access management. *Clyde Wilson* is president and CEO of The Parking Network, Inc., a company that audits millions of dollars in parking income for owners each year. Visit the International Parking Institute's Web site at [www.parking.org](http://www.parking.org) to learn more.



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**Parking Management - The Next Level** is designed to serve as a continuation and deeper exploration of the topics covered in the first publication in the series: **Parking 101 - A Parking Primer**. This will serve as a resource to everyone involved in the parking industry through chapters written as part of a "handbook" series such as:

- The Top Ten Most Common ADA Mistakes in Parking Lots
- Graphics and Signage
- Writing an Effective Request for Proposal (RFP) for Parking Facilities
- Employee Training: Customer Service Improves Performance
- Shuttle Bus Operation
- Successful Management of a Valet Operation
- Design and Build Delivery Systems
- Developing an Annual Parking Annual Report
- Recruitment, Training & Retention of Parking Personnel
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- Parking Structure Maintenance
- Parking Design Checklist
- Structural System Selection - Which is Right for You?
- Pedestrian Planning
- Security and Safety in Parking Design
- Writing Manuals for Parking Operations
- Off Street Facilities: An introduction to Steel-Framed Open-Deck Parking Structures

# Parking Facility Lighting: Myths & Realities

Donald R. Monahan, P.E.

Federal legislation, sustainable design and the new economy have led to greater demand for new energy-efficient lighting technologies. The trend in parking facility lighting is moving away from high-intensity discharge light sources such as metal halide (MH) and high pressure sodium (HPS) toward fluorescent lamps, induction lamps, and light-emitting diodes (LED). However, lighting manufacturers and representatives may exaggerate the benefits of these new technologies. In particular, the light output and potential energy savings have been exaggerated. The purpose of this article is to expose some of those myths and indicate the real benefits, if any.

Table 1 indicates a comparison of the light output, input wattage, and lamp life of these light sources.

**Table 1**  
Light Source Comparisons

Light Source	Initial Lumens	Total Light Loss Factor (at end of rated life)	Design Lumens	Input Wattage per Fixture	Lamp Life, Hours
150-watt HPS	16,000	0.65	10,400	188	28,000
175-watt Pulse Start MH	17,000	0.47	7,990	190	15,000
4, T8 Fluorescent	12,000	0.71	8,520	110	36,000
2, T5HO Fluorescent	9,000	0.81	7,290	122	36,000
85-watt Induction	6,000	0.56	3,360	85	105,000
80-count LED @ 350 mA	7,172	0.56	4,016	93	105,000
100-count LED @ 350 mA	8,965	0.56	5,020	116	105,000

**MYTH #1: ALL LIGHT SOURCES ARE EQUAL.**

**REALITY: False.** It takes approximately twice as many 60-count LED fixtures and more than twice as many 85-watt induction fixtures, 50 percent more 80-count LED fixtures, to produce the equivalent maintained light output as 150-watt HPS, 175-watt MH, 4T8 or 2T5HO fluorescent fixtures (see equivalent design lumens in Table 1 and comparative lighting calculations in Table 2). At a typical fixture spacing of 30-feet by 30-feet, the lighting power density for 150-watt HPS or 175-watt MH fixtures will be approximately 0.21 watts per square foot. The lighting power density for the 4, T8 fluorescent fixture is 0.12 watts per square foot. The lighting power density for induction lamps for twice the number of fixtures is 0.19 watts per square foot. The lighting power density for the LED 60 fixtures – for twice the number of fixtures – is 0.16 watts per square foot. The 100-count Beta LED fixture is nearly equivalent to the light output of the 175-watt MH fixture and represents a 44

percent reduction in energy on a one-for-one replacement basis. Since the operating cost is 75 to 85 percent of the 25-year life cycle cost, the fluorescent fixtures and 100-count LED fixtures are clearly the most energy-efficient for equivalent light output that meets historical standards for an average maintained illuminance of five footcandles or greater, and meets the Illuminating Engineering Society standard of a minimum of one footcandle anywhere on the floor. .

**MYTH #2: ILLUMINANCE CALCULATIONS ARE ALL CREATED EQUAL.**

**REALITY: False.** Manufacturer’s representatives provide lighting calculations at no cost; however, they often use average light output (mean lumens) over the life of the lamp rather than end of life maintained lumens. Most parking facility owners do not re-lamp prior to the lamps burning out. According to the Illuminating Engineering Society publication RP20-1998, the light loss factors should be determined immediately prior to lamp replacement. Therefore, the end of life lumen depreciation and dirt depreciation

