

BS 5489-1:2020



BSI Standards Publication

Design of road lighting

Part 1: Lighting of roads and public amenity areas —
Code of practice

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Summary of pages

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Foreword

Publishing information

This part of BS 5489 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 May 2020. It was prepared by Subcommittee EL/1/2, *Road lighting*, under the authority of Technical Committee EL/1, *Light and lighting*. A list of organizations represented on these committees can be obtained on request to their secretary.

Supersession

This part of BS 5489 supersedes [BS 5489-1:2013](#), which is withdrawn.

Relationship with other publications

BS 5489 consists of two parts:

- Part 1: *Lighting of roads and public amenity areas*;
- Part 2: *Lighting of tunnels*.

This part of BS 5489 contains guidance and recommendations that are intended to support the [BS EN 13201](#) series and to assist designers of lighting systems in using that standard.

Information about this document

This is a full revision of the standard. The principal changes are to align the standard with current best practice and with the BS EN 13201 series. New guidance is provided for lighting design when located within a “smart city” environment or when co-located with electric vehicle (EV) charging points.

The aim of this standard is to promote wider understanding of the lighting of roads and public amenity areas and to give guidance on the design decisions that need to be made. Rather than being prescriptive, it makes recommendations that are essential to the design process and that will enable production of designs that are appropriate and justifiable. The design of lighting for roads and public amenity areas can be a complex process with many different aspects, and therefore it is important that all relevant issues are taken into account.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at [bsigroup.com/standards](#), or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

As a code of practice, this part of BS 5489 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 5489 is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people for the task in hand, for whose use it has been produced.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type and does not constitute a normative element.

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This part of BS 5489 gives recommendations on the general principles of road lighting and its aesthetic and technical aspects, and provides guidance on operation and maintenance. It also provides guidance on means of minimizing energy consumption and limiting the impact on the environment and adjacent property.

It gives recommendations for the design of lighting for all types of highway and public thoroughfare, including those specifically for pedestrians and cyclists, and for pedestrian subways and bridges. It excludes the lighting of vehicular tunnels and underpasses, which are covered in [BS 5489-2](#).

It gives recommendations for the design of lighting for urban centres and public amenity areas. It gives recommendations and guidance for lighting relating to smart cities.

It gives additional recommendations for lighting around aerodromes, railways, coastal waters, harbours and navigable waterways, in order to minimize the possibility of the lighting interfering with these modes of transport.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document.¹⁾ For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

[BS 5266-1](#), *Emergency lighting – Part 1: Code of practice for the emergency escape lighting of premises*

BS 6100-2, *Building and civil engineering – Vocabulary – Part 2: Spaces, building types, environment and physical planning*

[BS 7671](#), *Requirements for Electrical Installations – IET Wiring Regulations*

[BS 8300-2](#), *Design of an accessible and inclusive built environment – Part 2: Buildings – Code of practice*

[BS EN 40](#) (all parts), *Lighting columns*

BS EN 12464-1:2011, *Light and lighting – Lighting of workplaces – Part 1: Indoor work places*

BS EN 12464-2:2014, *Lighting of work places – Part 2: Outdoor work places*

BS EN 12665, *Light and lighting – Basic terms and criteria for specifying lighting requirements*²⁾

BS EN 12767, *Passive safety of support structures for road equipment – Requirements and test methods*

BS EN 13201-2:2015, *Road lighting – Part 2: Performance requirements*

BS EN 13201-3, *Road lighting – Part 3: Calculation of performance*

BS EN 13201-4, *Road lighting – Part 4: Methods of measuring lighting performance*

BS EN 13201-5, *Road lighting – Part 5: Energy performance indicators*

[BS EN 60598-1](#), *Luminaires – Part 1: General requirements and tests*

[BS EN 60598-2-3](#), *Luminaires – Part 2-3: Particular requirements – Luminaires for road and street lighting*

[BS EN 62305](#) (all parts), *Protection against lightning*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

²⁾ This standard also gives an informative reference to BS EN 12665:2018.

PD 6547, *Guidance on the use of BS EN 40-3-1 and BS EN 40-3-3*

Other publications

[N1] COMMISSION INTERNATIONALE DE L'ÉCLAIRAGE. *Method of specifying and measuring colour rendering properties of light sources*. CIE 13.3. Third edition. Vienna: Commission Internationale de l'Éclairage, 1995.

[N2] INSTITUTION OF LIGHTING PROFESSIONALS. *Guidance notes for the reduction of obtrusive light*. GN01. Rugby: Institution of Lighting Professionals, 2020.³⁾

[N3] HEALTH AND SAFETY EXECUTIVE. *Avoiding danger from overhead power lines*. GS6. Fourth edition. London: HSE Books, 2013.

[N4] INSTITUTION OF LIGHTING PROFESSIONALS. *Code of practice for electrical safety in highway electrical operations*. GP03. Rugby: Institution of Lighting Professionals, 2011.³⁾

[N5] INSTITUTION OF LIGHTING PROFESSIONALS. *Safety during the installation and removal of lighting columns and similar street furniture in proximity to high voltage overhead lines*. GP10. Rugby: Institution of Lighting Professionals, 2004.³⁾

[N6] ELECTRICITY ASSOCIATION. *Model code of practice covering electrical safety in the planning, installation, commissioning and maintenance of public lighting and other street furniture*. Engineering Recommendation G39/1. Electricity Association, 1992.

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this part of BS 5489, the terms and definitions given in BS EN 12665, BS EN 13201-2:2015, BS EN 13201-3, BS 6100-2 and the following apply.

3.1.1 absolute photometry

process for measuring photometric quantities directly in SI units

NOTE 1 This term is often used in goniophotometry of luminaires, in contrast with relative photometry.

NOTE 2 Absolute measurements require instruments calibrated for the appropriate SI units.

3.1.2 arrangement

pattern according to which road lighting luminaires are sited in plan, e.g. staggered, opposite, single-sided or twin central

3.1.3 competent person

person who has training and experience relevant to the matter being addressed and an understanding of the requirements of the particular task being approached

NOTE A competent person is expected to be able to provide a reasonable interpretation of and advise on the best means by which the recommendations of this British Standard may be implemented.

3.1.4 conservation area

statutory, designated geographical area of architectural interest, the character or appearance of which it is desirable to preserve or enhance

³⁾ Obtainable from the Institution of Lighting Professionals, Regent House, Regent Place, Rugby, CV21 2PN.

