

The image shows a modern interior space. A large, dark green rectangular box is centered in the upper half of the frame, containing the text 'SPACE TYPES - DESIGN BRIEFS' in white, uppercase, serif font. The background is a photograph of a room with a vibrant orange wall. A square window with a dark frame and three horizontal panes is set into the wall. Below the window, a horizontal strip of light illuminates a wall of large, grey, textured rectangular tiles. To the right, a dark, possibly black, fireplace or built-in unit is visible. The floor is made of light-colored, square tiles. The ceiling is a plain, light grey color.

SPACE TYPES -
DESIGN BRIEFS

BUILDING EXTERIOR LIGHTING DESIGN BRIEF

The NYC Department of Design and Construction (DDC) manages the construction and renovation of NYC's building stock throughout the five boroughs. These guidelines apply to the exterior areas of these facilities immediately adjacent to the buildings, including entry and egress lighting, exterior security lighting, parking lots, and sidewalks.

SPECIAL EXTERIOR LIGHTING QUALITY ISSUES

During the day, the exterior environment is flooded with ambient light from the sun and sky. Not only are light levels high, but the distribution of natural light is somewhat uniform. The nighttime environment is completely different, with a dark sky vault and lots of local man-made light sources. High contrast and the potential for glare is much higher at night, so the strategies of exterior lighting can be quite different than those used in building interiors. In addition to the general qualitative issues described earlier in this manual, the following issues have particular relevance to the lighting of building exteriors:

- Nighttime visibility, peripheral detection, adaptation
- Glare control
- Light Pollution and Light Trespass
- Security, safety, shadows, facial recognition, uniformity
- Orientation, way-finding, points of interest
- Color appearance and contrast
- Reflectances and surface characteristics
- Daytime appearance of exterior luminaires



Close spacing of low-output luminaires reduces glare and provides comfortable lighting for faces.

courtesy: Lighting Research Center, RPI, Delta Publications

Nighttime Visibility

The eye is capable of adapting to a wide range of light levels but not at the same time. To function well, it must be adapted to the prevailing light conditions. During daytime conditions, our eyes use “photopic vision,” which utilizes the eye’s cones and the center of the visual field. The eye works differently when it is adapted to low light levels. Under very dark, moonlit conditions, our eyes use “scotopic vision,” which primarily utilizes the eye’s rods, resulting in greater acuity in the peripheral visual field. In most urban and suburban environments like New York City, our eyes use “mesopic vision,” which is a combination of both photopic and scotopic. In nighttime environments, the goal of the lighting design is to keep the eye adapted to mesopic or scotopic vision, and not to introduce high light levels that will cause an imbalance in the visual field and cause the eye to try to use photopic vision. (See glare and security concerns below). Recent research indicates that light sources that are rich in blue and green (metal halide or fluorescent) improve peripheral mesopic vision, clarity and depth of field better than sources rich in red and yellow, such as incandescent and high pressure sodium.

Glare Control

Glare is caused by high contrast between the glare source and the prevailing light conditions to which the eye is adapted. Consequently, the same headlights that feel blinding on a dark road are only uncomfortable on a well-lighted urban street, and do not cause glare at all during the day. There are several ways to reduce contrast and the potential for glare in the nighttime environment:

- Distribute light more uniformly, and over a broader area. Reduce the ratio of surface brightness between the lightest and darkest surface.
- Reduce light levels
- Reduce source brightness. Use more fixtures with a lower wattage per fixture.
- Shield light sources.

Contrast ratios should be close to uniform, in the 1:5 ratio between average and maximum luminance. Exterior lights should be shielded and located to avoid glare. Fixtures near the property line should have “house-side shielding” to prevent glare to residential neighbors.

Light Pollution

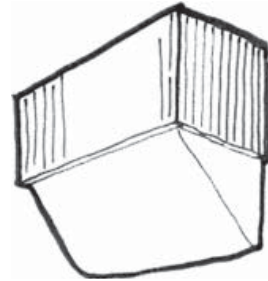
The orange sky glow above the New York metropolitan area is a result of light pollution. Stray light that goes directly into the atmosphere wastes energy and can be disruptive to humans and wildlife. The LEED™ rating system offers a credit for minimizing light pollution by requiring full cut-off luminaires (i.e., where no light exits the fixture above the horizontal). LEED™ also restricts façade lighting and building lighting from leaving the site when lighting façades choose fixtures with a controlled distribution rather than a wide or diffuse distribution. In applications where lighting up from below may be the only alternative (like statues and monuments), light specific surfaces rather than spilling over with a blanket of light. It should be noted that not all luminaire light pollution is caused by light emitted above the horizontal. On average, light reflected off the ground can account for up to 20% of light pollution. Hence, a luminaire with a very narrow distribution directly down may cause more reflected light pollution than a luminaire with a wider distribution, where the reflected light at low angles is more likely to be absorbed by obstructions.



