
# Gatwick Airport Northern Runway Project

**Book 5**

## Environmental Statement
## Appendix 5.2.2: Operational Lighting Framework

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# 1 Purpose

## 1.1 Summary

1.1.1 This document forms **ES Appendix 5.2.2** prepared on behalf of Gatwick Airport Limited (GAL). This document sets out the Operational Lighting Framework for the operation of the Project. This Framework provides an overarching creative and technical framework by which the true potential of the the Project can be realised, creating a consistent, welcoming, sustainable and safe environment after dark.

1.1.2 Optimising value with respect to capital and running costs is a key element of the Framework, in relation to project life, energy costs, hours of use, labour rates and lighting equipment replacement frequency.

1.1.3 Similarly, the Framework considers its role in supporting sustainable development, with measures to minimise environmental impact wherever possible. For example, the Institute of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light have been referenced in the Framework to minimise potential adverse impacts on local biodiversity, local area residents and users of the space.

1.1.4 Consideration is given to the UN Sustainable Development Goals in the context of Gatwick Airport's second Decade of Change document.

1.1.5 Finally, consideration has been given to the types of lighting equipment being selected as part of a future lighting design, as well as its mounting location, materiality, durability and the light source utilised, to ensure minimal disruption to day and night-time activities when the installation needs maintenance or replacement.

1.1.6 This Framework considers the visual requirements for each type of space or facility and provides guidance not only on providing a sense of safety and security, but also to ensure that it is done in a sustainable manner.

## 1.2 Purpose of report

1.2.1 The purpose of this report is to collate the high-level criteria and guidance relating to the provision of exterior lighting for the Project and to provide transparency during the design and operation phase to ensure the lighting design intent is understood and implemented during the operational phase of the Project.

1.2.2 This document is intended to describe a Framework for lighting for the Project which outlines key considerations for use when developing the lighting design.

## 1.3 Cross References

1.3.1 This Framework refers to other design codes, technical specifications and standards. A table of cross references is provided in the Technical Annex. The Technical Annex also contains a summary of key performance requirements from industry recognised design standards and guidance documents. These documents are recommended for consideration when developing the design solutions.

# 2 Context

## 2.1 Location

2.1.1 Gatwick Airport is located on the border of Surrey County and West Sussex County, between the towns of Horley to the north and Crawley to the south.

2.1.2 Figure 1 shows the existing site including all airport associated amenities on an operational and commercial basis.

## 2.2 Topography

2.2.1 Runways are located to the south of the site and are at a similar level to the rest of the site.

2.2.2 Terminal buildings are located to the north-east of the site, with the majority of hangars on the northern half of site.

2.2.3 Car parks are located around the Project site, with the largest to the north, east and south-east.

## 2.3 Land use

2.3.1 The land to the north and south mainly comprises residential urban areas.

2.3.2 The remaining site perimeter mainly comprises rural vales, farmland and woodland.

2.3.3 The proposed works introduce additional office, hotel, and car park provisions to the north, east, and southwest, and include various junction improvement works to the road links north of the Project site.

## 2.4 Landscape and Heritage

2.4.1 There are no local or national level landscape designations within or adjacent to the Project site. The High Weald AONB lies approximately 3 km to the south-east.

2.4.2 The existing airport is a visible feature within views from the surrounding areas including the Sussex Border Path and Cycle Route 21 (which run through the Project site) and in distant views from Norwood Hill to the north-west, Turners Hill to the south-east and Tilgate Park to the south. Further details can be found in Section 6.2.

2.4.3 The site of Thunderfield Castle, located to the north-east, and a site in Tinsley Green to the south-east are the only scheduled monuments in the vicinity of the Project site, though neither has direct visibility to the Project site.

2.4.4 The River Mole and Crawter's Brook flow from south to north, passing beneath the runway in a culvert. Gatwick Stream flows alongside the railway line, joining the River Mole to the north of the airport.

2.4.5 Highways changes to the A23 near Riverside Park will bring the road closer to Gatwick Stream.

## 2.5 Surface Access

2.5.1 The airport is located adjacent to the M23 motorway, approximately 25 miles south of central London, and less than 10 minutes from the M25. Junction 9 of the M23 motorway is located 2 miles east of the site, serving as a primary transport link.

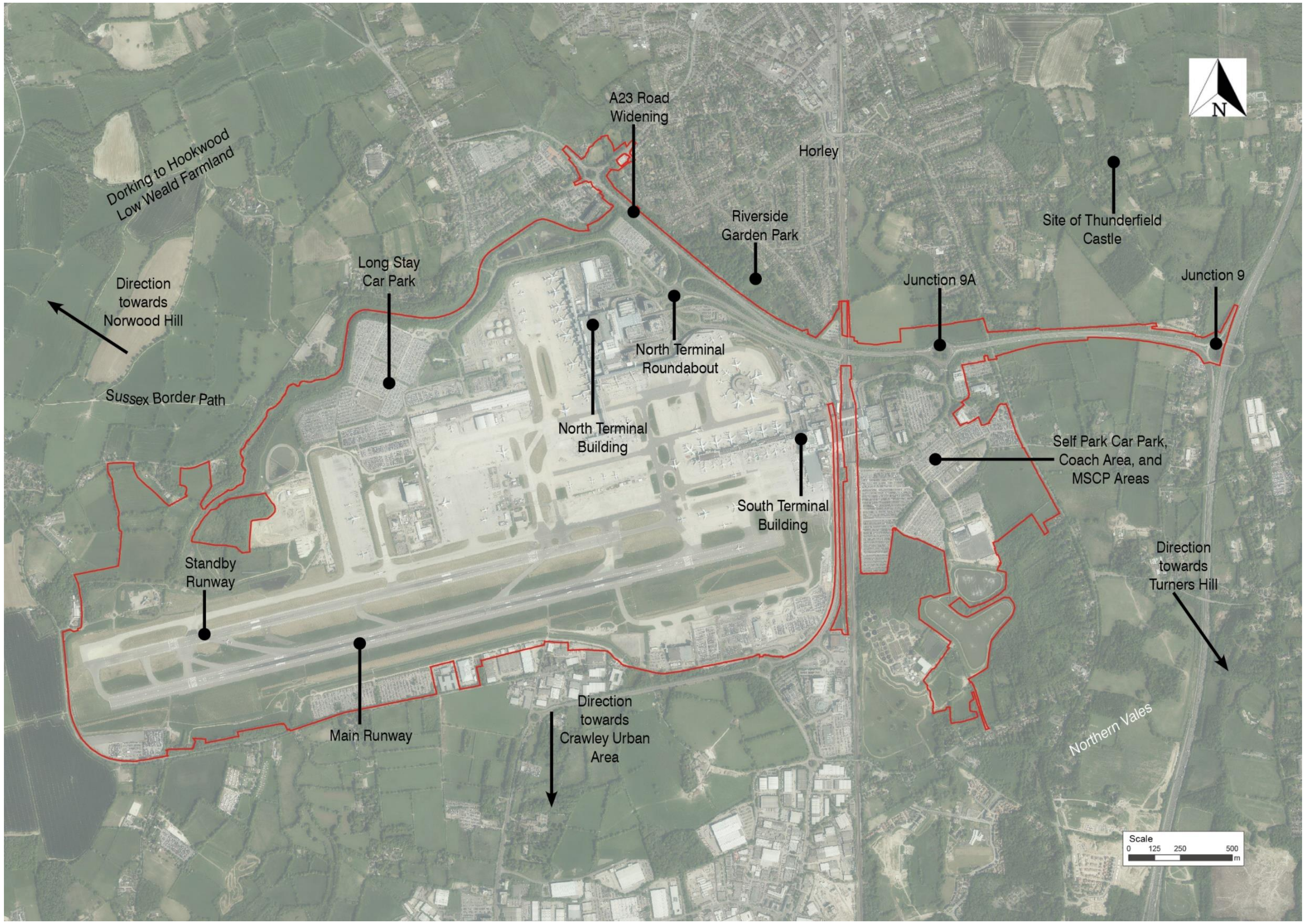
2.5.2 Airport Way connects the M23 spur to the airport (via Junction 9A and the North and South Terminal Roundabouts) and the A23.

2.5.3 Gatwick Airport has its own mainline railway station with direct services to 129 other stations each day and up to 26 train departures an hour.

2.5.4 There is a designated cycling and walking route serving Gatwick, Crawley and Horley, forming part of National Cycling Route 21 (London to Brighton), which offers a safe and sustainable travel option, particularly for airport-based staff.

2.5.5 Additional provisions include drop-off and valet facilities, waiting areas for taxis and coaches, bus and coach stations, cycling facilities and pedestrian routes.

**Figure 1: Existing site plan**



## 2.6 The Project - Summary

2.6.1 The Project facilitates the use of the Northern Runway in coordination with the main existing runway, including improvements to the supporting infrastructure and road links.

2.6.2 It is anticipated that by 2047 (the long-term forecast year) this could increase Gatwick's passenger throughput to approximately 80.2 million passengers per annum (mppa), compared to a maximum potential passenger throughput based on existing facilities (with future baseline projects) of 67.2 mppa. This represents an anticipated increase in capacity of approximately 13 mppa.

2.6.3 **ES Figure 5.2.1a** and **Figure 5.2.1b** (Doc Ref. 5.1) show the scope of works associated with the Project.