3.1.5 constant light output

functionality to constantly adjust the luminous flux of the light source based on the known or predicted depreciation behaviour of the light source to enable a constant luminous flux over time

[SOURCE: PD ISO/CIE TS 22012:2019, 3.5]

3.1.6 cost

intended and unintended, financial or non-financial negative effect caused by a scheme

3.1.7 design spacing

required distance between the geometric centres of adjacent road lighting luminaires, calculated in accordance with BS EN 13201-3, for a straight and level section of the particular type of road

3.1.8 edge illuminance ratio (R_{EI})

average horizontal illuminance on a strip just outside the edge of a carriageway in proportion to the average horizontal illuminance on a strip inside the edge, where the strips have the width of one driving lane of the carriageway

NOTE This was previously known as surround ratio.

3.1.9 emergency lane

lane not normally or regularly used by road users except in emergency or during breakdown

NOTE The emergency lane is often referred to as a hard shoulder. Where a hard shoulder is regularly or has become permanently open to traffic, for the purposes of road lighting design it is not counted as an emergency lane.

3.1.10 footbridge

bridge over an obstacle to pedestrians, provided for the passage of non-motorized traffic only

3.1.11 geometry

interrelated linear dimensions and characteristics of the road lighting system, i.e. spacing, mounting height, transverse position and arrangement

3.1.12 high mast lighting

system of lighting for large areas using masts carrying clusters of luminaires

NOTE High mast lighting columns are typically greater than 18 m in height.

3.1.13 light source luminous flux factor (f_{LF})

ratio of the luminous flux of a lamp (or light source) at a given time in its life to the initial luminous flux

NOTE 1 Light source manufacturers can provide this information either in tabular or in graphical form.

NOTE 2 Further guidance is provided in [PD ISO/CIE TS 22012:2019](#).

3.1.14 light source survival factor (f_{S})

fraction of the total number of lamps (or light sources) which continue to operate at a given time under defined conditions and switching frequency

[SOURCE: BS EN 12665:2018, 3.3.17, modified – Notes 1 and 2 have been omitted]

3.1.15 lifecycle

complete cycle of scheme, from decision to light and the provision of funds up to the decommissioning, removal and recycling or disposal of the scheme apparatus

3.1.16 lifetime

time from construction up to removal of a scheme

3.1.17 lighting designer

person who is suitably experienced and competent to undertake lighting design for public spaces

3.1.18 mounting height

nominal vertical distance between the photometric centre of a road lighting luminaire and the surface of the road

3.1.19 relative photometry

measurement obtained as a quotient of two photometric quantities

NOTE 1 This term is often used in goniophotometry of luminaires, where luminous intensity distribution is measured as relative values normalized by total luminous flux of the lamps used and reported in the unit cd/klm.

NOTE 2 This method is not applicable to LED light sources and LED luminaires with integrated LED light sources.

3.1.20 residential road

road that carries little vehicular traffic, other than that generated by residents

3.1.21 road bridge

structure carrying a road over another road, railway, river, etc.

3.1.22 set-back

shortest distance from the forward face of a lighting column to the edge of a carriageway

3.1.23 smart city

city that increases the pace at which it provides social, economic and environmental sustainability outcomes and responds to challenges such as climate change, rapid population growth, and political and economic instability by fundamentally improving how it engages society, applies collaborative leadership methods, works across disciplines and city systems, and uses data information and modern technologies to deliver better services and quality of life to those in the city (residents, businesses, visitors), now and for the foreseeable future, without unfair disadvantage of others or degradation of the natural environment

NOTE The term “sustainable cities and communities” is often used in place of “smart cities”.

[SOURCE: BS ISO 37122:2019, 3.4, modified – notes replaced]

3.1.24 S/P ratio

ratio of the luminous output of a light source evaluated according to the CIE scotopic spectral luminous efficiency function, $V'(\lambda)$, to the luminous output evaluated according to the CIE photopic spectral luminous efficiency function, $V(\lambda)$

3.1.25 traffic flow

number of vehicles passing a specific point, at a specific time, in a stated time

3.2 Symbols

For the purposes of this part of BS 5489, the following symbols apply.

$\overline{E}$	maintained average horizontal illuminance, in lux (lx)
$E_{\min}$	maintained minimum horizontal illuminance at any point, in lux (lx)
E_v	vertical plane illuminance at a point, in lux (lx)
f_{LF}	light source luminous flux factor
f_{LM}	luminaire maintenance factor
f_M	overall maintenance factor
f_s	light source survival factor
f_{TI}	threshold increment (TI), as a percentage (%)
H	mounting height, in metres (m)
$\overline{L}$	maintained average road surface luminance, in candelas per square metre (cd/m ²)
L_x	LED rated life: length of time, in hours (h), during which LEDs will provide more than a claimed percentage (x) of initial light output
R_a	general colour rendering index as defined in CIE 13.3 [N1]
R_{EI}	edge illuminance ratio
r	reduced luminance coefficient
T_{CP}	correlated colour temperature (CCT)
U_l	ratio of the minimum to the maximum road surface luminance found in a line along the centre of a driving lane
U_o	ratio of minimum illuminance (luminance) to average illuminance (luminance) of/on a surface
v	speed limit, in miles per hour (mph)
<i>NOTE 1 mph = 1.61 km/h.</i>	
$V(\lambda)$	CIE photopic luminosity function that shows relative sensitivity of the human eye under photopic light conditions to different wavelengths of visible light
$V'(\lambda)$	CIE scotopic luminosity function that shows relative sensitivity of the human eye under scotopic light conditions to different wavelengths of visible light
W_L	width of driving lane, in metres (m)
W_r	width of relevant area of carriageway, in metres (m)
x	percentage of initial luminous flux of an LED
y	percentage of LEDs that will have failed at end of rated life
Φ	luminous flux of light source or lamp(s) in luminaire, in lumens (lm)
θ_f	luminaire tilt in application, in degrees (°)

4 General recommendations

NOTE Attention is drawn to the statutory requirements listed in references [1] to [15]. There is no statutory requirement to provide road lighting. Neither are there any statutory requirements to install a particular class of lighting if a decision is made to light a particular road. However, there are statutes that empower highway authorities to light roads. The provision of road lighting on a previously unlit road might involve statutory requirements and might cause the imposition of speed limits.

4.1 Reasons for road lighting

COMMENTARY ON 4.1

Road lighting encompasses the lighting of all types of highway and public thoroughfare, assisting traffic safety and ease of passage for all users. In this respect, good lighting can be one of the measures used to reduce night-time traffic collisions. It can allow pedestrians to see hazards, orientate themselves, recognize other pedestrians and feel more secure. It also has a wider social role, with the potential of helping to reduce crime and the fear of crime, and can contribute to commercial and social use at night, of town centres and tourist locations, by improving the daytime and night-time appearance.

Transport and environment policy is increasingly emphasizing the need to improve conditions for walking and cycling. One factor that potentially influences decisions to travel by these modes is the quality of walking and cycling routes. After dark, lighting has an important role to play in helping to create acceptable conditions. Traditionally, footway lighting has often been considered little beyond functional lighting for the space alongside the carriageway. However, lighting can offer more, and can contribute to creating an environment that is pleasant and interesting as well as satisfying the basic functional objectives.