Light pollution (right) obliterates the view of the stars.

Light Trespass on Neighbors

Luminaires mounted to buildings and on poles should be aimed or shielded to avoid any light trespass into the property or windows of adjacent buildings, especially in residential areas. Unshielded security floodlights or “wall-packs” should be avoided. Nighttime lighting can have a negative effect on human sleep cycles. The international lighting authority, the Commission Internationale de l’Éclairage (CIE) has developed recommendations for establishing community standards for limiting light trespass, in recognition that cities have different lighting needs than outlying areas. These recommendations are shown in the chart below. While these have not yet been adopted in New York City, verify if there are any local ordinances that may be more stringent, or in rare cases may require higher light levels, such as Times Square.



Avoid “wall-pack” type of luminaires (above) with no glare shielding.

ENVIRONMENTAL ZONES FOR LIGHT TRESPASS

ZONE	DESCRIPTION FROM THE COMMISSION INTERNATIONALE DE L’ÉCLAIRAGE (CIE)	PRE-CURFEW LIMIT*	POST CURFEW LIMIT*
Zone E1	Areas with intrinsically dark landscapes. E.g. National Parks, self-limited residential communities.	0.1 fc	0.1 fc
Zone E2	Areas of low ambient brightness. Outer urban and rural residential.	0.3 fc	0.1 fc
Zone E3	Areas of medium ambient brightness. Urban residential areas.	0.8 fc	0.2 fc
Zone E4	Areas of high ambient brightness. Urban areas with both residential and commercial use, and experiencing high levels of nighttime activity.	1.5 fc	0.6 fc

Chart adapted from IESNA-RP-33-99. *Light levels are measured at the perimeter of a site, i.e., at the neighbor’s eye in the vertical plane perpendicular to the line-of-sight. “Curfew” time is established by the community or the design team.

Setting Priorities: Some of the requirements for nighttime lighting conflict with other project requirements. For example, the desire for security, comfortable face lighting and wide distribution of light may seem to conflict with the tighter beam control recommended to avoid light pollution or light trespass. Work together as a team to develop compromise solutions (e.g., near-horizontal distribution luminaires but not above horizontal). If a good compromise cannot be accomplished, set team priorities (e.g., security concerns will outweigh sky pollution concerns for a specific jail perimeter wall).

Security – Safety, Shadows, Facial-Recognition, Uniformity

Lighting that provides a sense of security increases legitimate nighttime activity, which in turn increases actual security. This is accomplished by:

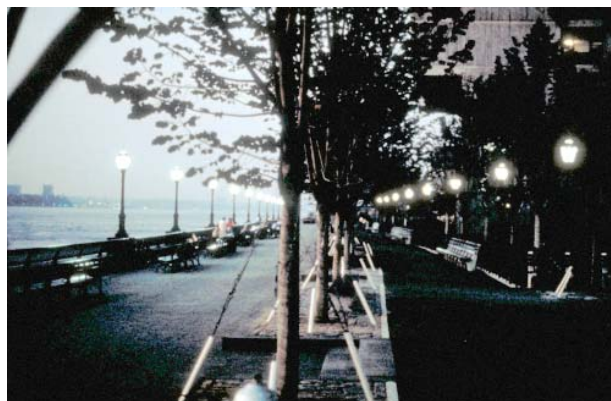
- Increased uniformity
- Reduced shadows
- Reduced source glare
- Avoid over-lighting
- Natural appearance of people and surrounding objects.
- Natural color

Excessively high light levels or high wattage visible sources should be avoided, because they can cause the eye to lose its nighttime adaptation level, making it more difficult to see into shadows or detect peripheral motion. Sidewalks, pathways and bikeways should be designed to provide illumination on the vertical plane, so people's faces are comfortably lighted and they can identify the faces of others at a reasonable distance. Since low height bollard luminaires light the ground and do not contribute to face lighting, they should only be used in conjunction with other, taller luminaires, or where another criterion (such as the view of water) takes precedence. Plantings or obstructions that may create deep shadowy areas should be redesigned or coordinated with supplemental lighting. Additional transitional lighting should be provided to the sides of walkways as they pass marginally secure areas, such as building alcoves, below-grade building entrances, or dense shrubbery. Where guards or security cameras are in fixed locations, the lighting should be directed away from the viewers, to increase visibility.

Lighting to promote safety from tripping or other hazards is enhanced by the same factors as security lighting. In addition, light fixtures should be located at changes in grade level or surface material, at pathway intersections, or near any dangers such as pools or walls.

