5.8 Road lighting

Techniques

General

The human eye does not perform well in the dark or at dusk when visual performance is impaired by lower visual acuity, poorer colour discrimination and a much lower tolerance to disability glare – hence the increased accident risk to drivers and pedestrians.

Road lighting plays a very important role in reducing accidents, and research has shown that good road lighting will significantly reduce accidents. Road lighting provides guidance through conflict areas such as junctions. This can be reinforced by the use of different lamp colours to distinguish a change of road classification or area definition. Road lighting can also have a secondary effect of preventing crime.

The amount of light required on a road to reveal objects i.e. vehicles, pedestrians and obstructions depends upon the amount or density of traffic, the speed of the traffic and if pedestrians are present – mixed usage areas. Crime rates also determine the lighting level required. For traffic routes a silhouette vision system is used.

Operating costs and environmental impact are important and the use of photocells to reduce the number of hours the lighting is used can be very economical. Lighting control systems can provide even further savings by allowing switching or dimming of lamps at of-peak or night time situations. Points of note are:

Luminance is the main criteria for traffic route lighting, so the road characteristics and the observer positions needs to be determined.

If illuminance has to be considered all the involved areas have to be taken into account including vehicles and pedestrian.

As one of main concerns in road lighting is extended maintenance operations luminaires with high IP ratings are recommended

In addition to extended maintenance periods it is also desirable to reduce the maintenance and installation operations to a minimum, therefore the use of a tool-free lantern is suggested.

Lamps with a high luminous efficacy are mainly used, preferably HST/E ones. Additionally latest technology has improved efficacy in lamps with a higher colour rendering such as CFL and HIT-CE and some of the latest standards benefit this technology and allows using a lower class but improving the quality of the light.

Road lighting

The use of electronic control gear is recommended. Although this increases initial investment it is shortly repaid by extending lamp life and maintenance periods.

Lighting controls for road lighting applications cover a wide range of applications, from a single fitting controlled by a photocell to a large-scale installation monitored from a remote control point and managing luminaire data in real time. Therefore lighting controls should be considered because in addition to reducing power consumption they extend lamp life and give the possibility to remotely identify failures and optimise maintenance operations.

Multiple fitting enclosures are available although each has an optimal application. Polycarbonate enclosures are more resistant to vandal attacks, shallow glass maximises optical performance and flat glass reduces possible glare issues.

In low mounting height installations with a risk of vandal attacks, a polycarbonate bowl is highly recommended and the use of vandal proof screws to fix the luminaire to the column and reinforced closing clips secured by special screws are also recommended.

When considering a possible proposal for a road it is recommended to have information of the existing road lighting. Many projects are a continuation of previous installations or new parts from a previously light area. In these cases it is good to introduce newer technologies without confusing the users. Better optical fittings can be used but try to keep a similar layout, mounting height, etc.

At the design stage not only the requirements for the road have to be considered, in all cases the adjacent areas should be taken into account and that will define the best option. When houses and the road are close to each other low mounting heights, use of brackets and low glare fittings are a highly recommended although this may not lead to be the best functional solution.

Highways and high speed roads - Points of note are;

These roads are designed for high speeds (>60km/h) and no pedestrians, cyclists or slow vehicles are involved. There are no intersections and access is controlled.

Traditional mounting heights are above 12 m to properly light a twin carriageway with 3 or 4 lanes plus a hard shoulder at either side. Brackets should be considered to optimise performance.

Road lighting

Although traditionally columns have been installed in a central reservation, an opposite installation with columns behind the hard shoulder can improve maintenance operations and reduce traffic disruption when in process.

As glare becomes a major concern an optimised designed optic and/or the use of flat glass enclosures are necessary.

Key luminaires:


Main Roads - Points of note are;

The main usage of the road is for vehicles at high speed (>60km/h) but pedestrians, cyclists or slow vehicles may also be present on footpaths, cycle paths and slow lanes. Intersections can be present and need special attention.

A common installation is using columns around 10m high and in an opposite or twin central configuration but it needs to always be related to the road layout, the number of lanes involved and the lighting criteria to achieve.

Where cycle and pedestrian pathways are present the use of luminaires with different lamp settings is beneficial to comply with requirements for the road and also to be able to correctly light the pathways without needing to change the pole characteristics.

As in all road lighting applications a high IP rating has to be considered to extend maintenance periods.

Key luminaires:


Road lighting

Ring roads and radial roads - Points of note are;

These are usually medium speed roads and high-speed urban roads where pedestrians and cyclists are common.

Luminaire mounting heights around 8 and 10m in a staggered or single sided arrangement are usual, although many other possibilities can be considered due to the multiple layouts of these roads.

As these roads can be of multiple lanes the main concern is the common use by cyclist and pedestrians usage.

In some cases, when a road has many lanes and cycle and/or pedestrian pathways are also present the use of twin poles may be considered (i.e. using an additional luminaire at a separate mounting height to light the adjacent pathways) or alternatively the use of bollards which also provide a physical separation between traffic types. In these cases using different light sources for motorised and other traffic (such as high pressure sodium and a white light lamp) can help to differentiate between the two areas.

Key luminaires:


Mixed traffic roads - Points of note are;

These are normally medium to low speed roads with a large number of slow vehicles and pedestrians. Intersections are very common. Regional roads and urban roads are mainly part of this group as well as commercial streets.