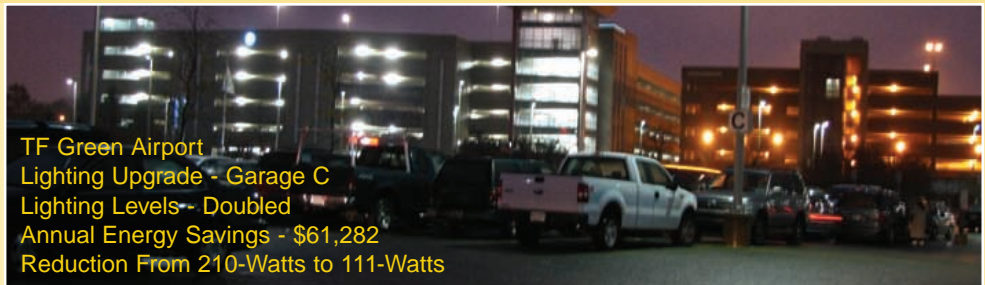
should be used in the calculations. Also, each area covered by a single luminaire must meet minimum illuminance standards or the owner will be at risk for personal injury law suits due to slip and fall or trip and fall. The total light loss factor for each light source is illustrated in Table 1. These values are not all that conservative as the rated life is determined when 50 percent of a large population of lamps have expired. Fifty percent are then still working and continuing to depreciate. Measurements in hundreds of parking facilities indicate average illuminance on the order of three foot-candles when the design was intended to produce five foot-candles.

**MYTH #3: THE INITIAL COST OF THE LIGHT FIXTURE IS A SIGNIFICANT PORTION OF THE TOTAL LIFE-CYCLE COST.**

**REALITY: False.** The initial cost of the light fixtures is less than 15 percent of the total life cycle cost over 25 years. However, induction fixtures are double the cost of fluorescent fixtures and LED fixtures are quadruple the cost of fluorescent fixtures.

**Table 2**  
Comparative Lighting Calculations

Room Dimensions:	60 ft by 300 ft
Ceiling Height:	9.75 ft
Mounting Height:	8.75 ft
Ceiling Reflectance:	35%
Wall Reflectance:	35%
Floor Reflectance:	20%
Lateral Spacing, ft:	30 ft



	Average Horizontal Illuminance on Floor, FC			Average Vertical Illuminance @ 5 feet on side wall, FC			Minimum Horizontal Illuminance on Floor, FC			Minimum Vertical Illuminance @ 5 feet on side wall, FC			Lighting Power Density		
	20	30	40	20	30	40	20	30	40	20	30	40	20	30	40
Longitudinal Spacing, ft															
Beta LED 60	4.8	3.2	2.5	1.7	1.1	0.7	1.7	1.0	0.8	0.7	0.4	0.4	0.12	0.08	0.06
Beta LED 80	6.3	4.3	3.4	2.3	1.5	0.9	2.3	1.3	1.0	1.0	0.5	0.5	0.16	0.10	0.08
Beta LED 100	7.9	5.1	4.2	2.8	1.5	1.1	2.9	1.5	1.3	1.2	0.5	0.6	0.19	0.14	0.10
Widelight LED 100	6.4	4.5	3.5	3.5	1.5	1.2	2.7	1.0	1.0	1.1	0.7	0.9	0.22	0.15	0.12
Kim PGL71W	2.9	1.9	1.5	2.5	1.9	0.9	1.3	0.8	0.8	1.3	0.8	0.8	0.13	0.08	0.07
Gardco 85W Induction	3.7	2.5	1.9	2.1	1.4	1.2	1.3	0.8	0.7	0.9	0.5	0.6	0.15	0.10	0.08
KIM 85W Induction	4.0	2.7	2.1	2.7	1.8	1.5	1.3	0.8	0.8	1.3	0.7	0.9	0.15	0.10	0.08
Maris 80W Induction	3.3	2.2	1.8	2.4	1.5	1.1	1.0	0.7	0.6	1.2	0.7	0.9	0.14	0.09	0.07
Lithonia 4T8 STD	10.4	7.2	5.7	7.3	3.5	2.7	3.0	1.8	1.7	3.5	1.8	2.2	0.19	0.12	0.10
Columbia 4T8	9.8	6.8	5.3	6.9	3.4	2.6	3.9	1.7	1.7	2.3	1.7	2.2	0.19	0.12	0.10
Renova 3T8 std	6.5	4.2	3.3	3.6	3.6	2.8	1.8	1.1	1.0	2.0	1.4	1.6	0.16	0.11	0.09
Lithonia 2T5HO	9.6	6.6	5.2	6.8	3.5	2.7	2.9	1.7	1.6	3.3	1.8	2.2	0.20	0.13	0.11
KIM PGL1 150W HPS	11.2	7.5	5.9	8.3	5.6	4.1	3.9	2.9	3.2	3.6	1.6	1.6	0.31	0.21	0.13
KIM PGL1 175W MH	8.6	5.1	4.2	4.9	2.9	2.2	2.9	1.8	2.0	1.9	0.8	1.0	0.35	0.23	0.16

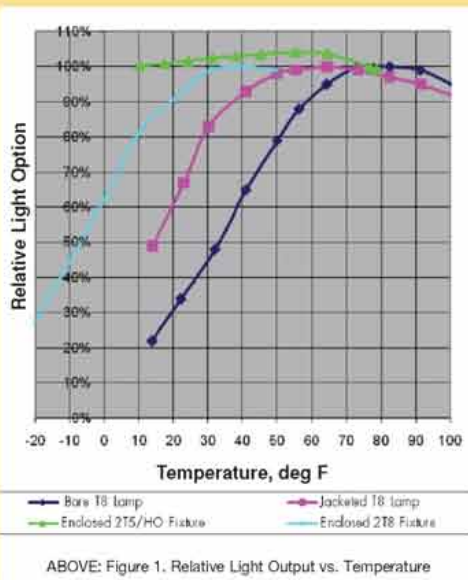
**Note:** Yellow highlighted illuminance is below industry standards.