The provision of traffic calming measures might require particular lighting arrangements. Further guidance relating to lighting for traffic calming features is given in ILP TR25 [16].

Recommendations for the selection of lighting classes are given in [Clause 5](#), with additional guidance in [Annex A](#).

Road lighting should provide visual clues and reveal obstacles so that safe vehicular progress is possible. It should reveal all the features of the road and traffic that are important to all road users, including pedestrians.

Road lighting should not be proposed for the sole purpose of providing visual guidance for traffic; however, where practicable, lighting should be arranged to assist such guidance, and the components of the lighting installation should be arranged such as not to visually mislead motorists as to the route ahead (see [5.1.3](#) and [6.2.3](#)).

When lighting is provided on a previously unlit road, guidance should be obtained to determine whether any traffic signs will have to be illuminated, and the impact that the new lighting might have on ecology (see [4.2.4](#)) should be taken into account.

When lighting is added to an area previously unlit, the distance to other existing lighting should be arranged such there is not a light, dark, light effect created. The travelling speed should be determined using the 85th percentile of surveyed speed or the speed limit. If a section of road is to be left unlit then the minimum unlit section of road should be agreed with the Lighting Authority. A road safety review and a risk assessment should be undertaken prior to agreement of unlit section.

NOTE There is no recommended minimum distance between unlit sections of road. However, one “rule of thumb”, which is already used for conflict areas, is that of the “five seconds rule”. This is the distance travelled in 5 s at the travelling speed. For high speed roads, the distance advised within the draft DMRB TD501 [17] is “four times the safe sight stopping distance”.

4.2 Environment

COMMENTARY ON 4.2

Environmental issues associated with road lighting are prime considerations when designing a new or replacement lighting scheme.

The environmental impact of lighting can be reduced by varying the lighting level to allow the appropriate lighting class to be applied at the relevant time, even switching off at certain times if deemed appropriate. Further guidance is given in [4.3.5](#).

This subclause indicates some matters that need to receive attention and gives recommendations, but it is recognized that in aesthetics, subjective judgements can apply.

4.2.1 General

Designers should address at least the following environmental issues:

- a) daytime and night-time appearance ([4.2.2](#));
- b) minimizing obtrusive light ([4.2.3](#));

NOTE 1 Guidance is given in ILP GN01 [N2].

- c) undertaking a visual impact assessment;

NOTE 2 Guidance is given in ILP PLG04 [18].

- d) effect on ecology, flora and fauna ([4.2.4](#)); and

NOTE 3 Some species of flora and fauna are protected by legislation.

NOTE 4 Lighting for bats guidance is given in ILP GN08/18 [19].

- e) specific environmental issues within local planning policies.

NOTE 5 Further information on environmental sensitivity is available from the DEFRA "MAGIC" website (magic.defra.gov.uk/magicmap.aspx) [20].

The safety of users should take precedence over aesthetics in the event of any conflict of interest between these two factors. Planning authorities or other appropriate organizations should be consulted on matters of appearance.

4.2.2 Appearance

4.2.2.1 Daytime appearance

COMMENTARY ON 4.2.2.1

The design and siting of road lighting and other road equipment can make a great difference to the street scene, even though this might not be consciously appreciated. In situations such as a processional way or monumental bridge, the design and placing of lighting columns can make a positive formal contribution to the scene.

More usually, however, buildings, trees, paved surfaces, grass and people provide all the interest required.

In cases where the siting of lighting columns is integral to the formality of a street scene, the columns should be designed and placed with due regard to the architectural or landscape setting.

In other situations, road lighting equipment should be made as unobtrusive as possible.

The designer should consult the client to determine whether there are opportunities to reduce street clutter.

4.2.2.2 Night-time appearance

COMMENTARY ON 4.2.2.2

An aspect of planning any lighting scheme is the positive contribution it can make to the improvement of the night environment.

While efficient lighting for traffic and pedestrian safety is essential, particularly in urban and residential roads, consideration of the whole visual scene at night is highly desirable.

The basic design should provide lighting that will be suitable and sufficient for traffic and pedestrian safety. It should also ensure as far as possible that the lighting directly helps to create a pleasant and attractive night-time atmosphere, especially for areas of civic importance (see 7.4).

Factors such as amenity and environmental requirements, and the assistance in perception of a safe environment that lighting provides, should be taken into account.

The colour rendering index of the light source (R_a) should be suitable for the application.

Where the police use CCTV for prosecution relating to street crime, they should be consulted regarding the lighting requirements, including colour rendering and level.

The colour appearance of light sources should be suitable for the application or task. Lighting designers should undertake appropriate due diligence when choosing an appropriate correlated colour temperature (T_{cp}), and should take into account local legislation, policy and guidance which might limit the allowable colour temperature.

NOTE Colour appearance is quantified by the correlated colour temperature (T_{cp}), which describes the colour appearance of the light that is produced, in terms of its warmth or coolness. The T_{cp} relates the colour appearance of the light source to the colour appearance of a reference source when the reference source is heated to a particular temperature, measured on the Kelvin (K) temperature scale. A low colour temperature ($\cong 3\,000\text{ K}$ and lower) describes a warm source. A high colour temperature ($\cong 4\,000\text{ K}$ and higher) describes a cool source.

4.2.3 Obtrusive light

COMMENTARY ON 4.2.3

Control of the light distribution of installations is necessary in order to limit obtrusive light and sky glow. In some cases, lighting can be intrusive at night, e.g. in rural and open areas where lighting can be seen as an intrusion in an otherwise darkened environment.

Upward light should be minimized in all road lighting installations by controlling the intensity of light from luminaires as installed, at angles close to or above the horizontal and installing the luminaire horizontally.

NOTE 1 The installed intensity classes from BS EN 13201-2:2015 can be used for this purpose.

Precautions should be taken to avoid unnecessary light intrusion into adjacent properties (see Note 2).

NOTE 2 A limited level of illumination onto front gardens and the face of properties might in some cases, and at the discretion of the client, be allowed in order to enhance the appearance of the area and the protection of property.

NOTE 3 Further information is given in ILP GN01 [N2].

The sensitivity of an environment should be taken into account when designing lighting schemes, particularly in areas such as green belts, national parks, dark sky parks and areas of outstanding natural beauty.

In schemes where residential areas are adjacent to environmentally sensitive areas, the light distribution should be controlled to minimize light spill onto the adjoining areas by selection of an appropriate installed intensity class from BS EN 13201-2:2015.

NOTE 4 There are other advantages in controlling obtrusive light. Light spill affects ecological diversity, as night hunters are often placed at a disadvantage. The ILP/BCT publication ILP GN08/18 [19] provides specific guidance on lighting in areas where bats are prevalent.

