

3.8 Lighting

3.8.1 Lighting Level and Arrangement

“Outdoor lighting is used for a variety of purposes in our modern society. For work or recreation, it enables people to see essential detail in order that they may undertake their activities at night. It can facilitate and enhance the safety and security of persons or property, for example through lighting on roads and pathways. It may be used to emphasize features of architectural or historical significance, and to light parks and gardens. It is used for advertising or display to promote products or services, or to call attention to commercial premises by means of area lighting or signs,” — excerpted from *Outdoor Lighting Code Handbook, International Dark-Sky Association*¹.

All lighting must be gauged ultimately in terms of the visibility it enables users to gain. The following sections raise the concerned areas affecting visibility with regard to outdoor lighting situations for consideration.

3.8.1.1 Walkway and Staircase

Sufficient lighting should be provided along the walkway during both day and night time in order to maintain a perceivable, safe and secure environment. The lighting level should allow the pedestrian to perceive the walking surface, identify obstructions and objects, and realize hazards ahead.

Daylight considerations:

- (a) Avoid designing any section of the walkway with poor daylight conditions (3.8.1.1a).
- (b) Avoid having poor daylight along a walkway caused by overgrown trees and bushes.
- (c) Avoid sudden change in lighting level, such as from a walkway with an opaque cover and little sidelight ending in an open space facing direct sunlight (3.8.1.1b).
- (d) If it is unavoidable to have a section of the walkway with poor daylight, artificial lighting should be provided (3.8.1.1c).

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3.8.1.1a Section of walkway with uneven daylight condition



3.8.1.1b Walkway facing bright sunlight



3.8.1.1c Artificial lighting to light the walkway portion with less daylight

Night time considerations:

- (e) Provide uniform lighting at regular intervals along the walkway.
- (f) Avoid glare, reflection, poor colour rendering, and large pieces of area in shadow or shade along the walkway (3.8.1.1d).
- (g) Avoid sudden change in lighting level.
 - The lighting for the walkway should not be in high contrast to its surrounding environment, for example:
 - (i) A comparatively lower but sufficient level of lighting would give better visibility for a walkway along a dark field than bright light (3.8.1.1e);
 - (ii) Brighter light should be provided near a brightly lit area, such as a building entrance;

(iii) Bright and glaring floodlight from a nearby football field over-spilling onto a walkway should be filtered or partial blocked, otherwise even providing bright light for the walkway would not produce acceptable visibility result due to the high contrast in lighting level.

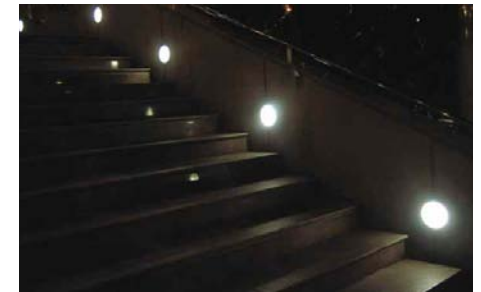
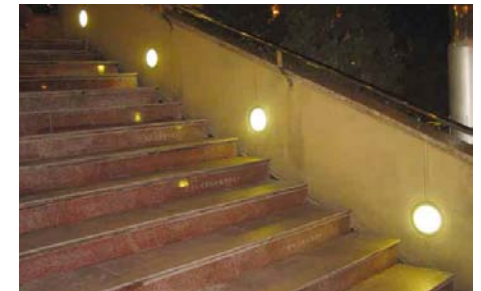
- Overhead placement of lighting above a staircase provides better visibility to the stair than wall-mount lighting alone (3.8.1.1f).
- It is very easy to over-light an external area. Over-lighting does not give an environment improved visibility. Due to the contrast with dark areas at night in external space, over-lighting an area would easily produce glare and cause adaptation problem for the eyes (3.8.1.1g).
- The effect of colour contrast and luminous contrast of the nosing should be checked under the night lighting condition to ensure visibility.



3.8.1.1d Tree pit up-light and bollard light



3.8.1.1e Wide access route lit up by reflective light



3.8.1.1f Wall-mount lighting alone (bottom) at low position does not provide good visibility for staircase

3.8.1.2 Signage

- (a) Lighting should be provided to signage intended for night use.
- (b) The light source should be placed above the sign and shielded with light directed towards the sign.
- (c) The surface of signage should not produce glare under sunlight or artificial light.
 - It is best to avoid the use of reflective surface in a tilted position unless it is placed under shade, e.g. avoid using stainless steel for tilted directory map in a park without a shaded cover.
 - If floodlight or point light source is used for signage, the source should not be placed too close to the signage surface to avoid glare, shades and sharp changes of lighting condition on the sign surface (3.8.1.2a).