2.6.4 The High Weald AONB lies approximately 3 km to the south-east.

2.6.5 The project is described in detail the **ES Chapter 5: Project Description** (Doc Ref. 5.1) and the key works are summarised below, refer also to **ES Figure 5.2.1a** and **ES Figure 5.2.1b** (Doc Ref. 5.1).

2.6.6 Amendments to the existing northern runway including repositioning its centreline 12 metres further north to enable dual runway operations.

- Reconfiguration of taxiways.
- Pier and stand alterations (including a proposed new pier).
- Reconfiguration of other airfield facilities.
- Extensions to the existing airport terminals (north and south).
- Provision of additional hotel and office space.
- Provision of reconfigured car parking, including new car parks.
- Surface access (including highway) improvements.
- Demolition and relocation of Central Area Recycling Enclosure (CARE) facility.
- Water treatment facilities.
- Reconfiguration of existing utilities, including surface water, foul drainage and power.
- Landscape/ecological planting and environmental mitigation (refer also to Figure 5.2.1g).

# 3 The Lighting Framework

## 3.1 Basis of Design

3.1.1 The exterior lighting vision for the Project at Gatwick Airport aims to define the experience and environment through which the staff and passengers will move, whether they are at the start or the end of their journey or going to work.

3.1.2 The lighting on the airport and surface access network are regulated. This Framework will only apply to the Project to the extent that it complies with the regulatory regime and best practice in place at the time.

3.1.3 The operation of the airfield is of critical importance. All lighting schemes proposed or developed as a result of this Framework will need to be compliant with the relevant Aviation Standards (see Table A1. 1), be proportional and not at the expense of the safe operation of the airfield. Refer to Sections 17 and 18

## 3.2 Design Objectives

3.2.1 This Framework for the use of light in the Project and the wider Gatwick Airport proposes five elements:

- Create an inclusive, comfortable environment and passenger experience that is positively memorable.
- Aid wayfinding and help passengers on their journey to, through and from the airport.
- Create continuity and coherence between spaces.
- Conserve of energy, avoid waste.
- Minimise obtrusive light and its impact on neighbouring receptors.
- Support safety and security for all airport users.

3.2.2 A primary function of the lighting will be to provide appropriate levels of illumination to enable people to see in the absence of natural light. The extent to which people need to see after dark will vary from area to area, with some requiring high levels of visual acuity whilst others may require an understanding of scale and the ability to identify a safe passage through a space.

3.2.3 This Framework provides information which will help inform the lighting designs for each project. Consideration will be given to the manner in which each space will be used after dark, as well as its relationship to the existing spaces adjoining it to provide a coherent visual scene.

## 3.3 Legibility and Wayfinding

3.3.1 During daylight hours people use elements of the man-made and natural environments to build a 'mental map' of an area. This helps them to orientate themselves, navigate from place to place and gain an understanding of the scale and nature of a space and its relationship to the wider context.

3.3.2 After dark many of these '*visual cues'* disappear and it is largely left to artificial light and natural darkness to inform the interpretation of a space and its relationship to those around it.

3.3.3 The most visible elements in a nocturnal landscape can tend to take on a more dominant role in a person's '*mental map'*. The most visually prominent elements are generally those that are perceived as being the brightest, although other factors such as colour, scale, animation and personal association also play important roles.

3.3.4 By developing a considered and consistent lighting approach to the key navigational tools such as roads and pedestrian paths, light will play a crucial role in supporting legibility and accessibility and in reinforcing specific visual and physical connections across the airport.

## 3.4 Accessibility

3.4.1 The design of artificial light should consider the various needs of the passengers and staff of the airport after dark. This includes those with special needs and the elderly. Considerations to support a highly accessible after-dark environment should include: avoiding excessive contrasts, avoiding direct and reflected sources of glare, avoiding shiny, mirror-like surfaces at pedestrian level, controlling shadow and limiting potentially confusing upward lighting. Refer also to Section 5.

## 3.5 Energy and Costs

3.5.1 In July 2019 Crawley Borough Council declared a climate emergency and made a commitment to reduce emissions from its activities by at least 45% by 2030 and achieve net zero carbon by 2050. The relevant planning policies in its Local Plan to 2015-2030 (Crawley Borough Council, 2015) for new developments related to in this Operational Lighting Framework is Policy ENV6: Sustainable Design and Construction which sets the requirement for new non-domestic buildings to achieve BREEAM Excellent, where technically and financially viable, together with a range of other requirements relating to using renewable and low carbon energy technologies, improving existing buildings and establishing district energy networks within heat priority areas or near potential sources of waste energy, with futureproofing developments for new connections.

3.5.2 In this context, this Framework propsoses the following are considered when developing the lighting design:

- Minimising the impact of obtrusive light (BREEAM Pol 04 Reduction of night time light pollution).
- Energy efficiency in design and operation (e.g. LED lighting, circularity), Efficiency of energy supply (e.g. smart lighting controls), renewable energy integrated into the design of integrated of the new facilities. (e.g. coordination of lighting with the car park canopy PV arrays).

3.5.3 Energy is a very important element in the operation and maintenance of any building. As a consequence, equipment and the control of lighting levels and thus the energy consumption will be considered in the design. Where practicable, lighting should respond to the presence or absence of staff and passengers, reducing the light output when a space is empty.

3.5.4 The choice of whether to provide lighting will be a key decision in the design process to limit unnecessary energy use. For example, rarely accessed roofs of buildings may not require lighting as preventative maintenance can be planned for daytime, with temporary lighting provided to carry out emergency repairs. This could avoid lighting being accidentally left energised.

3.5.5 Lighting designs will give consideration to optimised value with respect to both capital and running costs. Whole life-cycle costs will be considered in relation to project life, energy costs, hours of use, labour rates and light source and control gear replacement periods. Specific energy targets will vary by project; consideration shall be given to the Gatwick's own technical standards and the current Second Decade of Change or equivalent strategy for the long-term ambition of Gatwick.

## 3.6 Sensitive Receptors

3.6.1 Lighting designs will consider and mitigate, where practicable and safe to do so, potential impact towards relevant sensitive receptors, such as residents, heritage sites and local flora and fauna. Obtrusive light (including flicker, glare, light intrusion and sky glow) will be considered in the desgn process by reference to recommendations of ILP Guidance Notes GN01 (Reduction of Obtrusive Light) and GN08 (Bats and Artificial Lighting). Consultation with an ecologist is recommended as part of the lighting design development. Refer to Section 6.

3.6.2 Further detail on the key objectives and measures for minimising obtrusive light from both lighting equipment and illuminated signage/advertising is described in Section 7.

## 3.7 Safety and Security

3.7.1 Artificial light consider the provision of a safe environment for all users at all times. This includes positively defining potential hazards such as steps and ramps and areas where pedestrians encounter moving vehicles, at for example, pedestrian crossings. Such areas may be defined after dark through passive techniques, such as landscape materials with appropriately contrasting reflectance, as well as through active illumination; perhaps using focused light and increased intensity.

3.7.2 Lighting deisgn will consider the provison of an overall sense of security throughout the airport, including supporting both active surveillance (e.g. CCTV) if/when required and modelling of people and surfaces should be provided where required. Where the CCTV surveillance is supported by infra-red technology, the requirement for additional light in the visible spectrum may not always be necessary. The security consultants will be consulted through the design development.

3.7.3 Perceptions of safety and security are not necessarily dependant on providing high intensities of light and indeed, in some cases, low levels of light can be important in maintaining a sense of security and privacy. Creating an environment that feels secure will largely be dependent on ensuring that spaces are legible, appear well maintained, give due consideration to inclusivity, and do not inhibit adaptation.Refer also to Section 5 for further information.

## 3.8 Maintenance

3.8.1 As part of the development of individual lighting schemes, consideration will be given to the types of lighting equipment and light sources selected as well as their mounting locations, materials and the longevity of their finishes. This will ensure minimal disruption to day and night-time activities when the installation needs maintenance or replacement.

3.8.2 A reduced portfolio of luminaires and light sources will also help to simplify maintenance regimes. Maintenance issues will need to be addressed in terms of cost effectiveness and maintenance programmes. The ease of maintenance (e.g. tool free servicing) and ease of cleaning (no special product or tools) will also be considered when selecting equipment as both are key factors in extending the lifetime of a product.

3.8.3 Equipment will be selected using the principles identified by the the Construction (Design and Management) Regulations[1] to reduce the risks inherent in maintenance activities. For example, base hinged lighting columns and high masts may be considered to enable ground level luminaire maintenance. However, this may need to be reviewed on a case-by-case basis, for example there may be no space in which to lower a column. Where possible, LED drivers may be remote mounted in an accessible location to minimise the need for high level access (for example in the base of the column).

3.8.4 Lighting control systems are recommended to provide remote monitoring of individual luminaires to report lamp-life and lamp failure to further ease maintenance regimes. Additional details on lighting control considerations are provided in Section 4.

## 3.9 Light Source

3.9.1 LED technology is proposed to be the light source of choice for applications across the Project site. The existing Gatwick standards propose a colour temperature of 4,000K (Figure 2 for reference). However, the impact of full-spectrum white lighting on the nocturnal environment is becoming better understood and alternative specifications may be considered to minimise obtrusive lighting effects on both humans/wildlife and biodiversity.