In the following situations, luminaires should be used which, when installed, conform to classes G*4, G*5, or G*6, or threshold increment (TI or f_{TI}), or both, as specified in BS EN 13201-2:2015:

- a) traffic routes and motorways in environmentally sensitive and open areas;
- b) roundabouts and mini-roundabouts, particularly in environmentally sensitive areas and/or with unlit approach roads;
- c) elevated roads and bridges; and
- d) remote isolated junctions.

NOTE 5 Information on lighting in the vicinity of astronomical observatories is given in the joint IAU/CIE publication Guidelines for minimising urban sky glow near astronomical observatories [21] and the CIE publication Guideline for minimising sky glow [22].

4.2.4 Ecology

COMMENTARY ON 4.2.4

When designing a new or replacement scheme, it is important to consider the impact that the new lighting might have on ecology. There is increasing awareness and guidance available regarding the way that artificial lighting can impact flora and fauna. Some specific guidance is given in A review of the impact of artificial light on invertebrates [23].

An example of ecology which is impacted by lighting is areas where bats are roosting, foraging or commuting, for which there is published guidance (ILP GN08/18 [19]).

The minimum distance between unlit sections of road may vary from the guidance in 4.1 where gaps are left in the road lighting to provide bat corridors. In some situations, it might be possible to provide the bat corridor by reducing the mounting height in conjunction with the use of a warmer white light source. Some specific guidance is given in ILP GN08/18 [19] recommending mitigation such as specifying the correlated colour temperature (T_{cp}) of the light source to be "a warm white spectrum" (ideally $< 2\,700\text{ K}$).

Designers should liaise with ecologists to understand specific ecological sensitivities for the site. The lighting should then be designed to take these into account.

4.2.5 Sustainability

COMMENTARY ON 4.2.5

There are measures which can be taken to improve the sustainability of a road lighting solution.

To achieve a sustainable solution does not require significant financial investment, but it does require appreciation of the impact of the scheme from different points of view. Through innovative and considered decision-making, sustainability can be achieved with little additional investment at the design and construction stage relative to the cost of operating the scheme over its lifetime. It might be the case that a sustainable solution will cost less over its entire lifecycle than a less sustainable solution.

Along with technological solutions such as energy-efficient light sources and controls, and using renewable energies for their electricity source, simple practices such as selection of the appropriate lighting class and use of variable lighting can help to make lighting more sustainable.

Sustainability also requires issues of waste, pollution and energy in the products' lifecycle to be addressed. The need for designs to be energy-efficient designs is covered in 4.3.

When designing lighting schemes, the design should be as sustainable as possible whilst meeting the required design parameters.

NOTE Guidance on sustainable lighting solutions is given in [Annex B](#).

4.3 Electrical energy

COMMENTARY ON 4.3

Lighting accounts for a significant proportion of electrical energy usage within the built environment and electrical energy costs are forecast to trend upwards in the foreseeable future. The need for sustainable design (see [4.2.5](#)) is also relevant.

Many authorities have targets to reduce electrical energy use, and consequently electrical energy targets often form part of the requirements for a lighting design.

4.3.1 General

Designers should develop appropriate energy-efficient designs in all schemes.

NOTE 1 Attention is drawn to Directive 2009/125/EC (the Ecodesign Directive) [24].

NOTE 2 Useful information can be found in the EU Green public procurement publication on street lighting [25].

4.3.2 Measures to minimize electrical energy use

Energy efficiency measures should be taken in accordance with BS EN 13201-5.

NOTE 1 BS EN 13201-5 defines the calculation and measurement of energy efficiency coefficients of road lighting installations. This is based on the system power necessary to light the relevant area based upon the selected lighting class. The coefficients apply for all traffic areas covered by the lighting classes as defined in BS EN 13201-2:2015.

Good lighting can contribute to electrical energy and carbon reduction strategies and should be at the forefront of any electrical energy and carbon reduction strategy developments. There are various strategies available, each of which should be assessed and an appropriate option chosen.

NOTE 2 These strategies include, but are not limited to, the following.

- **Variable (or adaptive) lighting.** The road lighting standards classify the required lighting class based on usage; therefore, when the use of a road or area reduces, for example, between midnight and 0600hrs, and provided that the equipment is suitable, the lighting levels can be reduced. See [4.3.5](#) for further guidance.
- **Trimming.** Trimming can be applied to switch on and switch off ambient light levels. Modern light sources operated on the optimum electronic control gear do not require as much time to warm up to full output, therefore the lighting can be switched on closer to the time required, thus reducing the operating hours.
- **Part-night.** Lighting is turned off between certain hours such as midnight to 0600hrs. Longitudinal uniformity is maintained during the switch off and switch on that occur during the hours of darkness, that is, switching not occurring at dusk and dawn. The control system switches lights on and off in a contiguous order, as a random approach temporarily compromises longitudinal uniformity.
- **Switch off.** Lighting is switched off and removed.
- **Sensors.** These include passive infra-red (PIR), motion sensors, presence detection and push button switches. The sensors may be combined with any of the other strategies listed.

If part-night, switch off or sensors are considered, the highway authority should be consulted to verify that road safety is not discernibly compromised. If moving to part-night or switch off, the authority should ensure that the highway signage, white lining and other features are assessed by a qualified highway engineer to verify that they are compliant for an unlit road. A full risk analysis and user consultation should be undertaken before either of these two options is implemented.

NOTE 3 The electrical energy tariff for public lighting is generally based on an operational profile; the majority of lighting installations operate all night, so the electrical energy rate is an average of the various rates over that

period. This profile makes use of the times when electrical energy demand is very low (e.g. midnight to 0600hrs) and hence electricity is very cheap compared to peak periods. Any change in operational profile needs to be advised to the electrical energy provider so that they can assess the impact on their supply. This might result in a change of tariff, which could increase the electrical energy rate, and whilst the installation load might be decreased, the overall cost of electrical energy might not reduce by the same level.

4.3.3 Hours of operation

COMMENTARY ON 4.3.3

The question of whether to light a road is outside the scope of this part of BS 5489, which deals with technical matters, but the matters discussed in this subclause are relevant to its operation once the decision to light has been taken.

Road lighting, where provided, is normally required during all the hours of darkness, in operation from about 30 min after sunset to about 30 min before sunrise, although the controls are usually related to daylight illuminance levels, rather than time (see 4.3.2 for guidance on trimming).

Guidance on the selection of lighting classes is given in [Annex A](#).

A risk assessment should be undertaken prior to making a decision for part-night lighting, taking the following factors into account.