3.8.1.3 Footbridge, Lift, Escalator and Tunnel

Sufficient lighting should be provided along a footbridge, an escalator, in a lift or a tunnel during both day and night time in order to maintain a perceivable, safe and secure environment (3.8.1.3a and 3.8.1.3b). The lighting level should allow the pedestrian to perceive the walking surface, identify obstructions and objects, and feel secure to enter or leave the footbridge, lift or tunnel.

Daylight considerations:

- (a) Avoid designing any section of the footbridge, lift or escalator with poor daylight conditions.
- (b) Avoid having poor daylight along a footbridge or escalator caused by overgrown of trees and bushes.
- (c) If it is unavoidable to have a section of the footbridge or escalator with poor daylight, artificial lighting should be provided.



3.8.1.1g Combination of signage, display, pavement and overspill of indoor lighting



3.8.1.2a Strong wall-mount lighting for signage create patches of bright and dark areas



3.8.1.3a Footbridge with skylight



3.8.1.3b The same footbridge with double row of down lights at night

- (d) Sufficient artificial lighting should be provided to a tunnel during daytime. Brighter lighting might need to be provided near the ends of the tunnel during the day to allow the eyes to adapt to the sunlight before entering or after leaving the tunnel. Avoid having sharp turns near the ends of the tunnel.

Night time considerations:

- (e) Provide uniform overhead lighting at regular intervals along the footbridge, lift or tunnel (3.8.1.3b).
- (f) Provide lower side-wall lighting or backlit lighting for the escalator steps because the motion of the escalator and a lit direction and/or warning sign can be clearly seen (3.8.1.3c).

- (g) While for security reasons the lighting level for the footbridge, lift or tunnel might be brighter than the walkway, sudden change in lighting level should be avoided (3.8.1.3d).

- The lighting for the walkway near the entry of the footbridge, lift or tunnel should be stepped up to prepare the eyes to adapt to the change in lighting level at night.
- Overhead placement of lighting above a staircase provides better visibility to the stair.



3.8.1.3c Wall-mount lighting for the area near the end of an escalator



3.8.1.3d Entry to a lift for access to a footbridge with wall-mount lighting in addition to lighting for the walkway

3.8.1.4 Areas for Activities

Lighting for an active recreational area is usually much brighter than that for a passive recreational area (3.8.1.4a). It should also be noted that the lighting requirement of a tennis court for recreational use within a residential complex is lower than that of a tennis court for training within a sports complex. The lighting should be designed to suit the intended use and the immediate environment.

- (a) Shielded or cut-off lighting should be used (3.8.1.4b and 3.8.1.4c).
- (b) Light guard behind the lighting fixtures might be required if the recreational activities areas are very close to residential buildings.

- (c) The accessible routes leading to the brighter areas should have the lighting level gradually stepping up to allow the eyes to adapt to the lighting conditions while entering or leaving the areas.
- (d) The surface of the sports ground should be finished with non-reflective material in darker colour with line marking in white or light colour (3.8.1.4c).

Fencing, railings, furniture and equipment under the floodlighting zone should be in non-reflective darker colour. Use of unpainted stainless steel should be avoided.



3.8.1.4a Lighting for active recreational area at night



3.8.1.4b Unshielded Sports Lighting for recreational use



3.8.1.4c Fully Shielded Sports Lighting (courtesy of Soft® Lighting)¹

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3.8.2 Special Lighting Consideration

3.8.2.1 Lighting for Landscape and Features

Lighting for landscape and features serves two main purposes. Firstly, it provides a special visual effect for the enjoyment of the features at night. Secondly, lit-up features can serve as landmarks and help people to navigate through open spaces feeling more comfortable and secure at night.

Some common features include:

- Sculpture (3.8.2.1a)
- Clock tower (3.8.2.1b)
- Water element
- Feature wall (3.8.2.1c)
- Pavilion

It is also advantageous to have additional elements such as façades, gates, footbridges, landmarks and some parts of the boundary walls illuminated to assist in way finding.