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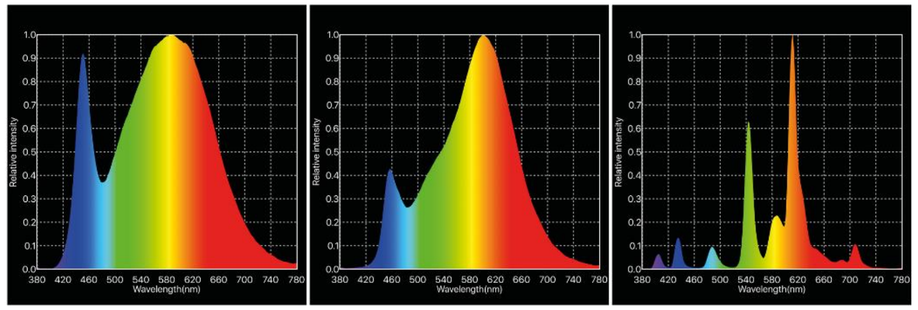
[1] https://www.hse.gov.uk/construction/cdm/2015/index.htm

**Figure 2: Indicative presentation of colour temperature**


3.9.2 In particular, there is strong evidence that there are significant advantages reducing the presence of blue spectral content with minimised wavelengths below 500nm (Figure 3). Refer to ILP Guidance Note GN08: Bats and Artificial Lighting for further details.

**Figure 3: Typical, relative colour spectrum of LED light sources (left to right 4,000K, 3,000K, 2,300K)**



3.9.3 Where nocturnal ecological considerations or human factors take precedence, warmer colour temperatures (<2,700K - Figure 2 for reference) will be considered in line with the available technology and research at the time of design development.

3.9.4 Furthermore, a wider range of LED lighting and control technology is increasingly available, and may be standard practice by the time the project design phase begins. The following concepts will be considered as measures for mitigating obtrsuive light, such as:

- Monochromatic LED light (Figure 4) which has been already been used on the Copenhagen Cycle Highway[2] to minimise impact on bat habitats and foraging routes.
- Lower/warmer colour temperatures (2,200K) for non-vehicular routes (e.g. Figure 4 – Copenhagen Cycle Highway[2]).
- Dynamic colour temperature variations using smart controls that respond to time scheduling or presence detection. Such systems may be appropriate on routes which require constant illumination, but are flanked by sensitive receptors where blue wavelength light should be limited. See example application in Figure 5.

3.9.5 The application of dynamic systems as described in 3.9.4 will need to be designed with future use of the external space in mind. It is important that dynamic controls remain configurable by the end user in the future; indeed modern Central Management Systems (CMS, See Section 4) are designed with this flexibility in mind. Furthermore, the frequency and rate of variation will need to be commissioned so that it does not appear distracting to road users.

**Figure 4: Monochromatic 'red' light for mitigation © Rune Brandt Hermannsson**

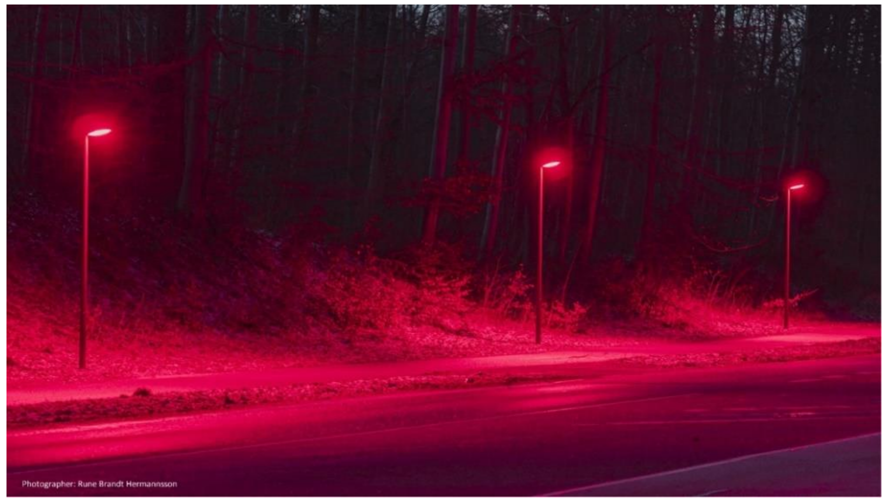
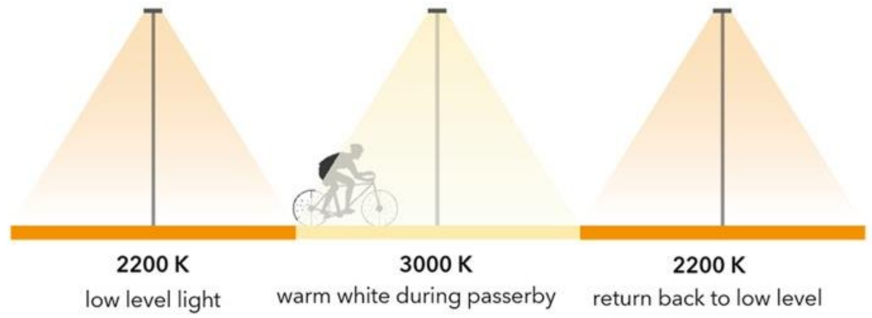


**Figure 5: Dynamic lighting solutions to mitigate environmental impact**




3.9.6 These lighting developments may be considered, in collaboration with the project ecologist, when developing the design to better support biodiversity net gain objectives and to reduce the impact of obtrusive light effects.

3.9.7 In discrete locations, such as pedestrian crossings 4,000K light sources can be used to make these task areas more visually distinctive compared to 3,000K surroundings, and therefore enhance the safety of the crossing. Refer to ILP TR12 Lighting of Pedestrian Crossings for further information.

3.9.8 Where appropriate, a colour rendering index Ra greater than 80, in accordance with the international colour code, will be considered for white-light light sources. This is of particular importance in areas with higher levels of illumination, where improved visual quality and accurate rendition of skin tones and signage etc. can facilitate tasks and human interactions and help to improve the user journey.

3.9.9 The longevity of any light source has significant impact on the visual performance of the lighting scheme as well as the frequency of maintenance (and additional risk such as working at height), operational costs, replacement and environmental impact due to the embodied carbon and processes/chemicals used in manufacture. Therefore, in developing the design, the longevity of the light sources and overall lighting scheme will be considered in terms of capital cost verses operational cost and will also consider the embodied carbon in terms of circularity (refer to 4.11), high lumen maintenance and lifetime basis credentials.

3.9.10 LED light sources can be susceptible to high-frequency flicker (Figure 7) and sensitivity varies between humans and different

[2] 1 https://issuu.com/theilp/docs/lighting_journal_-_march_v2?e=40820695/91386832

species of ecological receptors. Flicker effects may not always obvious to the human eye but have the potential to exert harmful effects on health. The various adverse effects of flicker include eye strain, fatigue, headache, migraine, blurred vision as well as photo epilepsy in sensitive individuals.

3.9.11 In the external areas, the vehicular or pedestrian users are unlikely to be present for long enough periods that these health effects will materialise. However, there is growing evidence of a negative, long-term impact on nocturnal wildlife in the vicinity of flickering light sources[3].

3.9.12 A specification to minimise flicker will be considered when selecting the luminaires for this Project. Visible blinking, flickering or strobing may be considered unacceptable at full lumen output, nor at any dimming level, should dimming be specified.

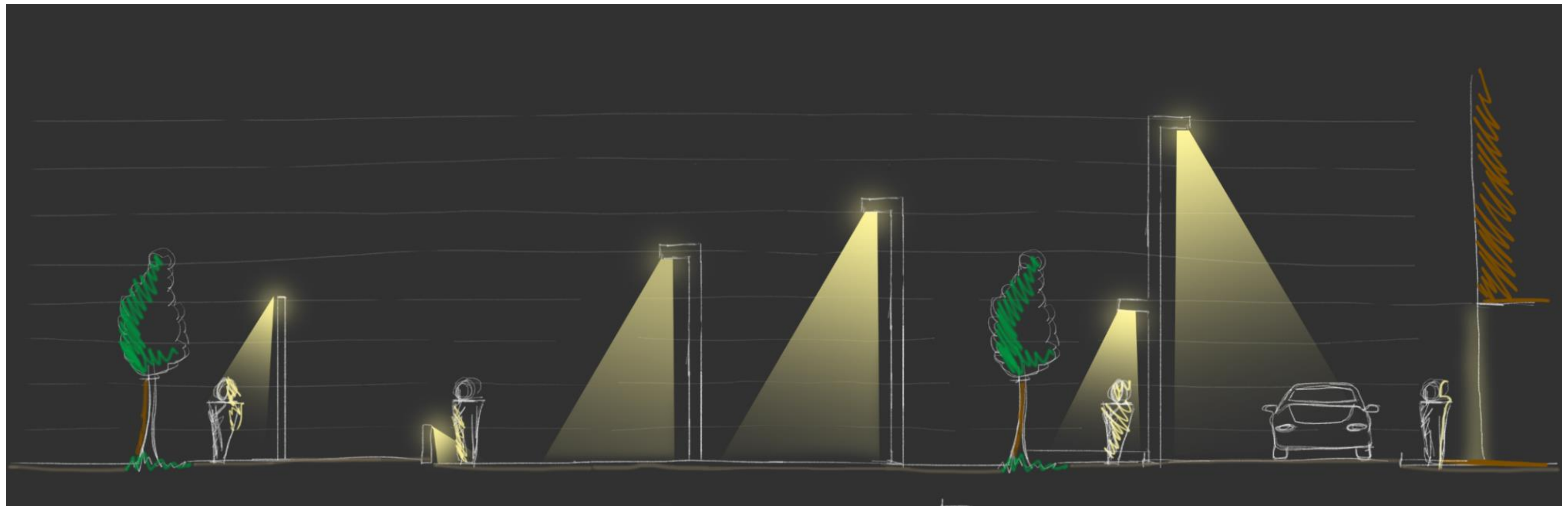
3.9.13 Many drivers available on the market are able to dim down to 1% output while maintaining Flicker Frequency above 500Hz. The requirements of IEEE 1789–2015 will be considered for LED drivers, where unless specified otherwise drivers will aim to limit the other biological effects of flicker.