- a) Lighting throughout the hours of darkness is particularly important as an aid to crime prevention, policing, and the general safety and comfort of the community.
- b) The level of lighting may vary during the night, dependent upon usage and other factors (see 4.3.5).
- c) In some limited situations, a lighting installation may be completely extinguished during certain periods of the night or the year when usage is very low.

4.3.4 Variable (or adaptive) lighting levels

COMMENTARY ON 4.3.4

Ever-improving technology allows for more flexibility in the variation of lighting level on all classifications of road dependent upon usage at any one time. As the usage is reduced, typically the lighting level can be reduced, unless there are overriding reasons not to do so (such as a high accident or crime rate). It might even be that it is appropriate to switch off for some periods of the night. Conversely, variable lighting can also allow the light level to be enhanced when traffic flows are increased.

Variable lighting is often referred to as dimming, but more appropriately is lighting to the correct lighting class to meet specific road parameters at a particular time. It might be that the highest lighting level an installation can achieve is only used on rare occasions, where traffic density is higher than normal (such as match days near to a football stadium), while the everyday lighting level might in reality be when the installation is operated at a lower lighting class.

There are additional environmental benefits of using variable lighting levels, including reduced light intrusion, light pollution, electrical energy consumption and carbon emissions.

Information on the selection of lighting classes is given in [Annex A](#). In [Annex A](#), parameters relevant to lighting are used in the selection of lighting classes. These parameters can vary during the night or over the year, and thus within the hours of operation the lighting class may be varied. This can be achieved by varying the lighting level or switching techniques. [Annex A](#) gives details of the lighting classes set out in BS EN 13201-2:2015 and gives guidelines on the application of these classes. For three categories of lighting (motorized traffic, conflict areas, and pedestrian and low speed areas) there are parameters which need to be assessed dependent on usage or local conditions. Many of these parameters remain fixed throughout the night, such as design speed, traffic composition and whether there are

parked vehicles, but some of the parameters, such as traffic density or ambient luminance, can change throughout the night. When these parameters change, this can result in the ability to select a different lighting class, thus allowing a variable lighting solution.

ILP PLG08 [26] provides additional guidance on variable lighting.

If switching light sources off is the method used to vary the lighting level, the uniformity requirements should be met.

NOTE This includes situations where individual luminaires are extinguished in order to reduce lighting levels.

When varying the lighting, each lighting level should meet the requirements of a distinct lighting class from BS EN 13201-2:2015.

If a dynamic system is used, suitable delays for switching between levels should be put in place to avoid nuisance switching.

4.3.5 Controls

COMMENTARY ON 4.3.5

Lighting control systems enable the lighting level to be varied according to the specific needs of each location. The lighting can be programmed to vary its output at set times or under set conditions; lighting control helps to reduce costs and conserve electrical energy. The choice of lighting control is extensive, including time switches, photo-electric control units (PECU) and central management systems (CMS).

The choice of control system might depend on the functionality required, budgets and the size of the installation.

Autonomous controls, such as photo-electric control units (PECUs) and time switches, are generally used to switch the lights on as darkness falls and switch them off at dawn. Part-night PECUs can be used to switch off or reduce the light source output of the luminaires during the night, e.g. at 0100hrs when activity reduces.

Central management systems (CMS) offer much more control and flexibility, providing two-way communication between a remote server and each light point of an installation. The control of individual light points provides significant functionality, including:

- *individually programmable switching and the facility to vary the light source output using established digital protocols;*
- *the ability to remotely override programmed switching or adaptive lighting events on special occasions;*
- *remote monitoring of the status and fault reporting of light points (thereby removing the need for patrols);*
- *gathering of data for maintenance planning;*
- *monitoring electrical energy usage; and*
- *linking to GIS systems.*

Communication may be by mains-borne signals or wireless.

Designers of lighting schemes should choose or define the lighting control appropriate to the required functionality of the design, taking into account the need to balance flexibility, cost and energy consumption.

NOTE Guidance on central management systems, which are one method of control, is given in ILP PLG01 [27].

The decision on whether lights are to be switched or varied should be made only after full consultation with interested parties, including the police authority and users' representatives, and after undertaking comprehensive assessment of the risks.

4.4 Economics

Lighting schemes often show cost benefits over their lifetime and, where applicable, a whole life cost-benefit analysis should be completed to show the benefits of a particular lighting scheme.

NOTE When the analysis is completed in this way, it often highlights different solutions compared to a simple analysis based on capital cost. The effects of maintenance regimes, electrical energy costs and accident savings can all have a major impact on costs and benefits over the lifetime of the installation. The cost and benefits might not be constant across the lifetime of the installation.

4.5 Lighting and human health

When specifying a light source, designers should avoid light sources which produce excessive flicker.

NOTE The overall potential for artificial lighting to impact on public health is outside the scope of this part of BS 5489. Guidance can be found in Public Health England report CRCE-RDD 01:2016 [28].

5 Lighting design criteria

5.1 Lighting design

COMMENTARY ON 5.1

Lighting design is a complex task, and there are many parameters which need to be taken into account in the development of a lighting design. Foremost of the parameters is the health and safety of users and others affected by the design (including road workers). Other considerations include maintenance, electrical energy and other lifecycle costs. Attention is drawn to the Construction (Design and Management) Regulations 2015 [15].

Information on the selection of lighting classes is given in [Annex A](#).

5.1.1 Visual tasks for motorists

COMMENTARY ON 5.1.1

The motorist has to seek and absorb sufficient visual information in order to position themselves correctly on the road and match their speed to the driving environment. The gathering of information is key to early anticipation and negotiation of hazards, obstacles, changes in road geometry and events. That early anticipation allows road users to plan and execute actions that leave a safe margin of error in terms of distance, vehicle stability and motorist workload.

Whereas in most lighting situations the aim is to light objects rather than their backgrounds (positive contrast), in most road lighting situations for vehicular traffic the converse is true (negative contrast). As only a small part of the central field of vision of a motorist is in sharp focus, most information is received peripherally and, therefore, not in detail. A motorist is likely to focus directly on a significant object that appears in the field of vision, but for a motorist to detect the presence of an object, the object has to present sufficient contrast against its background. This is true both by day and night, but at night the motorist's ability to perceive contrast is considerably poorer at low lighting levels.

The ability to manoeuvre safely requires that objects and visual guidance information be perceived in time for the motorist to act comfortably and safely. Visual performance and the visibility of objects are related to the level and distribution of the road surface luminance. The higher the road surface luminance, the better is the visual performance (there is a ceiling to this effect). The uniformity of the road surface luminance also has a significant influence on object visibility.

The driver experience of road lighting is key to providing a positive night-time driving experience. While designing to meet a standard is a baseline requirement, merely designing to a standard or to minimize energy use can often fail to meet user quality expectations. Glare and the T_{CP} of the light source are significant factors which impact on the user experience. Designers also need to take into account the lighting needs of an ageing driver population who are particularly affected by glare and whose eyes transmit much less blue light than those of a young driver.