**MYTH #4: I WILL SAVE A LOT OF MONEY WITH A LONGER LIFE LAMP.**

**REALITY: False.** The maintenance cost for lamp replacement and fixture cleaning is only five percent to 10 percent of the total life cycle cost. The savings in energy cost for using fluorescent fixtures easily outweighs any maintenance cost savings for the longer life induction lamps or LED fixtures. If you have fixtures in a relatively inaccessible location, then the cost of lamp replacement may be significant and a longer life light source could have some advantages.

**MYTH #5: FLUORESCENT FIXTURES SHOULD NOT BE USED WHERE THE WINTER TEMPERATURES FALL BELOW FREEZING.**

**REALITY: False.** While it is true that a bare fluorescent lamp loses 50 percent of its light output at 32 degrees Fahrenheit, fluorescent fixtures with an enclosed wrap-around lens capture the heat from the lamps and ballasts. The temperature inside a vapor-tight fixture can be as much as 30 degrees Fahrenheit above the outside ambient temperature. Further, full scale monitoring of above



ground, open parking structures by the Precast Concrete Institute indicates there is about a 15-degree lag in temperature inside the parking structure compared to the ambient air temperature outside of the parking structure. Tests indicate about a 20 percent loss in light output for an enclosed fluorescent fixture at 10 degrees Fahrenheit (see Figure 1). One should test a proposed fixture for relative light output versus temperature, then determine the historical low temperature at the location of the facility, and factor in the light loss due to temperature into the illuminance calculations.

**MYTH #6: EXISTING LIGHTING SYSTEMS CANNOT BE RETROFITTED WITH AUTOMATIC LIGHTING CONTROLS.**

**REALITY: False.** Wireless lighting controls are available to turn off lights when the facility is unoccupied and turn them back on when people or vehicles are present. In addition to occupancy sensors, sensors are available that turn lights off when adequate daylight infiltration is detected. A prototype parking facility in Grand Rapids, Mich., indicated a 42 percent savings in operating cost when using the wireless lighting controls.

**MYTH #7: RETROFITTING EXISTING HID LIGHTING SYSTEMS IS TOO COSTLY.**

**REALITY: False.** There are many incentives for retrofitting HID lighting systems and older T12 fluorescent systems with more energy-efficient lighting. The Energy Policy Act (EPACT) of 2005 provides a \$0.60 per square foot tax deduction for installing a lighting system that uses less than 0.18 watts per square foot. Further, local utilities often have rebates for installing energy efficient replacement lighting. The payback period for installing energy-efficient lighting is typically less than two years where the electric utility cost is over eight cents per kilowatt-hour. In many areas on the east and west coasts, the utility cost is 15 cents per kilowatt-hour. The payback period in those locations is less than one year.

**MYTH #8: WHITE LIGHT SOURCES ARE BETTER THAN YELOWISH LIGHT SOURCES.**

**REALITY: True.** White light sources have higher brightness perception than yellowish light sources (i.e. HPS). Lighting research indicates that it takes approximately 40 percent more yellowish light to provide the same brightness perception as white light sources.

**MYTH #9: LESS ILLUMINANCE CAN BE USED WITH WHITE LIGHT SOURCES COMPARED TO YELOWISH LIGHT SOURCES.**

**REALITY: False.** Human vision goes through three distinct operating states. In a concrete parking structure, photopic vision occurs (involving predominantly cones) at light levels greater than three FC. Scotopic vision (predominantly rods) occurs at light levels less than 0.001 FC. Mesopic vision occurs at light levels in between those ranges. There are studies that indicate enhanced vision under scotopic light levels. However, the low light levels for scotopic vision are not applicable to parking facilities. Further, the Illuminating Engineering Society has issued a policy statement that photopic vision should be used for all IES lighting standards.

**REMARKS**

Lighting technology is improving rapidly. Just two years ago, there were hardly any LED or induction lamp fixtures for parking garages. Now, just about every major light fixture manufacturer has both LED and induction light fixtures. In addition, the lumens per watt of LED chips has doubled in the last year. The lumens per watt for LED chips is likely to increase substantially by next year. Similarly the lumen output of induction lamps will likely improve substantially in the next year. Super T8 lamps are also likely to increase in lumen output in addition to increasing lamp life. Therefore, this article is appropriate for the current lighting market, but it is likely to change in the next year and more. ■

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# SAFE PARKING:

## What You Should Do to Protect Employees and Guests

Randall I. Atlas, Ph.D., AIA, CPP

### REAL-WORLD SCENARIOS

In 2008, 18-year-old Kelsey Smith was forcibly abducted from the public parking lot of an Overland Park, Kan., Target store. Her body was found four days later in a Missouri park about 20 miles away. In August 2008, in Macon, Ga., John Fox was returning to his car in a downtown public parking deck when he was accosted by a robber who used his gun to hit Fox several times on the head, then stole Fox's wallet and keys. And on September 5, 2008 the *EastBay Express* news Web site published an article called "Lots of Trouble" that reviewed the explosion of crime in the parking lots of San Francisco's Bay Area Transit System, reporting that, "In the Bay Fair station's parking lot June 9, 2008, three teens beat a man about the face and fled with his phone and laptop ... At the Coliseum station [on June 17], six men attacked another, hurling him to the ground and demanding his money."