Orientation – Way-finding & Points of interest

Because there is so little ambient light at night, whatever is illuminated gains importance in the visual environment. Careful establishment of a design hierarchy can create an organized composition that is safe, attractive, and orienting to the observer. Good quality lighting can add to a positive urban image, and establish the relative importance and character of buildings, landmarks and landscape elements. Conversely, poorly planned lighting can confuse the viewer, give misleading visual clues, and reduce the sense of security and safety of a building or neighborhood. It is generally a good approach to light buildings and landmarks in a natural manner, so that an area is equally recognizable day and night. Use buildings and monuments as reference points to enhance nighttime orientation. Light pathways uniformly or, if this is not possible, consistently place lights at important destinations or nodes of travel.



Regular spacing of post lanterns creates an organized rhythm for walkways.

photo: Robert Prouse

Surface Characteristics – Reflectances and Finishes

Polished, glossy, and shiny surfaces should be avoided, because specular reflections can reduce visibility day and night. The most matte finish available that will provide acceptable maintenance should be used. Use low gloss or eggshell paints or anti-graffiti coatings. Use heavily brushed metal surfaces. Lighter colored materials should be used for steps and level changes, and to delineate paths from surrounding

dark vegetation. Concrete reflects more light than asphalt and makes a road or parking lot or path feel brighter at low light levels. However, the lighter path and roadway finishes that improve luminance ratios also cause more light to be reflected upward to cause sky glow.

Color

Lamps in the bluer range with reasonably good color rendering (above 65 CRI) are preferable for nighttime visual acuity. It is believed that the better visibility resulting from a cooler CCT and higher CRI can offset a lower lumen output. Consequently, lamps such as metal halide with pulse-start ballasts, fluorescent amalgam, induction sources, and white LEDs or red-green-blue arrays of LEDs can be effective at night. Standard high-pressure sodium (HPS) lamps are adequate for highway driving but do not have adequate color rendering for most exterior applications. “White” HPS lamps provide better color rendering although the efficacy is below that of metal halide. Use ceramic metal halide for superior color rendering (CRI 75+) in heavily populated pedestrian locations. The apparent color (correlated color temperature) should range from 3200K to 5000K, depending on the context. The warmer (3200K) color temperature lamps may provide a better balance with adjacent city street lights using the yellow HPS lamps maintained by NYC Department of Transportation. An international design competition was held in 2004 to design the NYC streetlights of the future. The City Lights competition was co-sponsored by the NYC DDC and the NYC Department of Transportation (DOT). The new streetlight designs will eventually be added to the DOT Street Lighting Catalogue and will provide alternatives for lighting streets, sidewalks and parks. The winning design utilized LED sources, in addition to the required high pressure sodium option. While the lumens/watt of LED sources is currently much lower than metal halide or high pressure sodium, it is expected to increase in the future. Mock-ups and working prototypes over the next few years will determine the viability of the LED sources for this application.

Biological Effects of Color Spectrum

Lighting levels should be reduced in the evenings and nighttime to enable residential occupants to have a normal sleep cycle. The shorter blue wavelengths that are preferred for nighttime visibility are also more disruptive to sleep patterns. Consequently, site lighting near residences should always be controlled with “house-side shielding” or otherwise directed away from bedroom windows.

Daytime Appearance of Exterior Luminaires

Thought should be given to the appearance of exterior luminaires in the daytime environment. The color of poles, details of bases, spacing and coordination with street furniture all have an impact on the character and scale of a property. For larger projects with multiple types of light fixtures, consider organizing the appearance into a “family” with similar visible features, and an appropriate combination of lamp colors.



Select a “family” appearance for luminaires and poles.

As an alternative approach, simple poles in neutral, pale colors or fixtures mounted high on buildings can be used in a concealed manner to provide the primary illumination, while smaller, more decorative poles or fixtures can appear to be the “apparent source”. Concealed or primary luminaires should be accessible for maintenance, on the roof or at balconies or setbacks, and the beam pattern selected to avoid light trespass. Shielding should be used as required to avoid casting unwanted light patterns on the building itself. This technique of low wattage “apparent sources” supplemented by concealed, energy-efficient primary sources can save both energy and equipment cost, if done properly.

SPECIAL EXTERIOR LIGHTING TECHNICAL ISSUES

CONTROLS

At a minimum, control exterior lighting so that it is not operating during times of sufficient daylight, through the use of astronomical time switches and/or photosensor override. Consider limiting the nighttime hours that the exterior lighting operates. Only the few fixtures necessary for safety or security should operate all night. Occupancy sensors are rarely an acceptable choice for security because they are problematic with the metal halide sources most often recommended for exterior applications, since the lamps may not re-strike in an acceptable timeframe. In addition, repetitive switching may degrade lamp life, and will be an irritant to the neighbors.

EXTERIOR SECURITY LIGHTING

Diligence should be taken in the design of a security lighting system when exterior lights would normally be turned off for part of the night. Take into consideration whether the camera feed is under constant and instantaneous surveillance, or whether it is intended to provide a record of security breeches after the event. It is also important to avoid glare to pedestrians and motorists, and to avoid light trespass to neighbors. While security cameras can operate under extremely low light levels (less than .01 FC) HID light sources are not commonly dimmed. Consider some of the following strategies to avoid unnecessary energy consumption, light trespass and light pollution:



photo: Hayden McKay
Avoid glary entry lighting like the above.