Road lighting should achieve the class of lighting, in accordance with BS EN 13201-2:2015, appropriate to the conditions normally found at a particular time, so as to provide adequate brightness of the general scene and to maximize the contrast between objects and their background.

The light available should be used to maximum effect by lighting the road surface and the immediate surrounds to reveal objects in silhouette, with the exception of subsidiary roads (see 7.2), pedestrian areas and car parks in urban centres (see 7.4), and some conflict areas (see 7.5).

Good visual conditions should prevail over the entire road scene to enable the various levels of the driving task to be executed safely.

NOTE 1 The success of this method of lighting depends on designing the distribution of light from the luminaires to take advantage of the reflection properties of the road surface.

NOTE 2 The effectiveness of lighting with negative contrast is reduced when vehicle headlights are on.

5.1.2 Visual tasks of pedestrians – Recognition and personal safety

COMMENTARY ON 5.1.2

Lighting is needed to provide a street which is not only safe for people to use but is also perceived to be safe. The factors contributing to an environment perceived to be safe are a general feeling of safety which can result from an appropriately lit street; visual comfort, which can be defined as a pleasant environment in which glare is not considered to be a problem; and perceived ability to judge the intent and/or identity of other road users. The factors contributing to safe movement are the ability to detect obstacles on the pavement surface which could otherwise be a trip hazard, and to judge the intent and/or identity of other people at a distance sufficient to take avoiding action if necessary.

Pedestrians also need to be able to recognize signs and see potential hazards.

In situations where it is considered that the recognition of other people or their intent is particularly important, a lighting class from the EV series of lighting classes given in BS EN 13201-2:2015, Table 6, should be applied.

NOTE Subclauses 5.3.2.3 and 7.2.5 provide further guidance.

5.1.3 Visual guidance

The location of lighting columns should not give rise to confused visual guidance, particularly at junctions, roundabouts and bends. Lighting equipment should be positioned such as to complement the lane and edge of carriageway markings.

To avoid misleading patterns of luminaires, any change in lighting system along the carriageway should be visually linked with the road layout. For example, unexpected breaks should be avoided by continuing lighting for one or two lighting columns past any overbridges, gantries and large traffic signs until motorists have an unambiguous view of the road at the end of the lighting.

5.1.4 Lighting of the surrounds and footways

Objects on the footway, or to one side of the carriageway, or in the centre of the carriageway but on a bend, are seen at least partially against the surrounds of the road. These should therefore receive sufficient light to provide a light background against which objects can be seen in silhouette, or, if such a background is absent, to reveal objects by positive contrast.

NOTE 1 Adequate lighting on the surrounds helps the motorist to perceive more of the environment and make speed adjustments in time. The function of the edge illuminance ratio (R_{ei}) is to ensure that light directed on the surrounds is sufficient for objects to be revealed.

NOTE 2 Adequate lighting on the surrounds is beneficial to reveal people who might be about to step into the carriageway and vehicles emerging from side roads.

NOTE 3 This light is also of assistance to pedestrians, as it reveals the footway surface, obstructions and other pedestrians.

On all traffic routes except those with heavily trafficked adjacent footways and/or cycle tracks, and emergency lanes of motorways, lighting of the surrounds should be achieved by applying R_{ei} to the values given in BS EN 13201-2:2015, calculated in accordance with BS EN 13201-3.

For traffic routes with heavily trafficked adjacent footways and/or cycle tracks, an appropriate lighting class from BS EN 13201-2:2015 should be applied to a footway or other relevant area adjacent to the carriageway.

In the case of motorways with an adjacent emergency lane, the appropriate lighting class should be provided for the emergency lane to give a sufficiently bright background for revealing objects viewed towards the outer edge of the carriageway. This lane should be assumed to be a separate area for the purpose of calculation.

On motorways without an adjacent emergency lane, R_{ei} should be applied to the adjacent verge.

5.1.5 Glare

COMMENTARY ON 5.1.5

Disability glare reduces the contrast between objects and their background so that their visibility is decreased.

Glare should be calculated for a lighting design and should not exceed the limits as defined in BS EN 13201-2:2015 for the relevant task or application.

Glare calculations for traffic routes should be calculated in accordance with [5.3.1.4](#).

Glare calculations for subsidiary roads should be calculated in accordance with [5.3.2.4](#).

5.1.6 Maintenance factor

The luminance or illuminance levels in service should not fall below the maintained levels specified for the lighting class selected from BS EN 13201-2:2015. The calculation methods in BS EN 13201-3 should be used to determine luminance and illuminance levels and other quality criteria.

NOTE 1 These methods for determining the luminance or illuminance provided by a lighting installation incorporate a maintenance factor (f_m).

For road lighting design, the overall maintenance factor (f_m) for luminaires should take into account the following factors:

- a) the luminous flux factor (f_{lf}) – the lumen maintenance of the light source(s) at the end of the rated life;

NOTE 2 The luminous flux factor is also known as the lamp lumen maintenance factor (LLMF).

- b) the survival factor (f_s) – the failure fraction of the light source(s) at the end of the rated life;

NOTE 3 The survival factor is also known as the lamp survival factor (LSF).

NOTE 4 The survival factor is assumed to be 1.0 for the majority of road lighting applications where a failed light source is replaced. ILP GN11/19 [29] proposes a value of 0.97 unless otherwise agreed. In some applications, such as pedestrian subways, this factor is taken into account.

- c) the luminaire maintenance factor (f_{LM}) – the reduction in light output owing to the accumulation of dirt on the light-emitting parts of the luminaire. Typical values are shown in [Annex C, Table C.1](#).

NOTE 5 The luminaire maintenance factor is also known as LMF.

NOTE 6 Typical values of luminaire maintenance factors, f_{LM} , are given in [Annex C](#). Alternatively, luminaire maintenance factors established by local testing may be used.

The overall maintenance factor should be calculated as the product of all three elements, using the following formula derived from PD ISO/CIE TS 22012:2019:

$$f_m = f_{LF} \times f_S \times f_{LM}$$

NOTE 7 An alternative way of writing the above formula is: $MF = LLMF \times LSF \times LMF$.

NOTE 8 [Annex D](#) gives examples of maintenance factor calculations.

The luminous flux factor (f_{LF}) should be obtained from the luminaire manufacturer's data, taking account of light source type, controller type, constant light output (CLO), switching regime, operating environment and light source change policy.

When designing with a constant light output system, the correct values of initial luminous flux and luminous flux factor should be verified and used. In addition, the average power consumption (over the relevant period) should be verified and used in any energy calculations.

NOTE 9 Further guidance is given in ILP GN11/19 [29].