- (a) The lighting fixtures should not obstruct the accessible route.
- (b) If the lighting fixtures can be reached by hand, the part touchable by hand should not be hot.
- (c) The lighting fixtures should not produce glare and the lit-up features should not reflect the light to produce glare.

3.8.2.2 Vantage Point Lighting

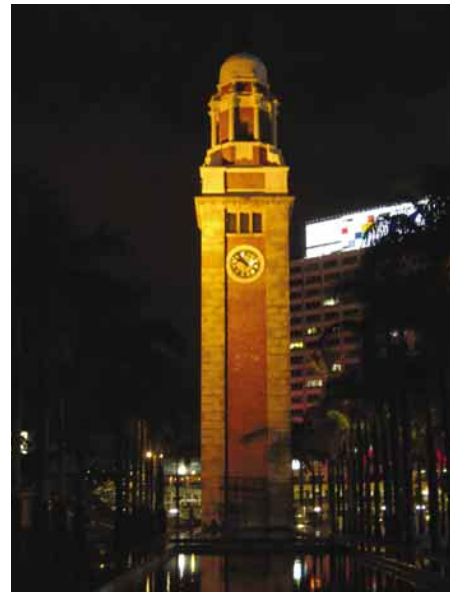
The design of lighting for vantage points for viewing at night requires special attention. The principle is to keep out any light shining into the eyes or lighting up any objects within the viewing cone of the eyes while looking towards the scene for viewing (3.8.2.2a).



3.8.2.1a Up-lighting for sculptures



3.8.2.1b Flood light for tower



3.8.2.1c Flood light for feature wall

3.8.2.3 Energy Conservation and Light Pollution

Viewing tower

- (a) The viewing tower itself might be a feature with flood lighting at night. The people standing inside the viewing tower should not be lit up by floodlight (3.8.2.2b).
- (b) Overhead or wall-mount lighting above the waist level should be avoided.

Lookout point and waterfront promenade

- (c) Lamp poles should be recessed from the edge of a lookout point and waterfront promenade (3.8.2.2c and 3.8.2.2d).
- (d) Shielded lighting or indirect lighting should be used.
- (e) Edges of the lookout point and waterfront promenade should be clearly visible. If the lighting from lamp poles is insufficient, then additional lighting near the floor level could be provided.

The issues of energy conservation and light pollution are increasingly gaining attention globally. Many countries such as Australia, Canada, Spain, New Zealand, United Kingdom and United States among others, have engaged in energy conservation research and practices and many have already enacted light pollution abatement legislations. People in Hong Kong are also becoming aware of the issue.

Appropriate lighting level with suitable lighting arrangement provide good visibility at night while poor lighting arrangement would only produce glare and poor visibility even with higher lighting level (3.8.2.3a).

Guidelines for eliminating lighting pollution:

- Eliminate the use of up-light towards the sky, such as flag lighting, up-light wall wash without canopy above the wall, etc.



3.8.2.2a Night view of Hong Kong Island from Tsim Sha Tsui with lamp poles recessed away from the edge of the seawall



3.8.2.2b Viewing tower



3.8.2.2c Spherical lamp poles at the edge of seawall before improvement at Tsim Sha Tsui



3.8.2.2d Indirect lighting and lamp poles recessed away from the edge of the seawall after improvement at Tsim Sha Tsui

3.8.3 Ambient Lighting and the Environment

- For up-light towards canopy, building cornice, etc, controlled light beam such as LED light, should be used and fine-tuned to eliminate any light spilling into the sky.
- For indirect lighting fixtures, it should be ensured that the reflectors catch the full angle of the light beam.
- Fully shielded down lighting should be the preferred arrangement. If the light has to be tilted, it should be at a minimum 45° down-tilt to control the worst glare (3.8.2.3b).
- Floor lighting is used to create special effects. However, it can sometimes adversely affect visibility. The use of floor lighting should be avoided for the main accessible route. If it has to be used, the lighting level should be minimized.

“Different areas, with different developed and natural conditions, have differing levels of appropriate light usage, and different sensitivities to the various obtrusive aspects of outdoor light usage.”¹

3.8.3.1 Ambient Lighting

Lighting from adjacent areas may be “borrowed” if it is at a similar lighting level as the area being lit.

If the adjacent areas have a much higher level of lighting, the spillover light will not help but rather create a higher level of lighting requirement, because a high contrast in lighting level will adversely affect visibility in the area with the lower lighting level (3.8.3.1a and 3.8.3.1b). Under such lighting provision, that area would look dark when the floodlight in the adjacent football court is switched on and it only would feel brighter when the floodlight in the adjacent football court is switched off.