These few examples illustrate the crimes that take place in parking facilities. An ongoing series of studies on premises security

liabilities by Norman D. Bates, president of Liability Consultants Inc., estimates that as many as 40 percent of rapes and assaults take place in parking lots. The mind-set that these are merely stables for vehicles and not places where human behavior occurs results in major errors in the design and operation of parking facilities. This shortsighted design approach can result in numerous hiding spaces and poor visibility created by high walls, structural columns and multiple levels. Even worse, subsurface or underground parking facilities often include no outside visibility.

### PREVENT CRIME THROUGH ENVIRONMENTAL DESIGN

Using the precepts of crime prevention through environmental design (CPTED) can help eliminate these issues. With CPTED, for example, criminals will realize that parking areas are places where they will be observed and where suspicious behavior will be challenged, making it not worth the risk and effort.

CPTED incorporates three principles:

1. Use natural surveillance so that users can see farther and wider, making it harder for criminals to hide or carry out their activities.
2. Create natural access control, including spatial definition that encourages legitimate site users and discourages illegitimate ones.
3. Manage and maintain the facilities to meet industry standards of care.

CPTED can address poor entrance and exit planning with, for example, signage that does not assist users to quickly or logically move through the facility; pedestrian access points that fail to provide natural surveillance; and perimeter access by persons walking or driving.

Tolerating vandalism, graffiti and general disrepair sends a clear signal to potential criminals and other undesired users that the site is fair game. Conversely, it makes legitimate users feel afraid or wary of patronizing your facility. It is necessary that legitimate users develop a sense of territoriality so that there is active involvement in keeping undesired users away.

#### ASSESS THE FACILITY'S VULNERABILITY

The first step toward parking lot security through CPTED is to conduct a security vulnerability assessment. Generally, in the United States, the standard of care dictates that the assessment include a criminal history of the site, a review of landscaping, lighting, stairwells, elevators, surveillance capabilities, access control equipment, and signage, as well as an inspection of any facilities for revenue collection, supervision, and rest rooms. The policies and procedures for the operation and staffing of the parking facility should also be scrutinized.

Many questions should be asked, including:

- What type of community does this parking facility serve – shoppers, commuters, students, or employees?
- How many cars frequent the facility and how quickly do spaces turn over?
- Are there clear lines of sight? Are there obstructions by walls, columns, or ramps?
- What are the hours of operation and how do those hours affect the user environment?
- Is the lighting all or mostly natural or is it man-made? Is man-made lighting at ceiling height? If so, then what is the color of ceilings and how are the lights placed?

- Is there CCTV, and if so, what are the details of the system? Is there ground floor protection, such as gates, screens and barriers?

Additional questions should address vehicle and pedestrian entrances, whether there are required paths of mobility for ADA compliance, the condition and maintenance of the elevators, stairwell placement and visibility issues, and whether there is selective closing of lightly used areas.

#### SECURE THE FACILITY ON THE GROUND

Perimeter definition and access control deters unwanted pedestrian-level access to the lot or garage. It can take the form of fencing, level changes, ground floor protection, and other architectural and environmental barriers that channel people to designated entry points and discourage others from hiding outside and inside the property or buildings.

Ground-level metal screening should be used to prevent or deter unauthorized access, while upper floors should be open with cable strung to prevent cars from overshooting the parking spaces and toppling off. Screened,

rather than walled, ground levels and open upper levels allow natural surveillance and make it more likely that calls for assistance will be heard.

Ground-level screening should not be floor to ceiling, however, as that can give a criminal a way to climb to higher floors. It's also a good idea when space permits to place short bushes close to the perimeter wall to discourage persons from climbing or cutting the screen.

Additional landscaping should be intermittent in size and texture. Instead of planting a solid hedge, combine low hedges and high canopy trees. All trees and bushes must be properly maintained to provide a good field of vision and to avoid creating hiding places. Plantings that are higher than three feet should not be placed within 10 to 15 feet of entrances to prevent hiding spots, and mature trees should be pruned to eight feet.

Traffic engineers will often encourage multiple access points to increase circulation patterns. However, the more entrances that there are, the more difficult it is to control the users and uses of the facility. The CPTED-recommended method is to have



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- Parking Definitions and Terms
- Basics of Parking
- Parking Surveys and Studies

- Gaining Community Acceptance of Parking Facilities
- Communicating with the Parking Public
- Financial Feasibility
- Surface Parking Lots
- Parking Structures
- Structural Design
- Parking Access and Revenue Control
- Providing Control on Revenue Capture
- Future/New Technologies
- Parking Safety and Security: A Legal View

one means of entry and exit for all vehicles. If the volume of traffic requires more, then each subsequent access point should also have an attendant booth, access gate arms, roll down shutters for after-hours closure, CCTV, and good lighting.

**Pedestrians.** Unfortunately, pedestrian access is one of the most commonly overlooked or poorly thought-out design features of parking facilities.