5.1.7 Absolute or relative photometry

COMMENTARY ON 5.1.7

Lighting design can be carried out using absolute or relative photometry, as described below. Both have advantages and disadvantages, and there is no preferred option as either method is expected to produce the same result.

- a) **Absolute photometry.** *A luminaire is measured in a photometer, and the complete output from the lantern is included in the photometric file. Photometric standards (such as LM 63 [30] from the IES) suggest that -1 be placed in the flux field as an identifier that the file is absolute. The -1 is generally multiplied by -1 to remove the minus. Absolute photometry has become more common with the introduction of LED lighting.*
- b) **Relative photometry.** *When creating relative photometry, the light source is removed from the luminaire and the light source is photometered to determine the output of the source. The source is then placed in the luminaire and the luminaire is measured in a photometer. The complete output from the luminaire is measured. As the output of the source is known, the output from the luminaire can be pro-rated per 1 000 lm and stored in the photometric file. The flux field then carries a multiplier which is included in the calculation to take the output back to the original measured output. Relative photometry has been used for many years and was common when multiple lamps were used in the same fitting. The flux in the photometric file could be altered to reflect the output of different lamps or sources used.*

The photometric file used to determine the performance of a luminaire should be an accurate representation of the luminaire.

5.2 Design strategy and road classification – Risk assessment

Designers should check whether a client has a specific lighting strategy, lighting policy or specification which relates to the area under consideration. If no such guidance is available then the designer should determine an appropriate design strategy and lighting class.

NOTE 1 Information on the selection of lighting classes is given in [Annex A](#).

The design policy or lighting strategy should be developed by competent persons in accordance with the recommendations given in this part of BS 5489.

NOTE 2 Guidance on the creation of a street lighting policy is given in ILP TR24 [31].

A risk assessment should be undertaken to assess the particular risks associated with the road. The result of the risk assessment should then be used to inform the choice of lighting class.

NOTE 3 [Annex E](#) provides an outline of the lighting design process for all-purpose traffic routes.

NOTE 4 [Annex F](#) provides an outline of lighting design process for subsidiary roads and associated areas.

NOTE 5 [Annex G](#) provides an outline of the lighting design process for lighting urban centres and public amenity areas.

5.3 Lighting criteria

COMMENTARY ON 5.3

This subclause provides information on the lighting criteria used for road lighting design. It can be categorized as relevant for traffic routes (see [5.3.1](#)), or for subsidiary roads including pedestrian areas, footpaths and cycle tracks (see [5.3.2](#)).

5.3.1 Traffic routes

5.3.1.1 Average luminance of the road surface ($\bar{L}$)

COMMENTARY ON 5.3.1.1

The values of $\bar{L}$ are the minimum values to be maintained throughout the life of the installation for the specified lighting class(es). They are dependent on the light distribution of the luminaires, the luminous flux of the light sources, the geometry of the installation, and the reflection properties of the road surface.

Lighting designs for traffic routes should meet the $\bar{L}$ requirements of the selected class as defined in BS EN 13201-2:2015, and should be calculated according to the method in BS EN 13201-3.

Calculated values should take into account the luminaire maintenance factor (f_{LM}) and luminous flux factor (f_{LF}).

NOTE 1 Luminaire maintenance factors vary according to the intervals between cleaning, the mounting height and environmental zone and the IP rating of the light source housing. [Annex C](#) gives indicative values. Their values may alternatively be established by field measurements.

NOTE 2 Light source luminous flux factors (f_{LF}) vary according to light source type and power. Values are usually available from light source manufacturers.

5.3.1.2 Overall uniformity of road luminance (U_o)

The overall uniformity of road luminance, U_o , should be calculated in accordance with BS EN 13201-3.

NOTE This criterion is important with regard to the control of minimum visibility on the road.

5.3.1.3 Longitudinal uniformity of road surface luminance (U_l)

The longitudinal uniformity of road surface luminance, U_l , should be calculated in accordance with BS EN 13201-3.

NOTE This criterion relates mainly to comfort, and its purpose is to prevent the repeated pattern of high and low luminance values on a lit run of road becoming too pronounced. It applies only to long uninterrupted sections of road.

5.3.1.4 Threshold increment (TI)

COMMENTARY ON 5.3.1.4

TI is a measure of the loss of visibility caused by the disability glare from the road lighting luminaires. Disability glare results from the scattering of light within the eye, so reducing contrasts of the retinal image. The mathematical procedure is given in BS EN 13201-3, and the calculation is made for a clean luminaire equipped with a light source emitting the initial luminous flux.

In traffic route lighting, the parameter threshold increment (TI) should be used as a measure of discomfort or disability glare. Lighting designs for traffic routes should meet the TI requirements of the selected M class as defined in BS EN 13201-2:2015 and calculated according to the method in BS EN 13201-3.

At conflict areas on traffic routes, lighting designs should meet the TI requirements of the selected C class as defined in BS EN 13201-2:2015, Table C.1.

For conflict areas, TI cannot always be calculated, and in these situations, luminaire intensity limits classes in accordance with BS EN 13201-2:2015 should be used.

5.3.1.5 Edge illuminance ratio (R_{ei})

In situations where an alternative lighting system is already provided on the surrounds, the use of R_{ei} is unnecessary; however, the lighting class on the surrounds should be checked to verify that it meets the requirements of BS EN 13201-2:2015 in full.

Lighting designs for traffic routes should meet the R_{ei} requirements of the selected class as defined in BS EN 13201-2:2015 and calculated according to the method in BS EN 13201-3.

When a minimum requirement is made for the edge illuminance ratio of a lighting installation, each of the separate values should meet the requirement.

NOTE Separate values apply for each of the two sides of a carriageway, and for each of the two sides of both carriageways of a dual carriageway.

5.3.2 Subsidiary roads, including pedestrian areas, footpaths and cycle tracks

5.3.2.1 General

The road lighting should enable pedestrians and cyclists to discern obstacles or other hazards in their path and to be aware of the movements and/or intent of other pedestrians and cyclists in the proximity. To achieve this, the design should take account of lighting on horizontal surfaces, as well as the control of glare and the colour rendering. Environmental issues should also be taken into account.

NOTE 1 The lighting of such roads can provide some guidance and increased peripheral vision for motorists, but is unlikely to be sufficient for revealing objects on the road without headlights.

NOTE 2 The visual tasks for pedestrians are described in [5.1.2](#).

5.3.2.2 Lighting of horizontal surfaces

The horizontal illuminance should meet the appropriate class in BS EN 13201-2:2015.

NOTE Horizontal illuminance is measured at ground level in terms of average and minimum values, and applies to the whole of the used surface, which usually comprises the footways and the carriageway surface, unless the carriageway is treated separately under the provisions for motorized traffic in [Clause 7](#).