- Specify separate fixtures exclusively used to provide the low light levels for security cameras.
- Aim the surveillance cameras at specific points of entry to the building, where ordinary lighting is placed, rather at broad areas on the site.
- Avoid aiming lights at high angles or beyond the site boundaries.
- Use multiple-level HID ballasts controlled by timeclock to operate after hours at their lowest light level for security cameras. Multiple-level ballasts may also be activated by motion sensors, so that they change from the lowest to the highest setting when activity is sensed.

WET AND DAMP LOCATIONS LUMINAIRES

Luminaires that will be exposed to the environment in unprotected locations, or installed in masonry, concrete slabs, or in direct contact with the earth, require a “wet location rated” label. Exterior luminaires that are somewhat protected from weather, such as those recessed under overhangs, should be supplied with a “damp location rated” label indicating that their design and materials resist galvanic action and corrosion. Non-metallic composite materials prevent corrosion but may not be as structurally suitable for some applications. Specify sealed and gasketed luminaires to prevent the intrusion of water and bugs, and to keep the luminaire cleaner. Weep holes should be appropriately located for the specific aiming angle of the luminaire.

DURABLE, VANDAL-RESISTANT LUMINAIRES

Vandalism must be considered for lighting equipment placed in exterior public places in New York City. Most luminaires suitable for exterior weather are already more sturdy than interior luminaires, but may not stand up to vandalism. Consider the following:

- Sturdy construction to prevent destruction or disabling of the lighting.
- Tamperproof construction, mounting and access hardware, to avoid access to electricity or parts.
- Rigid and fixed aiming to prevent the luminaire from being turned in a direction other than intended. This is typically accomplished with a mechanical locking mechanism.
- Lenses or diffusers that resist breakage, weakening, or discoloration by aging or exposure to ultraviolet light.

FULL CUTOFF LUMINAIRES

For the purposes of LEED™ (Version 2.1) light pollution credit, a “full cutoff” luminaire restricts the light output to only those angles below the horizontal to avoid light pollution to the night sky. The IESNA defines full cutoff as “a luminaire light distribution where zero candela intensity occurs at an angle of 90 degrees above nadir [straight down] or at all greater angles from nadir. Additionally, the candela per 1000 lamp lumens does not numerically exceed 100 (10 percent) at a vertical angle of 80 degrees above nadir. This applies to all lateral angles around the luminaire.” Light that is emitted closer to the horizontal (e.g., 50° - 80°) is valuable for lighting faces and improving the uniformity of light between luminaires. However, if light trespass is the greatest concern, luminaires that emit little or no light near the horizontal are preferable.

DIRT DEPRECIATION

Since light output is significantly reduced by dirt and debris in fixtures, outdoor fixtures should be sealed and gasketed. A maintenance program should be established so that all luminaires are checked regularly, burnouts replaced, and those fixtures cleaned and resealed that show evidence of moisture or dirt. Indirect “burial” fixtures are discouraged because they are easily covered with grass, leaves, mud and other debris, resulting in a waste of energy. In addition, they contribute to light pollution because they distribute light upward to the night sky.



photo: Hayden McKay

Burial light require regular cleaning to maintain light output.

THERMAL CONSIDERATIONS

Excessive surface heat can result from the tight seals necessary to weatherproof exterior fixtures. Take special care of this issue when specifying fixtures within reach of the building occupants or the public. UL testing protects against overheating and electrical failure, but does not address surface temperature that may be injurious to the public. Uplight “burial” fixtures are further insulated by dirt, so that all the heat must leave through the glass top. The excessive heat of these fixtures has been known to melt shoes, ignite mulch and burn children. The classification of “walk-over” only indicates that the fixture is capable of absorbing the weight of foot traffic - it does not mean that the temperature is safe for public walkways. Manufacturers are now producing burial uplights with lower temperatures on the upper glass surface.

EMERGENCY LIGHTING

Two separate light sources should be provided on the emergency system at each means of egress to account for the possible burnout or ballast failure of one of the sources. This can be accomplished with two lamps in one fixture, or two separate fixtures. If the facility does not have an emergency backup generator, it will be necessary to specify fixtures with battery backup for essential safety, security or exiting requirements. The design of the emergency lighting plan should always seek to orient the public by providing a clear, organized path to safety with a minimum of glare. If high intensity discharge (HID) lamps such as metal halide or high pressure sodium are part of the emergency system, some accommodation must be made to avoid underlighting due to a slow warm-up or re-strike delay. This is typically handled by auxillary quartz-halogen lamps that provide emergency light instantly, then turn off when the HID lamp is fully lighted.