Full handicap accessibility is key and should include dedicated handicap spaces, ramps, railings, floor surfaces, pedestrian crossovers, and dedicated pedestrian paths, as well as stair design and elevator location and design.

A primary rule is to avoid forcing pedestrians to cross the paths of the cars whenever possible. When such encounters are unavoidable, the design should create a safe passage for persons to move along until they come to a marked crosswalk that cautions drivers to take notice. Architects can design the pedestrian paths to intersect with or pass by the parking attendant station to create the

opportunity for surveillance and monitoring.

Approved pedestrian entrances should be clear of obstructions and distractions to encourage use. Unapproved entrances on the ground floor should be securely locked in compliance with building, fire, and life-safety codes.

**Toll booths.** In 2006 at the City Place Mall in West Palm Beach, Fla., a parking attendant observed two men loitering suspiciously in the parking garage. She locked herself in the booth, but she did not have a radio or telephone to call for assistance. The robbers broke in with a baseball bat, beat the attendant and took the contents of her cash drawer.

Toll attendants are thought of as guardians of the garage, but in reality they are often targets of crime because criminals believe that they hold the money. To protect them, attendant booths need to be situated in an area with a 360-degree field of view, be monitored and recorded by CCTV, and possess security glazing, duress alarms and drop safes with signage advertising that the attendant cannot retrieve money. The booths must also have



adequate levels of security lighting with placement to support CCTV coverage. Lighting should be dimmable to allow a guard to see outside at night.

The attendant's rest room should be located near the attendant booth in an area open to surveillance opportunities. The bathroom should be locked and have a personal alarm inside in case of attack.

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CPTED-minded designers should exclude public restrooms from their designs as they serve as a natural meeting place for victims and predators and are difficult to secure because of privacy issues. If the inclusion of public restrooms is unavoidable, then they should be placed so that the doors are visible from the attendant's normal working position. The bathrooms should have open maze-type, "lazy S" entrances that allow cries for assistance to be heard. Panic alarms and motion-activated lighting should also be installed.

#### STRUCTURAL ELEMENTS SHOULD PROMOTE SECURITY

If a facility is being newly built, then structural support elements should be round rather than rectangular. A round column allows for much greater visibility around the corners than a rectangular or square column. Also, the most CPTED-oriented ramp design is an exterior loop that allows floors to be level and to preserve unobstructed lines of sight. Where solid walls are needed, portholes with screening, windows, or openings wherever possible should be incorporated to create an openness that encourages and enables casual observance.

Stairwells and elevators should be located centrally and should be visible from the attendant's position. However, the sides of many parking garages are enclosed to hide the perceived unsightliness of cars. In these structures, where stairways and elevators can exist in blind spots, CCTV should be placed to monitor comings and goings, and panic alarms and door position switches installed to alert the toll booth attendant that someone is in a stairwell.

Stairwells should be visible from grade level and be constructed of clear glazing materials to allow visibility from the street. Stairwell terminations at the lowest level should not offer accessible hiding holes, and those that exit onto the roof should be secured to prevent unauthorized access. Doors to mechanic rooms on the roof level should always be locked. Both basement and rooftop doors should be wired for door-position switches, intercoms, screech alarms and signal transmission to security or police.

Elevators, like stairwells, should incorporate as much glass and high-visibility placement as structurally possible. Glass walled elevators placed along the exterior of the building provide for good natural visibility by persons on the street and within the garage. They should have intercom capability to comply with the ADA Accessibility

Guidelines (ADAAG), as well as audible alarms in case of a breakdown.

The stairs and elevators of high-rise or subsurface parking garages that serve offices, residences or other mixed uses should have elevators that empty into a lobby and not go directly to business or residential floors. Those exiting at the lobby must then use another dedicated bank of elevators or stairs that can be subject to screening, access control and surveillance by security staff.

#### SURVEILLANCE

CCTV cameras should be placed in areas with constant light (daylight or luminaries) to provide proper illumination for the lens. Low-light cameras can be used, but they are more expensive and they represent a tacit admission that lighting conditions might be poor.

Cameras should be placed to achieve an unhindered view. On surface parking lots, cameras should have good lines of sight and cover as much ground as possible. The cameras should be protected within dark polycarbonate domes to resist vandalism and to obscure where the cameras are watching.

CCTV systems in parking facilities need to be monitored in real time and digitally recorded for playback and enhancement. Cameras should be color, rather than black and white, to make it easier to identify specific vehicles and persons, especially in the playback mode, which can make a difference if a crime occurs and the garage operators want to recover important evidence.

Panic button call boxes should be integrated with the video surveillance system allowing a camera to be activated when a call box is pushed. CCTV systems can also be integrated into the access control system so that license plate numbers can be entered into a log when vehicles enter or exit the parking facility.

#### LIGHTING

Because this topic is extensive and there are a plethora of options and considerations, we will save the information for a future issue of *The Parking Professional*. Realistically, the topic of lighting could fill an entire issue with articles on its importance, current trends, future technology, energy efficiency, and numerous other variables. At the most basic security level, we'll say that without good lighting, CCTV systems become relatively useless and natural surveillance is impaired. Lighting in garages is addressed in detail in the IESNA G-1-03 Guidelines for Security Lighting, which recommends lighting levels for the various sites in the garage.