3.8.2.3a Light shows at the Harbour would be more attractive with a darker sky



3.8.2.3b Flood light tilted at shallow angle from a golf driving range

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3.8.4 Transitions

3.8.4.1 External/Internal Transition

During daytime people would feel blinded when entering a dark lobby from bright sunlight or vice-versa. This is because our eyes require time to adjust to the high contrast in lighting levels. Many common architectural design elements can help to improve the eyes to adapt, such as the following:

- Canopy for entrances;
- Recess of entrances to allow for a covered space under the shade (3.8.4.1a);
- Introduction of daylight into the lobby through a skylight, glass wall, windows, etc.

During night time people would feel blinded when leaving a brightly lit lobby to a dark external space or vice-versa. Designs that can improve the situation include the following:

3.8.3.2 The Environment

While the lighting level for all accessible routes must be maintained at a reasonable level for visibility, variation in lighting levels can be provided for other areas with different functions. By varying the lighting levels, different atmospheres can be created. However some good practices should be considered as follows:

- (a) The area should not have too high a contrast in lighting level from the adjacent areas.
- (b) Lighting must be sufficient to highlight the existence of any objects that may become an obstruction in the dark, such as a seating bench.
- (c) Overhead or facial level lighting should be provided to areas intended for group activities (3.8.3.2a and 3.8.3.2b).



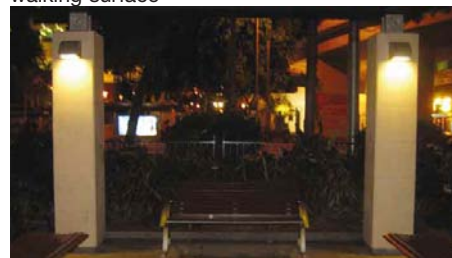
3.8.3.1a Daytime uniform lighting



3.8.3.2a Bollard light at the planters behind the seating benches provide facial lighting but dark walking surface



3.8.3.1b Night time contrast in lighting between the football field and the passive recreational area



3.8.3.2b Overhead lighting for a group of seating benches



3.8.4.1a A deep recess before entering into a dark lobby

- Transparency of entrance to let the light spill out from the lobby into the external space (3.8.4.1b);
- Transitional lighting arrangement outside the entrance (at the recess, canopy or along the final approach of the accessible route) that is brighter than the environment but darker than the lobby (3.8.4.1c).

3.8.4.2 End of Tunnel Effect

The lighting transition problem is particularly acute for tunnels because daylight cannot be introduced into tunnels (3.8.4.2a). For vehicular tunnels, the following solutions have been adopted:

- During daytime, canopy is used to control sunlight at tunnel entrances and extra lighting is provided inside the tunnels near the ends.
- During night time, dimmer lighting is provided inside the tunnels near the ends and further stepping down of lighting is provided immediately outside the tunnel entrances.

The same principles should be applied to pedestrian tunnels, but it could be applied at a lesser degree because people walking towards the tunnels have more time in allowing their eyes to adjust. The following practices may be considered:

- (a) Right-angle turn at the end of the tunnel should be avoided, as this would allow no time for the eyes to adjust to the change in lighting levels. This is also a poor design in terms of security.
- (b) Design a semi-lit-up area outside the tunnel entrances, such as canopy with open sides, semi-transparent canopy or shades provided by planting, etc. for daytime and progressive transitional lighting outside the tunnel entrances for night time (3.8.4.2b).



3.8.4.1b Transitional lighting outside building entrance

3.8.4.1c Lighting transitions between areas at night

3.8.4.2a Tunnel during daytime

3.8.4.2b A deep building with low ceiling height without natural lighting appears also like a tunnel and measures should be provided to allow the eyes to adjust to the different lighting levels