“Walk-over” does not mean a burial luminaire is thermally suitable.

SPECIAL COMMISSIONING CONSIDERATIONS

Adjustable or aimable exterior lighting fixtures require nighttime adjustment. Requirements for contractor participation and special equipment (bucket trucks, walkie talkies) should be included in the specifications. See sample specifications on the DDC website.

SPECIAL MAINTENANCE AND OPERATIONAL ISSUES

At night, without the ambient daylight, a broken fixture or burned-out lamp can create a significant zone of darkness and loss of uniformity. A much higher standard of maintenance is required for exterior luminaires since there is less overlap or interreflections found in building interiors. The maintenance schedule is usually driven by the security concerns. Outside maintenance contractors are available for frequent evaluation of exterior burnouts, and can be contracted to replace essential security lamps within 24 hours. Planned group relamping, based on the predictable hours of operation, saves labor costs, reduces the need for emergency response, and limits unsafe conditions caused by lamp burn-outs.

GROUND FAULT CIRCUITS INTERRUPTER (GFCI)

Exterior lighting should be connected to GFCI circuits. Consider low-voltage (12 volt or less) for underwater lighting and exterior applications that are easily accessible by the public.

EXTERIOR ILLUMINANCE AND LUMINANCE RATIO RECOMMENDATIONS

SPACE TYPE CATEGORIES	HORIZONTAL FC (MINIMUM AVERAGE)	VERTICAL FC (AVERAGE)	LUMINANCE RATIOS	NOTES
Exterior building entries	5	3		1
Exterior doors, inactive	3	3		1
Exterior emergency paths of egress	1			1
Sidewalks and bikeways, roadside	2	1	4:1	3,4,6,A
Sidewalks, walkways, pathways, and bikeways, not roadside. High or medium conflict with cars.	0.5 to 1	0.2 to 0.5	4:1	3,4,A
Sidewalks, walkways, pathways, bikeways, not roadside. Low conflict with cars (NYC Residential)	0.4	0.1	4:1	3,4,A
Parking Lots – commercial / residential	0.2	0.1	20:1	2,4, 5, B
Parking lots – police, jails, enhanced security	0.5	0.25	15:1	2,4, 5, B
Loading docks, active / inactive	10 / 1	3 / .3		1
Storage Yards, active / inactive	10 / 1	3 / .3		1

1) From *The IESNA Lighting Handbook 9th Edition, Chapter 10.* 2) From *The IESNA Lighting Handbook, 9th Edition, Chapter 22.* 3) From *IESNA RP-08-00.* 4) Vertical illuminance is measured at 5' above grade. 5) Values shown are minimums, not average. 6) "Roadside" means mixed vehicle and pedestrian, or immediately adjacent to vehicular traffic, without barriers or separation. A) Luminance ratios average to minimum. B) Luminance ratios maximum to minimum.

SPACE-TYPE GUIDELINES

BUILDING ENTRIES

There is a wide range of appropriate solutions for lighting entries at night. The objective is to provide vertical illumination to comfortably light people's faces, and horizontal illumination to light the pathway and any changes in level. Small wall sconces often create too much glare to be effective. Enlarging the surface area of the sconce, without increasing the wattage, can lower the surface brightness to a comfortable level. A pool of light from a mounting position high on the building can provide a low level of horizontal ambient light to supplement the face lighting, or pedestrian scaled post lanterns can be used near the entry. If there is a canopy, indirectly lighting its white underside can provide both horizontal and vertical illumination, or other "layers" of light can be added to the composition such as wall-sconces or low brightness downlights. The location of security cameras should be taken into consideration so they can be shielded from direct light.



Lighting at entry should provide a gentle transition between outside and inside.

CONTROLS

Use astronomical time switches or photocell overrides to ensure that lights do not operate when daylight is sufficient. Schedule lighting and zone exterior luminaires so that they are all on only when the building is occupied, with only a few lights remaining on for all night security. In rare cases, where entry doors are under buildings or deep overhangs, it may be necessary to use electric lighting during the day, to compensate for sky glare or to ease the transition from bright exterior to dark interior. In such cases, circuit the lights so that lower levels are provided for the nighttime conditions. The same concept applies to other areas with sudden and extreme light level transitions, such as garage entries, underpasses or tunnels. The surfaces of such transition areas should be finished with the lightest colors possible, i.e., a minimum wall and ceiling reflectance of 80% and a minimum ground reflectance of 40%.

EMERGENCY EGRESS DOORS

For safe egress, provide lighting on the outside of the door threshold extending for a distance at least equal to the width of the door opening. At least two lamps should be connected to the emergency circuit to achieve this goal. Since egress doors open outward, light fixtures mounted above the door are an effective solution. Good practice calls for uniformity, glare control, and a gentle fall off of light from the threshold toward exterior pathways. Consult NYC codes for specific requirements. Additional lighting on the emergency circuit is recommended when the site adjacent to the building has level changes or hazards that may cause injury in total darkness. Controls: Although by law egress lights do not have to be activated except during an emergency, it is good practice to have at least one of the lamps on during normal hours of evening occupancy. A photocell override should be used to ensure that the exterior lamps are never burning during daylight hours.