It is strongly recommended that operators inventory their lighting and adhere to the guidelines regarding placement, size of luminaries, shadow reduction, efficiency, etc.

#### SIGNAGE

Parking facility signage should be well lit, with letters or symbols that are a minimum of eight inches high. Wall signage for pedestrian and vehicular traffic should be graphic whenever possible to ensure universal understanding and provide a sense of clear direction. Walt Disney World's parking lots offer a classic example of how graphics, signage, and one-way traffic flow can allow effortless parking for several hundred thousand people a day, largely without incident.

**Illegitimate signage.** Graffiti should not be ignored, but rather should be removed as quickly as possible. The CPTED-minded architect can take steps to discourage graffiti by, for example, wall surfaces coated with graffiti-resistant epoxy paint and increased lighting levels in problem areas to increase natural surveillance. The act of trying to prevent their graffiti tells these individuals that the property is the territory of its rightful owners.

#### MIXED USES

Many garages are adding retail storefronts, such as copying facilities, fast food eateries, or car washes to provide compatible safe activities that draw legitimate users. Additionally, parking may be reserved during the day for businesses, but at night the lot becomes flat-fee parking for area nightclubs and restaurants.

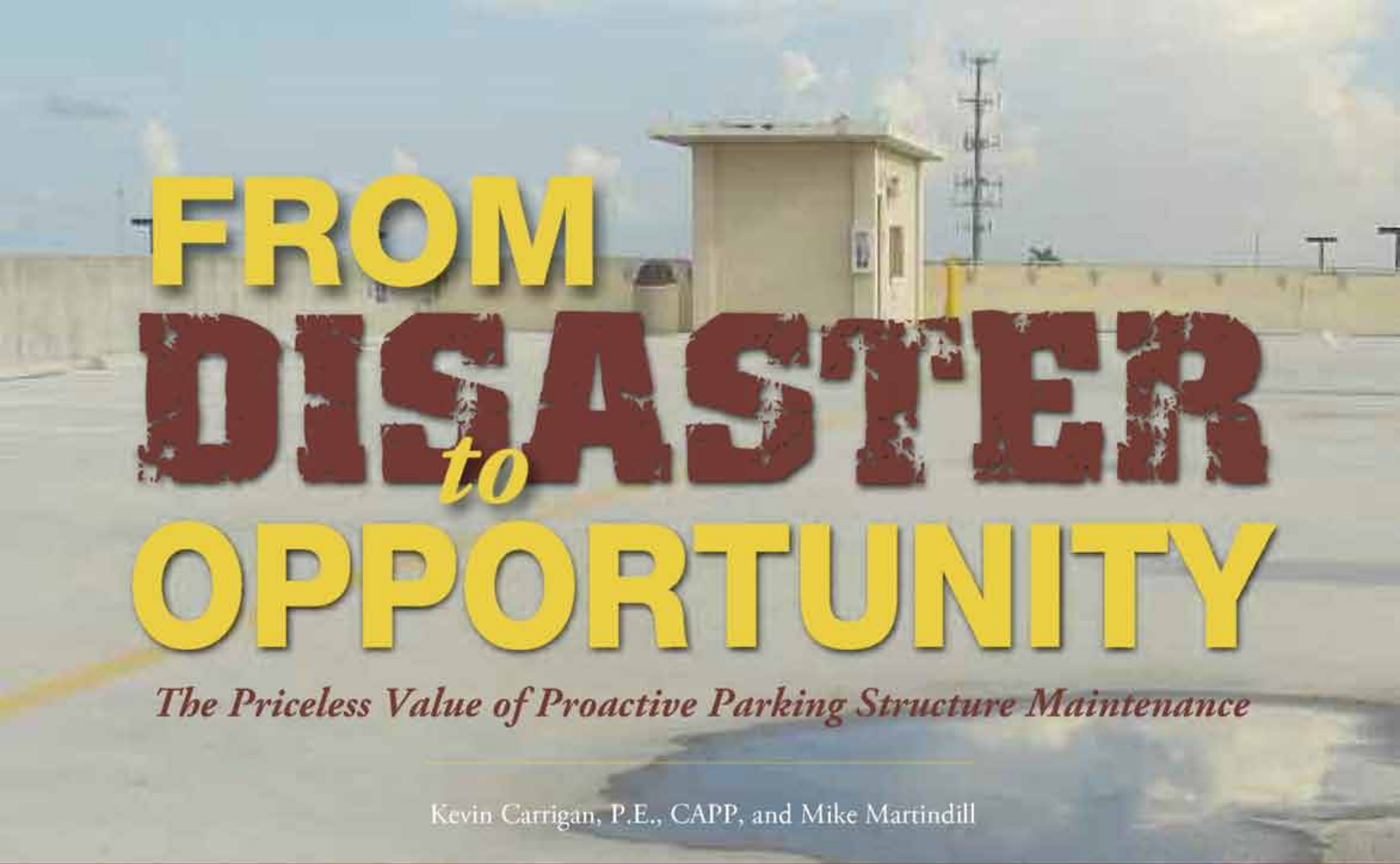
When a parking facility assesses risks and threats and a holistic CPTED approach to improving security is employed, including ground-floor protection, limited or restricted access, good sight lines and lighting, CCTV, and well-placed and equipped attendants, the risk of committing crime will increase and the opportunity for crime will decrease, undesired elements will search for new ground, and a safe haven will be created for legitimate users. ■