3.9.14 Consultation with an ecologist is an essential activity when selecting appropriate light sources through the development of the lighting design..

3.9.15 In summary, the following luminaire and light source performance characteristics would be applied to the external lighting scheme where appropriate:

- Lifetime basis L90B10 >100,000hrs (lumen output is ≥90% with no more than 10% failing to meeting this performance after 100,000 hours).
- Energy efficiency, efficacy >120 luminaire lumens/Watt
- Colour rendering >80CRI is recommended for accurate replication of colour and skin tones etc.
- Colour consistency is an important factor, and noticeable colour shift should be avoided over time.
- Minimised flicker: avoid visible blinking, flickering or strobing effects i.e. Flicker Factor should be less than 5% (Figure 8).
- Minimum protection rating: IP65 and IK09 is preferred.
- A ULR of zero is preferred for all luminaires and mounted with zero tilt ‘horizontal cut-off’.
- Where connected to a CMS, luminaires will require NEMA/Zhaga sockets, or similar, as appropriate for the connection to the CMS (see also Section 4).
- Where possible, all road/car park lighting will be selected from one luminaire manufacturer family (Figure 6), for visual consistency, to facilitate maintenance and to reduce the number of spares required for storage.
- As a benchmark, a score above 2.0 in the TM66 CEAM-Make assessment (See Section 3.11) is preferred.
- Consideration shall be given to the use of marine grade, corrosion resistant Class 5 (EN ISO 9223). galvanic protection to screws, accessories and fixings to enhance the longevity of lighting products.
- Die cast aluminium housings are preferred and it is recommended that they are be provided with bird spikes.
- It is preferred that all luminaires colour match where possible for visual consistency across the whole project.
- Constant Light Output (CLO) technology is preferred (Section 4.3).

**Figure 6: Family hierarchy of luminaires**



[3] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4038456/

**Figure 7: Representation of flicker effect from and LED light source**

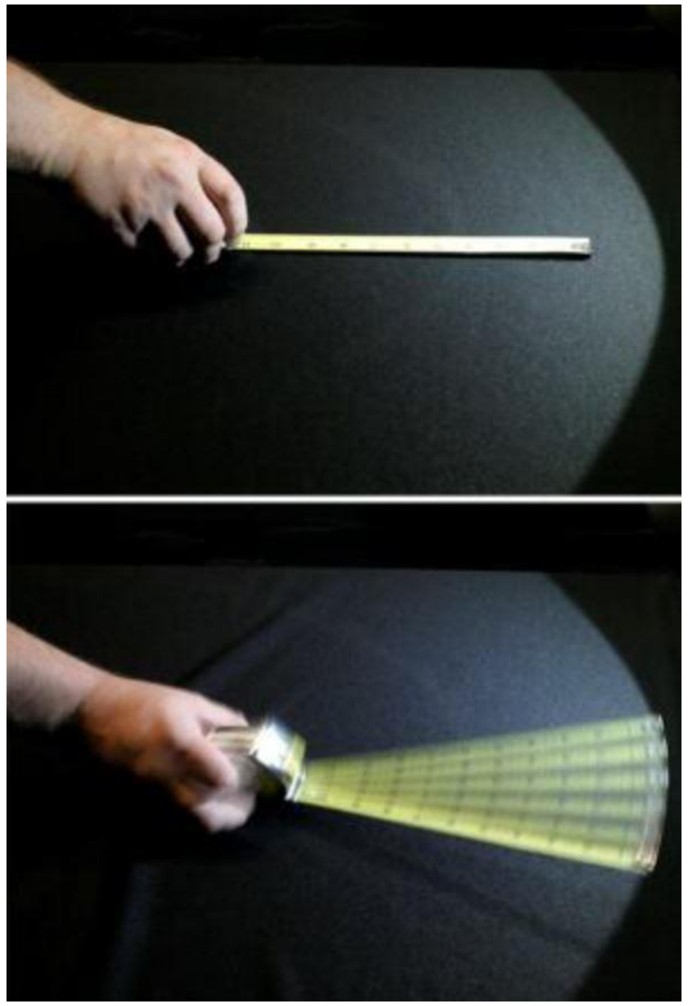
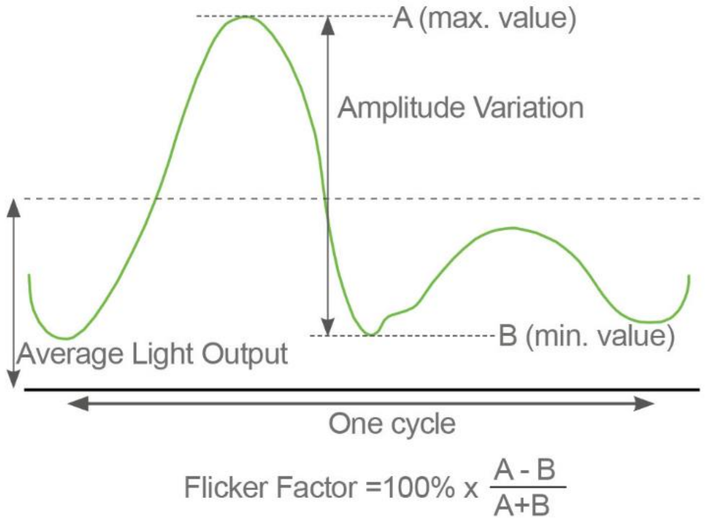


**Figure 8: Flicker Factor metric**



## 3.10 Decade of Change

3.10.1 The second Decade of Change document sets out a sustainability policy for the airport in the form of ten renewed goals (i.e., Local Economy, Opportunity and Accessibility, Workplace Safety, Local Communities, Noise, Airport Emissions, Aircraft and Surface Access Emissions, Water, Zero Waste and Biodiversity).

3.10.2 This Framework has been developed to respond to these goals. Examples of this are illustrated in Figure 9, with cross references to the relevant sections of this Framework.

3.10.3 The United Nations Sustainable Development Goals currently comprise 17 goals and related targets for 2030 to address the shared global challenges of poverty, inequality, climate, protecting the natural environment, prosperity, peace and justice. The SDGs are Government commitments with business having a vital role as partners for progress. Figure 9 indicates how the lighting response to the Decade of Change goals aligns with several of the current SDG themes and targets.

## 3.11 Sustainable Equipment Selection Principles

3.11.1 Sustainable design extends beyond minimising energy consumption. Attention is also focused on the whole life cycle of lighting equipment, to reduce its envrionmental impact. Therefore, when developing lighting schemes, consideration will also be given to other factors, such as:

- Materials and manufacturing processes.
- Associated package and transportion impact.
- Maintenance, serviceability and longevity.
- Energy performance and recording.
- End of life, reuse and/or recyclability.

3.11.2 This is further illustrated in Figure 10.

**Figure 9: Decade of Change**

3.11.3 To aid the designer when developing lighting schemes, the following questions can be considered:

**Certification**

- Is the product Cradle to Cradle Certified™?
- Can an Environmental Product Declaration (EPD), Product Environment Profile (PEP) or any Life Cycle Assessment (LCA) for the product be provided?
- Can information on Global Warming Potential (GWP) required for Life Cycle Assessment (LCA) be provided?

**Materials and Manufacturing**

- Where is it manufactured/assembled?
- What proportion of re-used and or recycled materials are used in manufacturing?
- What proportion of the waste material from the manufacturing that is reused?
- What proportion of the energy used in the manufacturing from renewable sources?

**Packaging and Delivery**

- Is the product packaging reusable, recyclable or compostable?
- Does the supplier retrieve packing materials from site after delivery?

**Flexibility and Maintenance**

- Is it possible to change the optics and accessories to allow for flexibility for future uses?
- Can luminaire LED engine and driver be replaced?
- Can LED engine and driver gear be re-fitted in situ or only in factory?
- What needs to be replaced within the LED engine to maintain equivalent performance?
- What tools are needed to service the luminaire?
- Is photometric and colour performance of replacement LEDs guaranteed and what is the validity period?
- Is there a spares regime for this luminaire that will allow replacement of components over its life?