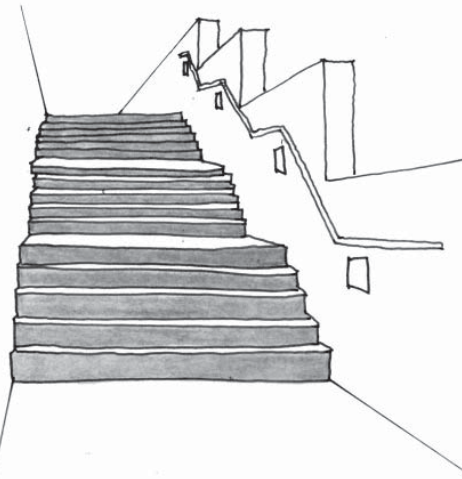
BUILDING RELATED ACTIVITY SPACES (HARDCAPED AREAS SUCH AS PATIOS):

Casual outdoor relaxation and seating areas that are adjacent to the building and used at night should be softly illuminated, with a minimum of glare, contrast or light trespass to the neighbors. For exterior break areas adjacent to an employee lounge, or outdoor seating adjacent to a residential community room, the spill light from the interior can often be used to light people's faces from at least one direction. For older eyes, face lighting should be supplemented from multiple directions, to avoid the silhouetting of a face when it is backlit by the building interior lights. The supplemental face lighting can come from pedestrian-scale (8-10'high) post-top fixtures at the perimeter of the hardscaped area. Lights mounted

high on the building, with the source shielded by cones or baffles can provide horizontal illumination over a wide area, but supplemental face lighting will still be required. Light colored ground surfaces are preferred. If a building contains residential units, the lighting of the exterior spaces shall not negatively affect the interior living spaces, especially the bedrooms.

STAIRS AND RAMPS

People stumble on steps in broad daylight, so lighting is not the only factor in the safe navigation of level changes. Contrast between finishes on the walking surfaces plays a major role. The objective is to ensure that sudden changes in level, like steps and curbs, stand out from the adjacent hardscape. Using a lighter-colored material for the nosing of steps is the most effective strategy. Using rougher finishes and lighter colors on treads than risers and surrounding hardscape is another technique. Light fixtures, such as bollards, handrail lights or step lights are effective as markers for lighting steps, ramps, curbs or other hazardous conditions. At the very least, lights should mark the top and bottom of stairs and level changes.



The top and bottom of each set of risers is lighted by step-lights recessed into the wall at landings.

The direction of light is important to enhance the perception of a level change. For example, light from the top of steps toward the bottom creates desirable shadows on the risers and back of steps, increasing the contrast between the upper nosing and the next lower plane. Light coming exclusively from the direction of the lower step distributes light into the riser and reduces the desired contrast. It is usually not possible to light steps uniformly, but every effort should be made to avoid glare and confusing patterns of light or shadow.

LOADING DOCKS / TRASH AREAS

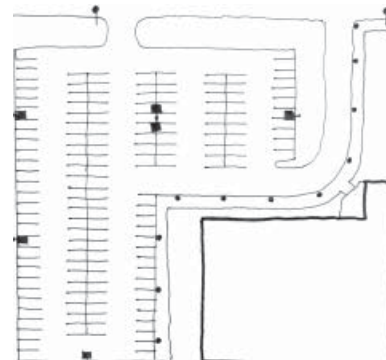
Care should be taken so that these spaces are not eyesores at night. As much attention should be given to glare control and light trespass on the rear of a building as the front. Use white light sources such as metal halide or fluorescent. Shield the view of sources from off the site whenever possible. In particular, control glare for truck drivers backing into loading docks. Consider special telescoping-arm task lights made for loading docks, which can be extended into the truck enclosure for loading and unloading. Controls: For areas that are not used after a certain hour, automatic astronomical time switch control is sufficient. If areas are used only infrequently at night, consider compact fluorescent (CFL) sources with occupancy sensors. For more frequent, but not continuous nighttime use, consider metal halide sources with two-level high-low ballasts or CFL sources, connected to occupancy sensors. Metal halide two-level ballasts are necessary since the lamps do not immediately re-strike after being turned fully off.

PARKING LOTS

Open parking lots are most effectively lighted with pole-mounted luminaires. The lighting objectives are:

- Uniformity, to reduce harshness of shadow between cars
- Good color rendition, to improve visibility of motorists and pedestrians, and aid recognition of cars and people.
- Glare control for motorists and pedestrians
- Control of light trespass to neighbors and light pollution to sky.