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# FROM DISASTER *to* OPPORTUNITY

*The Priceless Value of Proactive Parking Structure Maintenance*

Kevin Carrigan, P.E., CAPP, and Mike Martindill

**S**ometimes tragedy serves as a very painful reminder of the importance of routine maintenance, inspections and a proactive approach to protecting our infrastructure and building assets. For example, in 2007 when the I-35W Bridge collapsed in Minneapolis, the State of Minnesota immediately embarked on a comprehensive, state-wide inspection of all of its bridges. This comprehensive measure was exactly what the community needed to see happen to ensure that the infrastructure was safe. Similar actions were taken in states across the summary.

Our infrastructure needs as a country are well documented. Many of the major systems that support our nation's people and economy are in urgent need of repair, upgrade, replacement and significant capital investment. These include our roads and bridges, our sewer and water systems, dams and levees, and the electrical grid. On a smaller scale, the parking structures we use for work, home and play are essential infrastructure elements that also require our attention and investment.

Unfortunately, a parking structure recently collapsed in Midtown Atlanta. A terrible disaster and, fortunately, no one was

injured. But this incident, like in Minnesota, prompted owners and operators across the state to inspect their parking structures to ensure that they are safe.

The reaction to both the Atlanta and Minneapolis events reinforces the importance of regular inspections and the proper maintenance of parking structures. Even though they are constructed of highly durable and long-lasting concrete, parking structures expand and contract, and are exposed to the elements – just like bridges. Therefore, owners and operators must implement a truly proactive approach to ensure their continued safe use and long-term durability.

The best course of action for any owner to take is to engage a professional engineer to perform an assessment or “Condition Appraisal” of their parking structure or concrete building (for example, a stadium). The benefits and value of appointing an engineer to perform an assessment include: identifying immediate areas of concern and addressing them promptly; developing a capital budget for a repair program; developing a maintenance program for extending the useful life of the asset and, in general, providing an expert opinion on the safety of the parking facility.

Utilizing a structural engineer who

specializes in parking structure design is the most effective approach to facilitating a Condition Appraisal. Parking structures are unique and, therefore, require a specialized analysis. Unlike buildings where the structural frame is typically enclosed, parking structures are exposed to weather, salt and harsh conditions that have a detrimental impact on all exposed elements, including the structural frame, stairs and elevators. Since parking decks experience more severe and harsh conditions than most other structures, someone experienced in parking design, construction and restoration, fully understands why problems occur and, most importantly, what needs to be done to correct the problems in a cost-effective manner.

Some of the more important elements to assess during a Condition Appraisal include:

**Drainage** – Standing water is one of the most destructive (and common) problems within parking structures. Without effective and adequate drainage, standing water can lead to slipping hazards, corrosion and even compromising the structural integrity of the garage. In the north, where salts are used, the impact of poor drainage is intensified.

**Joint and Cove Sealants** – Parking structure joints help to control the location of concrete cracking. They are grooves, which are located between floors, double tees and vertical elements such as walls, spandrels and expansion joints. These areas need to remain sealed at all times in order to prevent deterioration.

**Unexpected Movement, Deflections or Cracking** – These may be signs of structural inadequacies. Owners or operators should consult a qualified professional to review these issues as soon as they notice any unusual changes in the structural appearance.

**Exposed Connections** – In most cases, especially in precast structures, attention should be paid to structural connections exposed to the harsh environment to ensure that structural intent is not breached. Corroded and otherwise damaged connections could potentially affect load-carrying ability, which could result in structural failure, in turn, endangering the public.

**Expansion Joints** – The purpose of expansion joints is to allow movements and relieve internal stresses within parking structures that are caused by thermal expansion/contraction, concrete shrinkage and seismic/wind forces. An engineer will recognize failed or failing expansion joints that should be repaired or replaced in order to prevent water leakage and deterioration.

**Lighting** – Lighting is a major priority for establishing parking structure safety and higher light intensities help to provide an increased feeling of safety and security. A parking structure engineer has extensive knowledge of the requirements and recommendations for light intensities in the specific areas of a parking structure, including drive aisles, lobbies and stair/elevator towers.

A thorough parking structure Condition Appraisal, from visual observations and delamination survey to concrete testing, will help to identify areas of concrete distress, weakness or concern, as well as establish an order of magnitude cost of repairs. It is critical to detect these issues as soon as possible so that they can be repaired in a timely manner. As we have learned, the longer problems go unresolved, the greater the impact is on repair costs, garage operations and patron safety. Catching problems early can save an owner hundreds of thousands of dollars in repair costs, let alone any liability that might be associated with spalling concrete or trip hazards from failed expansion joints and floor spalls.