3.8.5 Glare, Reflection, Colour Rendering, Shadow and Shaded Area

3.8.5.1 Glare

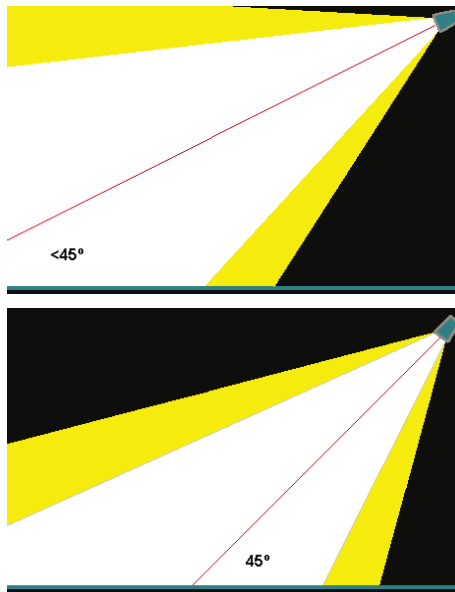
Glare reduces visibility and creates great discomfort to users. It should be minimized as far as practicable and controlled by the architectural design and the design of the lighting.

- Use fully shielded lighting to minimize glare from the light source.
- If the light has to be tilted, it should be minimum 45° down-tilt to control the worst glare (3.8.5.1a).
- Avoid the use of glossy and glare generating materials for floor, wall or other large surface areas, especially if they are in close proximity to a strong light source (3.8.5.1b).
- Avoid a single strong light source in a dark field or strong light sources sparingly scattered to light up an area (3.8.5.1c).

3.8.5.2 Reflection

- Avoid tilted glazing or stainless steel placed at low level. If they are placed at low level, they should not be placed near to, or pointed towards walkways, footbridges or tunnels (3.8.5.2a). Consideration should be made to avoid creating glare from reflected sunlight on curtain wall buildings (3.8.5.2b).
- Other than covers, also provide shades for some of the seating benches. Shades may be in the form of screen walls, landscaping, building blocks, etc.

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3.8.5.1a A 45-degree down-tilt will control the worst glare from floodlights. The illustrated pattern is 40 degrees (top)/60 degrees (bottom) full width at 50%/10% of peak candlepower, a typical PAR-38 floodlight pattern.¹

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3.8.5.1b Glossy white wall surface with bright wall-mount lights creates glare



3.8.5.1c Unshielded single strong light source in a dark field creates glare



3.8.5.2a Large piece of tilted glazing beside a footbridge creates glare even after replacement with non-reflective glass



3.8.5.2b Reflected sunlight from a curtain wall building creates glare to a nearby garden

3.8.5.3 Colour Rendering

- (a) Colour rendering quality should be ensured for external areas where colours are important, such as signage, colour contrast for nosing of stairs, car parking area, sports field, etc. (3.8.5.3a and 3.8.5.3b).

3.8.5.4 Shadow and Shaded Area

A shaded area can be useful as a transition between a brighter and a darker area. However the shaded area and the shading effects have to be carefully handled.

- (a) The lighting pattern created by the intersection of artificial light sources should have their intersection points above the eye level so that when one is walking past the lighting pattern, the flashing of light and shade to the eye can be avoided.

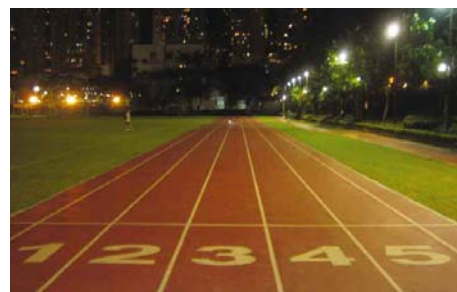
- (b) Avoid narrow parallel strips of sunshades that create bands of light and shade perpendicular to the direction of travel (3.8.5.4a, 3.8.5.4b and 3.8.5.4c). They cause great discomfort to users' eyes as they travel across the flashing bands of light and shade.
- (c) Avoid placing any hazards or obstacles, such as steps, a drop in level, a fire hydrant, etc, under total shade or in a shadow area.
- (d) A direct sunbeam from a skylight falling into a totally shaded area can create a dramatic effect, however filtered sunlight may provide better natural lighting for visibility (3.8.5.4d).



3.8.5.3a Colour rendering is important for identifying signage and floor markings



3.8.5.3b Colour rendering for a field for both daytime (left) and night time (right) activities



3.8.5.4a Skylight sun shading by a strip pattern perpendicular to direction of travel is undesirable



3.8.5.4b Bands of light and shade are created causing discomfort to users as they travel across the flashing bands of light and shade



3.8.5.4c Bands of light and shade falling on an irregular floor pattern may cause a sense of dizziness to some people



3.8.5.4d A direct sunbeam from a skylight falling onto a shaded area creates great lighting contrast