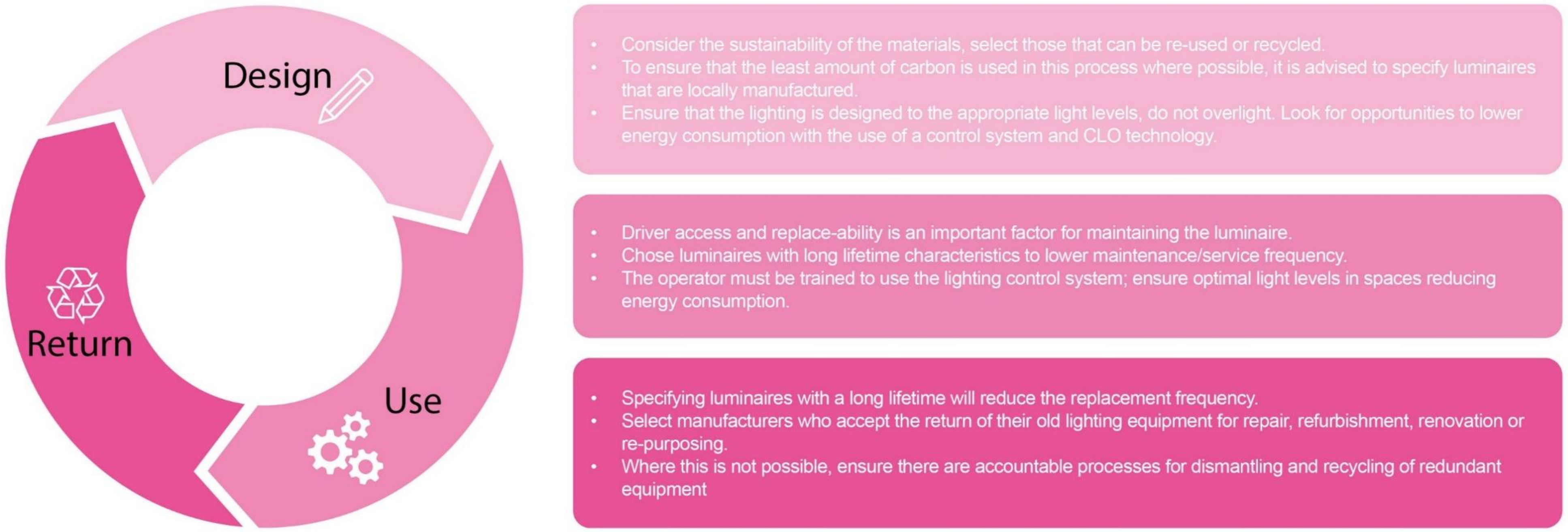
**Monitoring**

- Does luminaire record the operating / burning hours electronically?
- Does luminaire include a 'luminaire logbook' to prove year of manufacture, operating history and/or performance data?
- Does luminaire have the means to update firmware and logging?

**End-of-life**

- Can the luminaire be dismantled (and reassembled)?
- Can all materials used in the luminaire manufacture be recycled and returned to the materials reservoir?

**Figure 10: Operational Lighting Framework and circularity considerations**



# 4 Lighting Control

## 4.1 System Considerations

4.1.1 Lighting controls are to be considered as part of this Framework, to provide benefits ranging from the reduction of lighting energy consumptions to self reporting and testing of lighting equipment to streamline maintenance activities.

4.1.2 Lighting controls will help with the functional and operational requirements of a lighting scheme, to provide feedback on energy use and predict maintenance. Such features ensure the longevity of the proposals and de-risk the potential for early failure and neglect of the lighting system.

4.1.3 In addition to the documents listed in Annex A, existing Gatwick Technical Standard 20000-XX-Q-XXX-STD-000050 can be referred to (and reviewed/amended according to ongoing advancements in lighting control technology) in the production of the lighting control system designs.

4.1.4 A Telensa CMS (Central Management System) is currently being used at Gatwick Airport and it is assumed this will roll-out across the Project.

4.1.5 A CMS type system will enable a '*right light, in the right place, at the right time approach'*. This means the lighting can align with the usage and seasonality of the site; effective lighting controls will dynamically adapt the lighting to peak/off-peak usage and daily cycles of activity in the area.

4.1.6 Consideration will be given to provison of the following functionality by the CMS:

- Significant improvements in terms of reduced operational costs and efficiency.
- Improved lighting control for all areas, including monitoring and logging, 'on' alerts, time scheduling, fault reporting, maintenance scheduling, occupancy detection and optimised balance of artificial light with the day/night cycle.
- Reduce downtime, points of failure and operational inefficiencies.
- Adaptability and flexibility in the operation of the car parks. Respond to the daily peak/off-peak and seasonal usage variations dynamically adapt the lighting output in response to occupancy levels in each car park. In the future this could also respond to colour temperature variation as described in Section 3.9.
- All luminaires are individually addressable and can be interrogated to report back operational status and faults. In addition, this addressability will enable group and zonal control with scheduling per day and per zone via a 24hr/365-day calendar.
- Modern CMS systems, via the "Internet of Things" (IoT) or otherwise, can accommodate additonal environmental sensor devices (e.g. presence detection or noise sensors)to collect data for analysis or for use in influencing the lighting performance.
- Occupancy sensing devices (mounted on the lighting columns or on-board luminaires) will be considered and enable localised variations in illumination in response to daily/seasonal car park usage cycles. Occupancy sensing will be configurable with an appropriate 'time-out' to avoid frequent/nuisance switching i.e. short time-out periods are discouraged.
- Cross platform comparability (with the CMS communication devices and LED drivers) is preferred as it allows the client a wider range of equipment offers to be integrated into the CMS and permits for exacting lighting requirements to be met.
- There will be no detrimental impact on the operation of other radio, communications and security systems at the airport by the CMS or any associated components.
- Failure of any part of the CMS will not affect the operation of the luminaires. The nodes on each luminaire will have in-built intelligence to enable continued autonomous operation of the luminaire in the event of communications failure. Full control, including other activities (e.g. fault reporting), will automatically resume when the system is restored.

## 4.2 Dimming

4.2.1 Consideration will be given to dimming the LED light sources to reduce energy consumption and increase luminaire longevity via the use of appropriate control technology integrated into the luminaire. Dimmable light sources enable the luminous intensity to respond in balance with available ambient light from sunset to sunrise, or to automatically adjust to preset output levels in response to traffic flows, sensors, timers or remote controls.

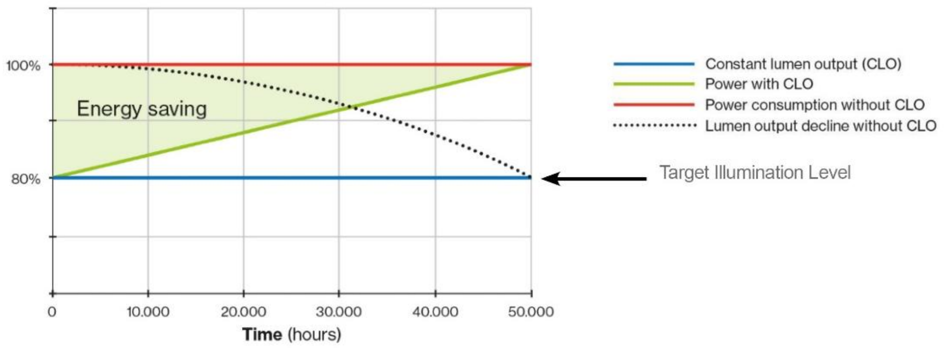
4.2.2 The illumination of each external space or access route will follow the guidance set out in Table A1. 1. In response to traffic densities, especially in off-peak periods or during the quieter seasons, the option to reduce the illumination levels by one lighting class (e.g. P2 to P3, M3 to M4 etc., or from 20lux to 10lux for a car park) will be considered as part of the overall lighting design and as an option programmed into the lighting control system (CMS). This will avoid unnecessarily overlighting the external environment when the traffic usage is at its lowest.

## 4.3 Constant Light Output (CLO)

4.3.1 The performance of light sources will decrease over time, due to cleanliness of the system and gradual decrease in component efficiency. This is normally accounted for in the lighting calculations by a maintenance factor and results in over-lighting of the task area on day-one to allow for performance losses over time.

4.3.2 However, electronic controls within the LED drivers will be considered to compensate for reduced performance, so as to omit the need for overlighting and maintain constant illumination at the required target level. This control technology is called Constant Light Output (CLO). Figure 11 demonstrates how this can be used to derive energy savings over the lifetime of the light source.

**Figure 11: CLO Example**



# 5 Safety and Inclusivity

## 5.1 Perceptions of Safety

5.1.1 Recent research[4] examining our nocturnal perceptions of safety has resulted in key findings:

**Brighter ≠ Safer**

- The research showed a correlation between unsafe perception of space and higher brightness levels. This has follow on effects for energy, environment and light pollution where the instinct is to over-light spaces to improve safety. The common knee-jerk reaction to add more light into a space needs to be reassessed.

**Quality, not quantity**

- The findings show that the quality of the light output is much more important once a low threshold of illumination is reached. Being able to distinguish a person and the colours they are wearing is more important than just being able to see their face. With new LED technology and a push towards smart lighting, high qualities in colour rendering, controlled beam angles and colour temperature is much more pertinent and customisable by designers and should be considered in the design of better experiences after dark.

**Warm White Preference**

- There was a strong correlation between spaces that were perceived to be safer with warmer coloured lighting. Street lighting alone does not provide a sense of safety when walking alone at night. Physical features such as trees, the colour of surfaces, and the types of lighting in urban spaces affect the way light is entering our eyes and can influence our perception of brightness and safety in a space.