For high-security parking lots, such as police stations, courthouses and jails, uniformity and good color rendering are more critical for good mesopic vision than are high light levels. Although increas-



Sharp-cutoff luminaires at the perimeter of parking reduces glare and light trespass to neighbors.



It is quite common to specify luminaires with different distribution in the same parking area. The luminaires can still have the same outward appearance and use the same lamp.

and an asymmetrical (Type IV) or forward-throw distribution is best for driveways and the perimeter of parking lots. Poles located near the perimeter of the property should be aimed away from neighbors, and the luminaires fitted with “house-side shielding.” Parking lot entries, ticket booths and pedestrian pathways should have slightly higher light levels than parking areas, and automobile driving lanes can be slightly less, but transitions should be gradual.

Controls: Astronomical time switches or photocell overrides should be used to ensure that lights are only operated during times of occupancy and when daylight is no longer sufficient. Two-level high-low ballasts might be appropriate in some applications where light levels can be reduced at times but uniformity should be maintained. Avoid switching off alternate luminaires as this will increase contrast and decrease safety and security.

ing the height of poles improves uniformity, especially between cars, it also makes it more difficult to conceal the source from neighboring properties. Use more, shorter poles with lower wattage lamps, to improve distribution. Overlapping of beams between poles improves uniformity. Avoid tall, widely spaced poles and high-output lamps, as these reduce uniformity and increase the size and severity of shadows between cars. Metal halide lamps are usually the best source for parking lots. Reflectors inside the luminaires can provide a variety of beam patterns using one size of lamp. A wide symmetrical beam distribution (know as Type V) is usually best in the center of parking lots,

WALKWAYS AND SIDEWALKS AND BIKEWAYS

The appropriate lighting scheme depends on adjacent lighting, hazards, and security concerns. Walkways don't always require continuous lighting especially in environments that are restricted to pedestrians or are in landscaped or park settings. Walkways and bikeways adjacent to roadways require more illumination, but may receive sufficient light from the street lighting. If lighting is discontinuous, luminaries should be placed at logical intervals that provide visual information, including intersections of pedestrians with other kinds of traffic, at path crossings, at benches or resting points, at curves, bridges or at changes in level. Avoid glare and light trespass. See additional comments under Security issues above. Controls: Astronomical time switches and/or photocell overrides should be used to insure lights are only operated when needed. The length of time such lights should operate is most often determined by security concerns. At times of low activity and in areas of low supervision (i.e., pathways not visible from residences or by security personnel), some design/owner teams have elected to install gates and post signs indicating the pathways are closed or not patrolled after a certain hour, and turn all the lights off. Otherwise, the lights might give the false impression that the pathway is more secure than it is. On urban or suburban streets, sidewalk lighting should be on from dawn to dusk.

STORAGE YARDS

Storage yards should be lighted in a similar manner to parking lots, with poles located to light between the aisles of storage. For active nighttime storage access, avoid shallow angles of light that will create glare for the workers or forklift operators. Tall poles with low-wattage lamps provide the best distribution and comfort. Shield view of lamps or bright reflectors from motorists or residents. Controls: Carefully weigh the cost of energy against the effectiveness of running the lights all night in storage yards for security reasons. Light levels for security surveillance should be considerably lower than those designed for active nighttime storage activities. Two-level high-low ballasts could provide early evening storage activity lighting and after-hours security lighting (for guards or cameras) while retaining a uniform distribution.

ENERGY CODE REQUIREMENTS

The Energy Conservation Code of New York State does not have an overall exterior power limit, but it does have an exterior lamp efficacy requirement, which states, “When the power for exterior lighting is supplied through the energy service to the building, all exterior lighting, other than low-voltage landscape lighting, shall have a source efficacy of at least 45 lumens per watt. Exception: Where approved because of historical, safety, signage or emergency considerations.” This effectively mandates certain types of lamps. (See Source Comparison Chart in the Overview section.)

The energy code requirements for ANSI/ASHRAE/IESNA Standard 90.1 are shown in the chart below. It should be noted that the same code or standard (i.e., NYS Energy Code or Standard 90.1) and the same version must be used for both the interior and exterior allowances and compliance. See Appendix A for more information.

FUNCTION	ANSI/ASHRAE/IESNA STD.90.1		NOTES
	- 1999 / 2001	- 2004	
Building Entrance with Canopy	3	3 w/ft ²	1
Building Entrance without canopy	33 w/lin ft	33 w/lin ft	1
Building Exit	20 w/lin ft	20 w/lin ft	1
Parking Lots and Drives		0.15 w/ft ²	1
Walkways 10' > wide		1.0 w/lin ft	1
Walkways 10' <, Plaza, Features		0.20 w/ft ²	1
Stairways		1.0 w/lin ft	1
Main Entries		30 w/lin ft of door width	1
Other Doors		20 w/lin ft of door width	1
Canopies		1.25 w/ft ²	1
Open Outdoor Sales		0.5 w/ft ²	1
Street Frontage + open area		20 w/lin ft	1
Building Facades	0.25 w/ft ² of illuminated façade area	0.2 w/ft ² for each wall or 5.0 w/lin ft for each wall length	2

¹ These values are multiplied by the square footage or lineal footage of each area, to arrive at a whole-building exterior allowance. In most cases, it is not necessary for each space type to comply with the individual values, as long as the total exterior allowance is not exceeded. ² This allowance is considered “use it or lose it”. It cannot be traded off with any other power allowance.