Columns no higher than 8m are commonly used in a single sided or staggered layout, although in some commercial streets with wide footpaths an additional column and luminaire may be used to achieve high quality lighting and differentiate areas.

For regional roads low luminance classes should be applied and illuminance classes where pedestrian usage is relevant.

Key luminaires:



Road lighting

Residential and local roads - Points of note are;

These roads are normally used by low speed mixed traffic. Pedestrian areas and local and residential roads are mainly part of this group.

Low mounting heights are common, with column height usually under 6m.

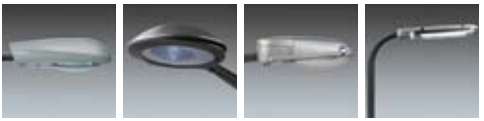
Single sided layouts may be used to reduce installation costs although layouts may vary due to multiple access points to private car parks or properties. The use of staggered layouts is common when parking lanes and wide footpaths are present.

Lighting classes tend to be from lower categories and in residential areas the use of high colour rendering lamps to improve perception is recommended.

In applications where crime ratios are high and facial recognition is required vertical and semi-cylindrical illuminance classes should be applied.

Low glare luminaires should be considered to reduce light trespass onto adjacent residential housing. Additionally the location and the orientation of the luminaires can help avoid any light trespass into houses.

Key luminaires:



Conflict areas and junctions - Points of note are;

In these areas traffic, either motorised or pedestrian, converges from many directions. Lighting in these areas has to increase awareness and guidance to drivers and pedestrians regarding the geometry of the area and the position of other users.

In terms of lighting the highest applicable class should be used in these areas, using the highest class of the incoming roads.

Road lighting

Access and exit lanes should be highlighted, including a short section of these lanes away from the conflict area. This is to ensure any obstacle in these areas is visible.

When positioning the luminaires the main aim is to help the incoming vehicles visibility. When entering a junction from a minor road a luminaire should be positioned to make vehicles visible as they approach the conflict area.

Columns can play a major role not only in terms of providing lighting but also to give guidance to the geometry of the area. A common technique is to increase the height of the columns in the conflict area and on the approaches. On roundabouts columns placed in a single sided configuration around the outer part of a curve provide a clear guidance for a driver as they approach the area.

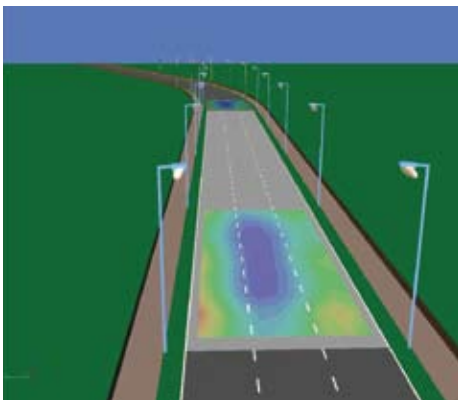
Key luminaires:



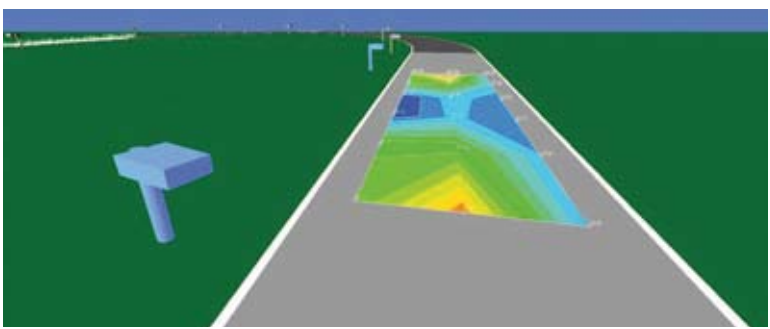
Road lighting

Schemes

Traffic



Scheme: Traffic route, 3 lanes, opposite arrangement. Total width 10.95m
Luminaire(s) used: Triumph 1 150W HST, 10m mounting height, 36m spacing, 5° tilt
Road: L_{av} = 5.75 cd/m² ; E_{min}/E_{av} = 0.59;
Threshold increment = 2%



Scheme: Access ramp, width 4m
Luminaire(s) used: Orus 70W CDM-T, 0.9m mounting height, 10.5m spacing
Road: E_{av} = 33 lux ; E_{min} = 15 lux

Road lighting

Lighting columns and fixtures may be themed to blend into and complement the area they are situated within. Careful choice of column height is necessary to prevent lighting becoming excessively visible and detracting from the view. However, a column height that is too low will reduce installation performance and require additional lanterns.

Whenever designing an installation the impact of the lighting hardware on a scene during daylight hours should be considered, as well as the performance of the lighting during darkness.

Catenary lighting solutions in which the lanterns are suspended along the centre of the carriageway are popular in many countries and remove the need for lighting columns and brackets. This can create a less cluttered environment at street level, although in architecturally interesting areas thought should be given as to the effect of the additional cabling on the field of view.

Frequently lighting columns collect additional street furniture, such as banners or signage. Lighting columns are constructed to withstand a defined windage (that is the force of the wind on the column). Windage is directly related to the surface area of any furniture mounted on or fixed to the column, and therefore adding additional objects to the column will increase the windage loading, and may cause weakening of the column and structural failure.