**Uniformity**

- There was a strong correlation between perception of safety and the difference between levels of light in the immediate surroundings. Walking into very dark areas can be harsh on people's vision as the human eye needs time to adapt when transitioning between different levels of light. A holistic, masterplan consideration of the brightness level in the immediate surroundings is important so that it takes less time for eyes to adjust and be able to see the surrounding environment better if entering or exiting a very dark space into a very bright space and vice versa.

5.1.2 For many airport users, the car parks are the first and last impression of the airport. It is important that the experience of users arriving after sunset is stress-free, perceived to be safe and visually comfortable for all. The research findings suggest that a consideration of a multi layered urban design and consistent lighting approach is conducive for safe experiences of the built environment.

5.1.3 A consultation exercise with existing users (i.e. staff, passengers) may be considered appropriate by the lighting designer to gain a comprehensive understanding of the context and user experience. Additional information may be gathered to provide the design team with the necessary information to allow them to engage with the concepts of pedestrian safety and equal access after dark, reflect on possible lighting vulnerabilities and act to reduce the potential risk to the public.

5.1.4 For example the following data may be gathered:

- Crowd-sourced qualitative data on the night-time experience.
- Existing crime statistics for the areas affected by the Project and its adjacencies.
- Known safety issues from the client, through consultation with the operations department and customer experience department at Gatwick.
- Previous user experience questionnaires and online reviews, for example Trustpilot/Tripadvisor/Gatwick administered customer feedback surveys.
- A daytime visual assessment of the site
- CCTV and security/CPTED5 assessment
- Night time community workshops
- Pedestrian flow statistics

5.1.5 This learning may be used to inform the human-experience that needs to be created by the lighting scheme in the areas developed under the Project.

## 5.2 Inclusive Design

5.2.1 An inclusive approach to lighting is essential regardless of age and ability. Light as a medium can create safe, accessible environments for all. Users, staff and passengers will be able to participate equally in the daily activities of the airport, promoting well-being, confidence and social interactions with a busy environment. Some suggested approaches which may be adopted are outlined below:

- Apply consistency between the lighting schemes in different character areas and along the routes which traverse the site.
- Include a smooth transition in lighting levels between schemes.
- Careful placement of vertical lighting where it may be proposed for feature or accent purposes (e.g. illuminated advertising, signage, portals, light features), particularly when placed at eye level. Consider the perception of glare to the partially sighted, as well as giving consideration to the potential for distraction caused by any dynamic lighting features that may be proposed
- Complete mock-ups of lighting proposals to include consultation with local user groups e.g. visually impaired, neurodiversity, blind and partially sighted, dementia etc.
- Consider ambulant and disabled user groups for their spatial needs and perception of space e.g. locating equipment to reduce of physical clutter within the external realm is important, consolidating lighting, signage, CCTV etc. onto single columns.
- Consider the experiences of those with visual impairments, avoiding high contrast and minimising glare.

5.2.2 When developing the lighting design, consideration will be given to PAS6463:2022 Design for the Mind - Neurodiversity and the Built Environment guidance. PAS 6463 gives guidance on the design of the built environment to include the needs of people who experience sensory/ neurological processing differences. This includes neurodivergent, neurodegenerative, hypersensitive and other neurological conditions which can affect sensory processing and mental well-being.

5.2.3 Consider daylight and sunlight conditions, for example reflected sunlight glare affecting road crossings, or allowing good daylight

[4] https://www.arup.com/projects/perceptions-of-night-time-safety-women-and-girls

[5] CPTED / Crime Prevention Through Environmental Design

penetration into commercial and living accommodation for improved well-being.

5.2.4 This Framework focuses on the quality of place, positive use of space, and enhancing the visitor, staff, commuter and passenger experience in a truly inclusive manner.

# 6 Ecology and Sensitive Receptors

## 6.1 Ecology and Wildlife

6.1.1 As far as is practicable, lighting will be controlled to remain contained within the site boundary.

6.1.2 Figure 12 shows key areas for consideration of ecology and wildlife, and includes sensitive receptors such woodland and areas of flowing water (e.g. River Mole, Gatwick Stream and Crawter's Brook). Any lighting provided in the vicinity of these areas will require specific consideration to ensure that potential adverse effects are identified, controlled and mitigated.

6.1.3 Mitigation is typically in the form of lighting equipment utilising precise optics and lenses, baffles and light shields, in conjunction with a suitable lighting control regime. Individual habitat requirements may necessitate the specification of a particular lighting spectrum.

6.1.4 In the context of the complex and intensive activity associated with an airport, of which many are safety critical, health and safety of site workers is of paramount importance. Ecological mitigation will be proportionate and not at the expense of safety.

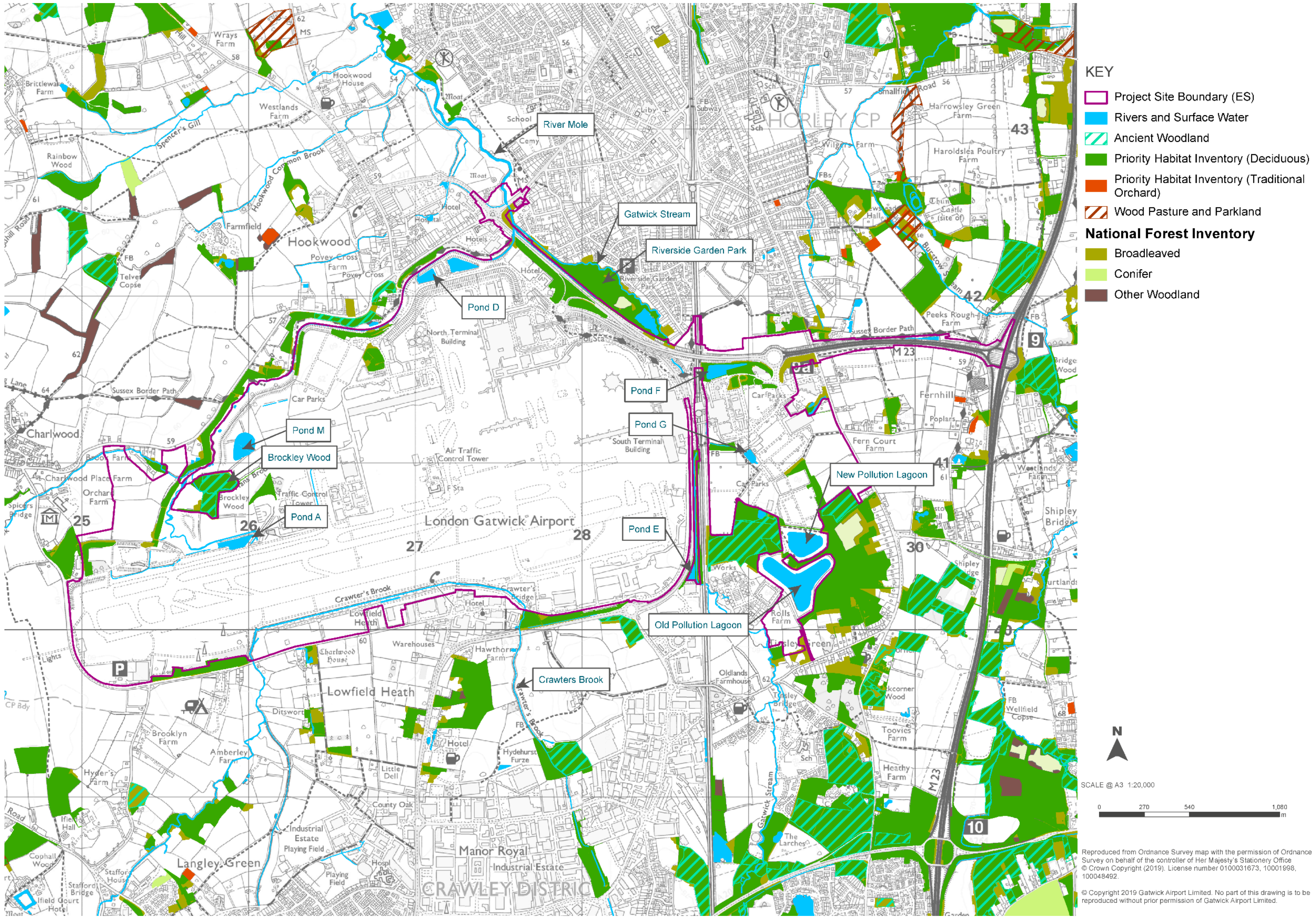
6.1.5 To date populations of the following fauna of conservation interest have been identified:

- Great crested newts breeding in ponds in woodland adjacent to Horleyland Wood and to the north of the River Mole near to the Bear & Bunny Nursery;
- Bat assemblage including Bechstein's bat Myotis bechsteinii roosting in low numbers in several woodlands;
- Terrestrial invertebrate assemblage;
- Range of breeding birds of varying status;
- Small badger setts to the north and south of the runways; and
- Grass snake Natrix in grasslands along the River Mole corridor.

6.1.6 Where appropriate, an experienced ecologist will consulted and the necessary baseline assessments are conducted to understand the relevant local concerns to ensure that the scheme avoids or minimises the impact on the requisite dark environments necessary for undisturbed habitation.

6.1.7 Refer to ILP GN08 for specific lighting requirements associated with bat conservation and the current Gatwick Decade of Change strategy for specific biodiversity targets.