REFERENCES – SITE LIGHTING DESIGN

The IESNA Lighting Handbook, Illuminating Engineering Society of North America, Ninth Edition, 2000, Chapter 21.

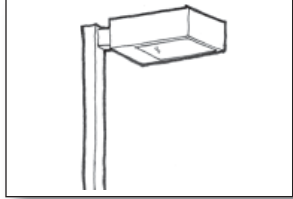


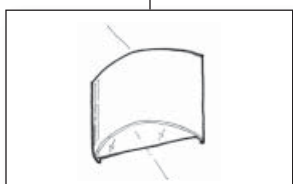
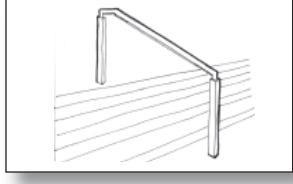
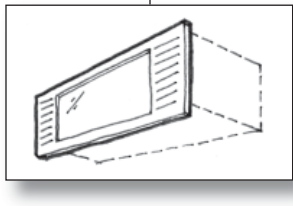

Guideline for Security Lighting for People, Property, and Public Spaces, IESNA G-1-03, Illuminating Engineering Society of North America 2003, available at iesna.org.

Lighting for Exterior Environments, IESNA RP-33-99, Illuminating Engineering Society of North America, 1999, available at iesna.org.

The Landscape Lighting Book, Second Edition, 2005. Janet Lenox Moyer, John Wiley & Sons, Inc.

Roadway Lighting, ANSI/IESNA RP-08-99, Illuminating Engineering Society of North America, 1999, available at iesna.org.

SAMPLE LUMINAIRE SCHEDULE FOR BUILDING EXTERIORS

	<p>POLE-MOUNTED PARKING/SITE FIXTURE (“SHOE-BOX” STYLE)</p> <p>Location: Parking Lot, Site Lamps: (1) 100W ED-17 ceramic metal halide, 3200 – 5000 Kelvin Description: Pole-mounted ceramic metal halide road/area fixture. Mount head a minimum of 12’ AFG and a maximum of 24’ AFG. Full-cut off, differentiated optics and distribution. House-side shield. Wet location rated.</p>
	<p>BOLLARD</p> <p>Location: Paths, Building Entrances Lamps: (1) 50W ED-17 ceramic metal halide, 3200 – 5000 Kelvin Description: Footing-mounted area fixture not to exceed 48” in height. Louvers and/or lens for optical control and glare mitigation. Wet location rated.</p>
	<p>“CENTRAL PARK” OR “BPC” STYLE POST-LANTERN</p> <p>Location: Paths Lamps: (1) 100W ED-17 ceramic metal halide, 3200 – 5000 Kelvin Description: Post-top period ceramic metal halide fixture, impact resistant polycarbonate lens. Luminares to match NYC Central Park or Battery Park City (BPC) style fixture. Horizontal mounted lamp in top of fixture. Minimum pole height 8’ AFG and maximum pole height 16’ AFG. Specify full-cutoff, differentiated optics. Wet location rated.</p>
	<p>WALL FIXTURE OVER DOORS</p> <p>Location: Exterior doors Lamps: (1) 50W ED-17 ceramic metal halide, 3200 – 5000 Kelvin Description: Surface-mounted, arm-bracket, ceramic metal downlight. Shielded for full cutoff. Wet location rated.</p>
	<p>HANDRAIL LIGHT</p> <p>Location: Stairs Lamps: (1) 28W, T5, 835-850 color Description: Fluorescent lamp recessed into handrail with lens. Integral ballast in handrail. Wet location rated.</p>
	<p>RECESSED STEP LIGHTS</p> <p>Location: Stairs Lamps: (1) 50W ED-17 ceramic metal halide, 3200 – 5000 Kelvin Description: Recessed into wall, ceramic metal halide step light with prismatic lens or louver. 120V integral ballast. Mount a minimum of 12” above the step, 18” preferred.</p>
	<p>LOADING DOCK LIGHT</p> <p>Location: Loading Dock Wall Lamps: (1) 60W Par-38 Halogen or CFL integrally-ballasted floodlamp. Description: Surface-mounted, adjustable-arm in three axes to aim into truck bed. Powder coated yellow for safety.</p>