5.3.2.3 Lighting of vertical surfaces

COMMENTARY ON 5.3.2.3

Adequate lighting of vertical surfaces is necessary for visual recognition. The quantification of this presents a difficulty because of the multiplicity of planes at each measurement point which have to be taken into account. BS EN 13201-2:2015 defines lighting classes for vertical illuminance.

In cases where enhanced visual recognition is required on vertical surfaces, a lighting class for vertical illuminance should be selected from BS EN 13201-2:2015 and calculated in accordance with BS EN 13201-3.

5.3.2.4 Control of glare in subsidiary roads

COMMENTARY ON 5.3.2.4

The control of discomfort and disability glare is not as critical for pedestrians as for motorists, because speed of movement is much lower, giving a greater reaction time. Methods for quantifying and controlling glare in pedestrian, cycling and low speed traffic areas are given in BS EN 13201-2:2015.

For residential and subsidiary roads, one of the following two methods of calculating the effect of glare should be used:

- threshold increment (f_{TI}) should be calculated in the roadway programme and should meet the limits as specified in BS EN 13201-2:2015, Table C.1 and Table C.2; or
NOTE 1 The arrangement of the luminaire (staggered or single-sided) can have an impact on the f_{TI}
NOTE 2 The f_{TI} option is the preferred option.
- if the f_{TI} option is not available, the luminous intensity classes should be used to calculate the output direct from luminaires. Direct glare from luminaires should meet an appropriate class as specified in BS EN 13201-2:2015, Table A.1, to provide adequate control of glare.

NOTE 3 Further guidance on lighting of subsidiary roads is given in the Commentary on [7.2](#).

NOTE 4 Further recommendations for lighting of residential and minor roads are given in [7.2.1](#).

6 Practical design considerations

6.1 Siting of lighting columns

6.1.1 General

COMMENTARY ON 6.1.1

One of the most difficult aspects of a lighting design is in the siting of lighting columns. Each street is different and presents differing challenges. Particularly on an established street, there are many topographical and physical features which can determine both suitable and unsuitable locations.

Intersections, pedestrian crossings, bends, gradients and crests of hills occur frequently, and their particular lighting might require compromise. In addition, there are constraints on the siting of lighting columns caused by overground and underground obstructions, as well as the need to consider the effect of road lighting equipment on the access to properties for occupation and maintenance.

Prior to finalizing lighting column locations, distributors' and statutory undertakers' service/plant drawings should be examined, and a site survey should be carried out by competent persons, to verify that the designed location is suitable. Factors that should be taken into account include, but are not limited to, the following:

- a) overhead power lines or other obstruction (see [6.3.4](#));
- b) underground power lines or other utility services or obstructions;
- c) trees, including potential growth and accounting for summer foliage (see [6.1.2](#));
- d) dropped kerbs;
- e) preference for alignment with property boundaries;
- f) need to minimize obtrusive light (see [4.2.3](#)), especially where it could affect residential property windows;
- g) views from residential properties;
- h) potential for vehicle impacts (see [6.1.3](#));
- i) provision of road restraint systems or use of passively safe lighting columns (see [6.1.4](#));
- j) accessibility for maintenance;
- k) vehicle charging; and
- l) active transport and active transport networks. Cyclists and pedestrians should not be inconvenienced by the siting of columns primarily provided for the benefit of motorized road users.

NOTE 1 Issues can be unnecessarily created when the designer has not appreciated the high level of use on such paths.

NOTE 2 Further guidance is given in HSE publication HSG 47 [32].

NOTE 3 Minor adjustments might be necessary for practical or aesthetic reasons, with care taken to ensure that these do not significantly affect the photometric performance of the installation.

NOTE 4 In some circumstances, public lights and associated equipment can be fixed to private buildings or sited on private land.

Lighting columns adjacent to bridges should be sited such that light from the luminaires is not obstructed and does not cause nuisance or glare to road users approaching or crossing the bridge. Lighting columns should if possible be sited such as not to interfere with the view of buildings or monuments of architectural interest, or with scenic views.

6.1.2 Effect of trees

Lighting columns when first installed should be sited such as not to require substantial cutting back of trees, taking into account the fully mature spread of the tree.

NOTE 1 In tree-lined roads, lower mounting heights than usual may be used to bring luminaires below the tree canopy.

In new streets where trees are to be planted, the lighting should be designed in consultation with the landscape architects and/or by taking into account the landscaping plan or the tree schedule.

NOTE 2 Careful siting of trees and luminaires can help to minimize interference with the performance and operation of the lighting by the foliage.

Lighting columns in the vicinity of trees should be sited such as to minimize any difficulties, including:

- a) incorrect photocell operation;
- b) impaired maintenance access; and
- c) damage to luminaire, column, foundation and electrical cables.

NOTE 3 Recommendations for trees in relation to design, construction and demolition, including some guidance relating to lighting schemes, are given in [BS 5837](#).

6.1.3 Lighting columns as hazards

COMMENTARY ON 6.1.3

Many accidents involve a motorized vehicle leaving the carriageway, and if the vehicle collides with a lighting column, the severity of the injuries to the occupants might be increased. The number of such collisions is likely to decrease with increased clearance of the lighting columns from the edge of the carriageway.

The recommended minimum clearances according to the design speed of the road given in [Table 1](#) should be achieved wherever practicable. The set-back of lighting columns should be sufficient to allow the free passage of all people on any footway.

NOTE 1 Blind and partially sighted people, people with limited mobility, wheelchair users and people pushing prams need additional space.

Table 1 — Recommended minimum clearances from edge of carriageway to face of lighting column

Speed limit	Horizontal clearance
mph	m
≤ 30	0.8
40 to 50	1.0
60 to 70	1.5

In situations such as motorways, where lighting columns are often protected by safety barriers, the set-back should be determined by the design requirements of the safety barrier.

In some situations, where it is necessary to place columns at less than the recommended minimum clearances, a project-specific risk assessment should be carried out.

The set-back should also take into account the recommendations given in [6.1.4](#).

The lowest point of overhang of luminaires or bracket arms that overhang the carriageway, or are within the respective horizontal clearances given in [Table 1](#), should have a vertical clearance of at least 5.7 m from the level of the carriageway surface. Therefore, no part of a lighting column or luminaire should protrude over the carriageway of a public highway open to vehicular traffic (or be within the respective horizontal clearances given in [Table 1](#)) if less than 5.7 m in height, unless a height restriction applies. Similarly, the height clearance over a pedestrian-only area of a public highway not accessible to vehicular traffic should be not less than 2.1 m.

NOTE 2 Where there are cyclists or horse-riders, or in areas with high levels of vandalism, a greater height is likely to be necessary.

In residential roads having footways of width 3 m or less, and situated directly adjacent to the carriageway, lighting columns should, where practicable, be sited at the rear of the footway, i.e. away from the carriageway.