**Figure 12: Key sensitive receptors in relation to the Project Site**



## 6.2 Heritage Assets

6.2.1 The Framework recommends that lighting designs show specific consideration for heritage buildings and areas within the site and its surroundings, where appropriate.

6.2.2 **ES Figure 7.6.1** and **Figure 7.6.2** (Doc Ref. 5.1) respectively indicate the non-designated heritage assets within 1km of the Project Site boundary and designated heritage assets within 3km of the Project Site boundary. These will be reviewed, and mitigation considered where necessary to ensure no adverse impact from lighting, in development of future lighting designs for the Project.

6.2.3 Three Grade I listed buildings and a number of other Grade II* and Grade II listed buildings are located within 1km of the Project site boundary, along with several 'locally listed' buildings. There are also other historic buildings recorded on the county HERs but not included on the statutory or local list. Church Road (Horley) Conservation Area is partially within the Project site boundary.

6.2.4 There are no Scheduled Monuments within the land required for the Project. One Scheduled Monument is located just outside of the Project site boundary (at Tinsley Green), with one further Scheduled Monument within 1km.

6.2.5 Lighting designs in the vicinity of the heritage buildings, or including the heritage buildings themselves will be managed to ensure that existing guidance by Historic England (External Lighting for Historic Buildings) and CIBSE (Guide to Building Services for Historic Buildings – Sustainable Services for Traditional Buildings) are respected.

6.2.6 Refer to the document list in Table A1. 1 and Annex 2 for specific lighting guidance applicable to heritage buildings.

# 7 Obtrusive Light

## 7.1 Introduction

7.1.1 It is essential for the operation of the airport that lighting is provided across the external areas after sunset.

7.1.2 ICAO Annex 14 recommends that measures are taken to avoid obtrusive light effects and recommends that upward light spill from apron and other ground lighting systems, and glare effects are mitigated against to avoid adverse impact on airfield operations.

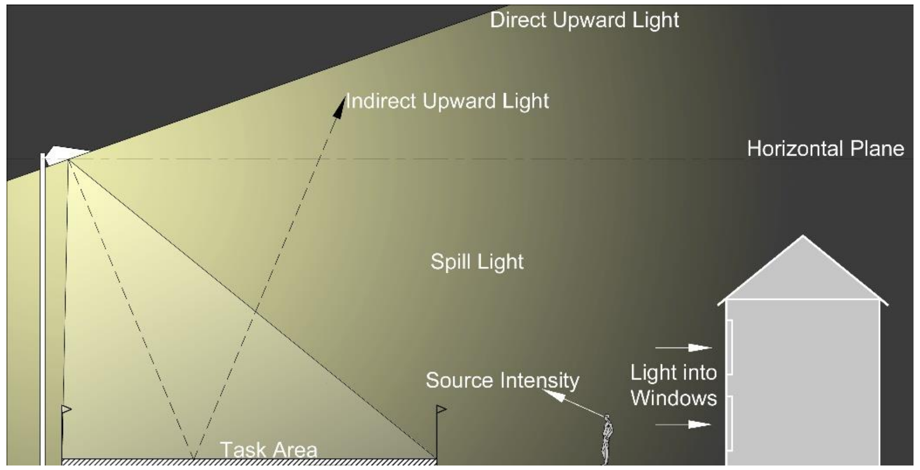
7.1.3 Consequences often associated with light obtrusion ('*light pollution*') are the loss of dark night skies and views of the stars, perception of an unsatisfactory nocturnal environment and the harming of wildlife habitats and ecosystems. Light obtrusion has also been shown to have detrimental effects on human health[6] and can present serious physiological and ecological problems. Of key concern to this project, light obtrusion manifests itself as unnecessary energy waste and therefore a contributor to climate change.

7.1.4 Many obtrusive light effects can normally be mitigated against through sound design principles and adherence to current best practice design guidance from national and international professional lighting institutions. Examples of best practice recommendations can be found in the publications referenced in Annex A.1 and primarily the ILP Guidance Note 1 GN01: The Reduction of Obtrusive Light.

7.1.5 Figure 13 illustrates the characteristics of obtrusive light which require assessment and, potentially, mitigation. Refer to ILP GN01 and the summary notes in Annex A.1.5 for specific lighting requirements. The characteristics of obtrusive light are described below.

- Light Intrusion: stray light beyond the task area onto neighbouring dwellings or sensitive receptors. Units: illuminance (Ev), measured in lux.
- Source Intensity: how bright the light source appears to an observer. Units, Intensity (I), measured in candelas (cd).
- Sky Glow: a combination of Direct Upward Light and Indirect Upward Light. This effect is often seen as an artificial glow above towns/cities in the night sky. The sky glow is quantified in the guidance notes by the percentage of the luminaire output emitted above the horizontal plane.
- Building or Signage Luminance: how bright an illuminated façade or sign/advert appears to the observer. Units: Luminance (L) measured in cd/m$^2$.
- Threshold Increment: is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation experienced by road users. Expressed as a percentage.

**Figure 13: Characteristics of obtrusive light**




7.1.6 Appropriate threshold limits for lighting are defined in ILP GN01 in terms of environmental zones. These define the typical nocturnal character of the external environment in five categories, from intrinsically dark, e.g. dark sky reserves to national parks, villages, suburbia, and city centres. Further detail can be found ILP GN01. Given the variation on activity across the Site, it is proposed that two environmental zones can be observed. This is detailed in Section 7.2.

7.1.7 The nocturnal character of the landscape can be observed in the night-time photography provided in **ES Figures 8.4.5 to 8.4.37** (Doc Ref. 5.1). These images can be used as a visual reference, against which future lighting design proposals can be objectively compared.

7.1.8 Development of this Framework has placed a respect for the environment and ecology at its core and consider measures to

[6] https://www.darksky.org/light-pollution/human-health/

minimise its environmental impact and provide a sustainable approach. Mitigation of light obtrusion effects will be considered from the outset of the design stage and will consider the following steps:

- Consult with the project ecologist to establish any particular lighting design limits connected with each sensitive receptor habitat.
- Lighting design will consider the ILP GN01 and ILP PLG04 recommendations for baseline measurement, impact assessment, design and mitigation with reference to the appropriate lighting characteristics for each Environmental Zone (refer to Section 7.2 and Table A1. 7).
- Consideraton will also be given to ILP GN08 and Section 3.6 of this Strategy.

## 7.2 Environmental Zone

7.2.1 Environmental Zone

7.2.2 It is recognised that the airport occupies a large site and, for operational reasons, the lighting will vary across the site. For example the south-west end of the runway is relatively dark compared to the core/terminal areas of the site.

7.2.3 To support development of the lighting design in a sustainable manner, this Framework proposes that the airport is defined in terms of the Environmental Zones (as per ILP GN01, Annex A.1.5) and that the lighting design within these zones upholds the threshold limits attributed to each zone.

7.2.4 Environmental Zones are categorised in the ILP document as follows:

- E0: Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places.
- E1: Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
- E2: Sparsely inhabited rural areas, village or relatively dark outer suburban locations.
- E3: Well inhabited rural and urban settlements, small town centres of suburban locations.
- E4: Town/city centres with high levels of night-time activity.

7.2.5 As a first step towards determining appropriate lighting performance for Gatwick Airport, Figure 15 shows the ‘Environmental Zone’ principles which will be considered when developing the lighting design for the Project. This categorisation represents current best practice and aims to ensure that the relative brightness of the site with respect to its environmental context is appropriate.

7.2.6 Subject to detail design and compliance with prevailing regulatory and technical standards it is proposed that the external lighting design within the areas of highest nocturnal activity (e.g. terminals, aprons, short/mid stay car parks) broadly will not exceed the recommended Zone E3 thresholds. Lighting design to other areas (e.g. airfield, long stay car parks) broadly will not exceed the Zone E2 thresholds

## 7.3 Local Residents and Other Receptors

7.3.1 Lighting designs for the Site will need to consider the potential impact of obtrusive light on to residential and sensitive/ecological receptors within the project locale.

## 7.4 A23 near Longbridge Roundabout

7.4.1 The highway amendments on the A23 include widening which brings the eastbound carriageway (south of Longbridge Roundabout) closer to Gatwick Stream (Figure 14). It is understood that Gatwick Stream together with Riverside Park forms a key natural ‘green’ corridor that links the east and west sides of the airport.

7.4.2 The road lighting design for this section of the A23 may need special consideration to avoid light spill onto Gatwick Stream. Presently there are trees and shrubs which mitigate light spill between the A23, however these will be removed as part of the road widening and may take years to re-establish after completion of the works.

7.4.3 Mitigation of obtrusive light effects from the new A23 lighting over Gatwick Stream may comprise one or more of the following and the lightig designer will need to review these in consultation with the ecologist and appropriate highways lighting authority:

- Colour temperature <2,700K with minimised wavelengths <500nm.
- Luminaire photometry specified to minimise back-spill towards the stream.
- Lower luminaire mounting heights to constrain spill light beyond the highway.
- Use of cowls and/or beam shaping devices on the luminaires to reduce light spill towards the stream.
- Part night dimming.
- Physical mitigation in the form of solid fencing.

7.4.4 Consultation has taken place with Surrey and West Sussex County Councils and National Highways. While the standard LED street lighting provision is in the 3,000K-4,000K range (Figure 2), they may permit lower colour temperature lighting to be used in situations where a environmental protection is required.