Along with conducting regular Condition Appraisals, the most effective approach to maintaining the quality and safety of a parking structure is to establish a thorough maintenance program. Ideally, the owner would establish this program as soon as the facility is constructed, or even during the design. This is obviously not always feasible, as many parking structures today have already been in operation for years. However, creating



Identifying issues such as water ponding, concrete corrosion and rusting early can help to avoid more expensive and serious problems later on.



this guideline as soon as possible will prove to be a valuable and effective strategy, whenever it is implemented.

A maintenance program can be broken down into two key categories of maintenance: routine/preventive maintenance and repair/replacement maintenance.

**Routine/Preventive Maintenance** tasks help to ensure the safety and proper operation of the facility. Daily tasks including sweeping, trash removal, washdowns and removal of ponded water will help to maintain the appearance and cleanliness of the facility, as well as help to prevent deterioration. For example, ponded water and high concentrations of chlorides (road salts) can result in the corrosion of embedded reinforcement

and other steel components that can be prevented through routine maintenance.

In addition to these daily tasks, owners should also plan for the regular assessment of a number of vital areas throughout the facility. The consistent inspection of joints, doors, mechanical systems and countless other components will help to stay ahead of any potential issues, as well as guarantee that any problems are resolved in a timely manner.

Repair/replacement maintenance items are those that a structural engineer would assess during a Condition Appraisal. Even with the performance of regular maintenance tasks, elements throughout the structure will become damaged or deteriorated, or they will reach the end of their useful service life. Most of these include structural and waterproofing issues or major system components such as lighting, drainage or fire protection.

The implementation of each of these tasks, from development of a maintenance program to performing regular Condition Appraisals, is an extremely effective strategy in asset preservation. Although it may be complicated and time-consuming to develop, the benefits that will result are worth the effort. These approaches will not only help to maintain an attractive, structurally sound and operational facility, but they will also help to prevent (or at least alleviate) the headaches that would no doubt come if these strategies were not in place.

Performing routine and regular maintenance, and having a professional engineer assess a parking structure's condition, will help ensure early identification and prompt resolution of problems. Being proactive will help maintain the quality of your asset and control unnecessary capital investment, while providing safe, attractive and convenient parking for years to come. ■

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# Membership Application

## 1 Membership Category

**Regular ... \$520** PLEASE CHOOSE A SECTOR BELOW

- |  |  |
|--|--|
| <input type="checkbox"/> <b>Academic</b> college/university, school                                  | <input type="checkbox"/> <b>Public</b> city, economic development, municipality, public works, police, law enforcement |
| <input type="checkbox"/> <b>Airport</b>  | <input type="checkbox"/> <b>Suppliers</b> equipment, manufacturers, technology vendors, etc.                           |
| <input type="checkbox"/> <b>Commercial Operations</b> private operators, shuttle services            | <input type="checkbox"/> <b>Transit/Transportation</b> bus, highway, rail  |
| <input type="checkbox"/> <b>Consultant</b> architects, engineers, planners                           | <input type="checkbox"/> <b>Other:</b> _____<br>Please further define sector above.                                    |
| <input type="checkbox"/> <b>Corporate</b> building owners, developers, entertainment, resort, retail |  |
| <input type="checkbox"/> <b>Hospital/Medical or Healthcare Facility</b>                              |  |

**Associate ... \$150**

Additional representative of one of the above categories. Your organization must have at least one full member in active status to qualify for this level of membership.

**International ... 50% off appropriate fees**

If you reside outside of North America and conduct no business in the United States, you can deduct 50% off the appropriate fees.

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Full-time college/university student or professor with interest in parking and transportation industry. Credentials required.

**Transitional/Retiree ... \$100**

Previous history of employment in parking or transportation industry and is currently retired or transitioning between jobs.

**Return completed application with payment to:**

International Parking Institute  
P.O. Box 7167  
701 Kenmore Avenue  
Suite 200  
Fredericksburg, VA 22404-7167  
540-371-7535  
540-371-8022 fax  
membership@parking.org

Or become a member online:  
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- ✓ *The Who's Who in Parking* annual directory and data book, as well as *The Parking Buyers Guide and Consultants Directory*
- ✓ Networking opportunities with key industry decision-makers
- ✓ Recognition programs for excellence in the industry
- ✓ Bi-weekly electronic newsletter identifying industry trends, business opportunities and parking/transit news

## 2 Contact Information

Name \_\_\_\_\_  
 Title \_\_\_\_\_  
 Organization \_\_\_\_\_  
 Street Address \_\_\_\_\_ P.O. Box \_\_\_\_\_  
 City/State/Zip \_\_\_\_\_ Country/Postal Code \_\_\_\_\_  
 Phone \_\_\_\_\_ Fax \_\_\_\_\_  
 E-mail \_\_\_\_\_ E-mail 2 (optional) \_\_\_\_\_  
 Website URL \_\_\_\_\_

## 3 Payment Information

**Payment by credit card**

PLEASE SELECT WHICH CARD:  MasterCard  Visa  
 American Express  Discover

Account Number \_\_\_\_\_ Security Code \_\_\_\_\_

Account Name \_\_\_\_\_ Expiration Date \_\_\_\_\_

Billing Address (if different from address above) \_\_\_\_\_

Signature (required on all contracts) \_\_\_\_\_

**Payment by check**

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 Make payable to IPI in U.S. funds

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