7.4.5 The CMS system operated by the local authorities has adopted a switching regime in other locations which allows for part night dimming to make allowance for wildlife habitats.

**Figure 14: Light obtrusion focus; A23 near Longbridge Roundabout**

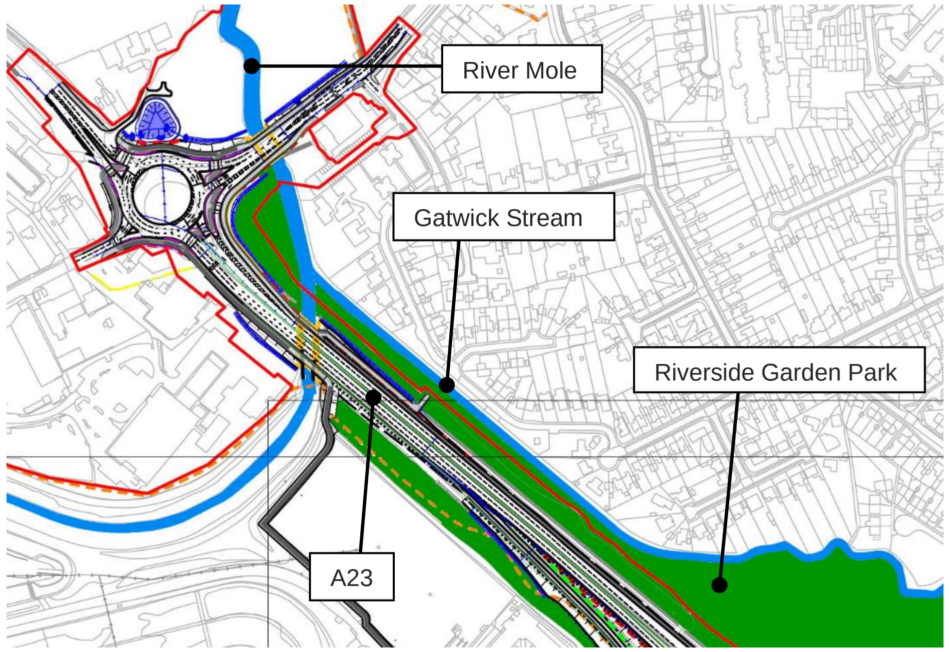
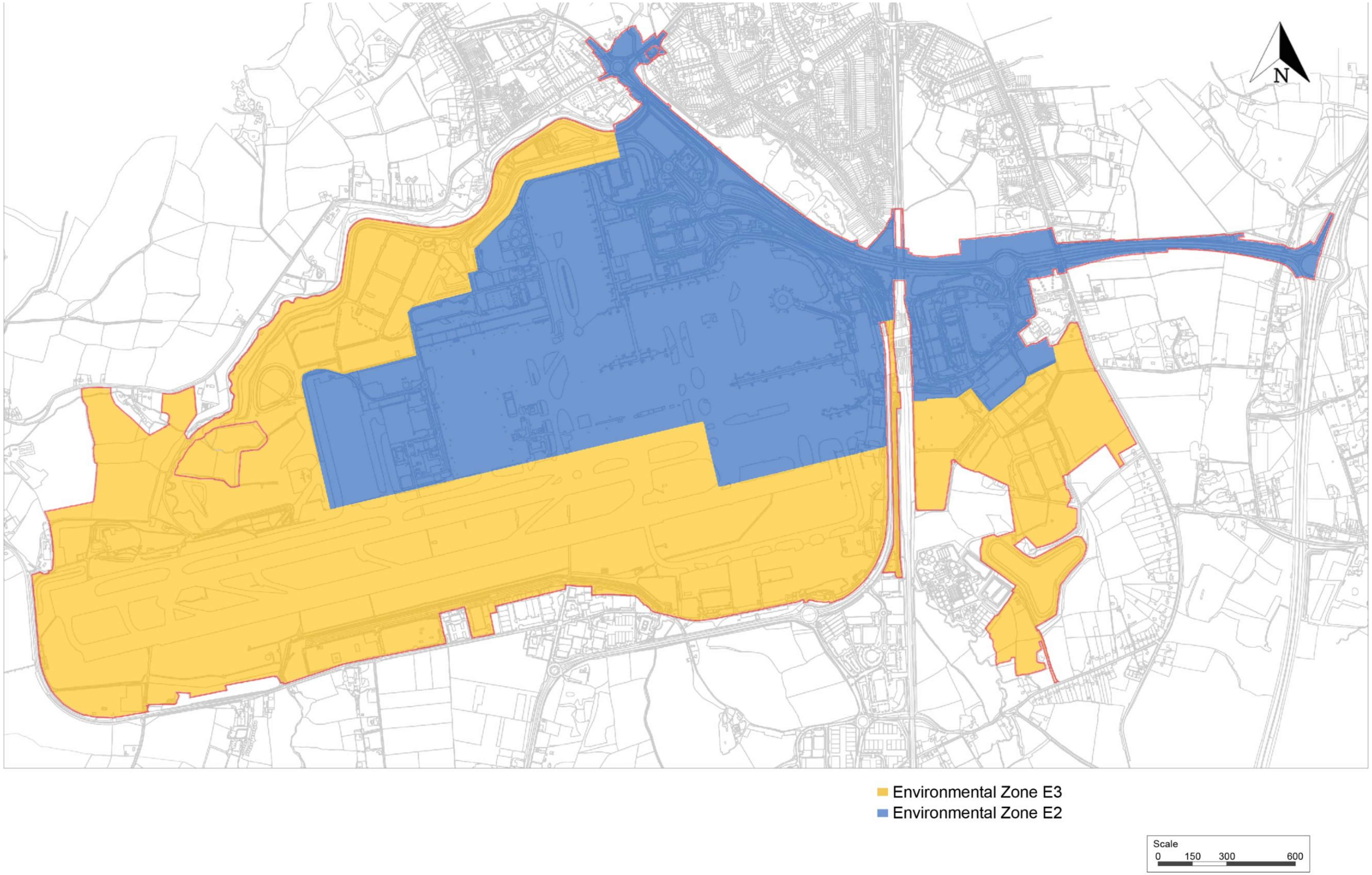


**Figure 15: Proposed GN01 Environmental Zones**



# 8 Customer Journey

## 8.1 Introduction

8.1.1 This section identifies the variation in lighting environments experienced on journeys to and from the airport. For many journeys, the exterior lighting is the first and last impression of each journey and it should be positively memorable.

8.1.2 Each project commissioned (Exterior or Interior) whilst being a standalone project is also part of the airport's overall development and may be completed in multiple phases. As such each project will be integrated and coherent with its surroundings and adjacent spaces.

8.1.3 Lighting of new or refurbished spaces forms part of the wider context and its design will consider the visual experience of the surrounding spaces so passengers can move seamlessly through the visual environment, such that the journey is perceived as a single cohesive experience. In essence, the lighting design will consider improved pedestrian access and wayfinding.

8.1.4 Two main journeys through the site have been identified:

- Figure 16 – outbound journeys or departures, starting at the Airport railway station, set down point, the roads, the car park or the bus/coach station or the taxi drop-off points, forecourt, transit via ITTS or footways, through the check-in hall, and finally the departures lounge.
- Figure 17 – inbound journeys or arrivals, starting at air bridges, baggage reclaim and customs, transit via ITTS or footways to the Gatwick Airport rail station, forecourt, car park, bus/coach station, taxi pick-up points, roads, onwards.

8.1.5 The scope of this report is the overall exterior Operational Lighting Framework for the Project; Landside and Airside (Figure 18).

8.1.6 Landside includes the outbound/inbound journey from the Gatwick Airport railway station, car park or bus terminus to the Terminal building and vice-versa.

8.1.7 Airside includes the apron stands, taxiways, airfield ground lighting and runways lighting.

# 9 Proposed Lighting Classification

## 9.1 Illumination levels

9.1.1 Figure 19 describes the lighting classifications considered appropriate for an indicative layout of the Project.

9.1.2 Acknowledging the Project as a multi-phase development, this diagram shows the elements currently associated with the Project, and categorises them in the context of this Framework.

9.1.3 Spatial archetypes have been identified in relation to their lighting treatment; a more detailed discussion of the lighting approach and considerations for each typical scenario have been provided in the following pages.

9.1.4 Refer to the Technical Addendum in Annex A for specific lighting requirements for each identified archetype.

**Figure 16: Outbound Journey (Departures)**

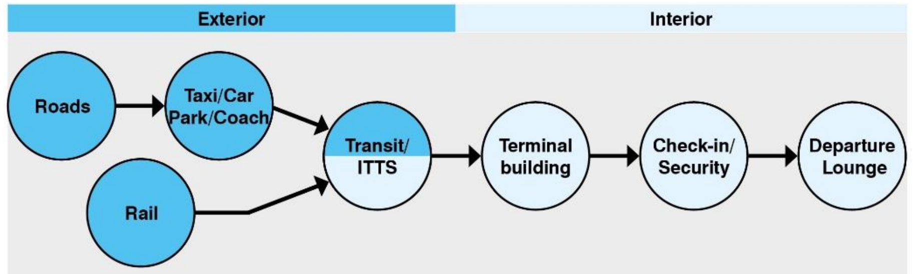



**Figure 17: Inbound Journey (Arrivals)**

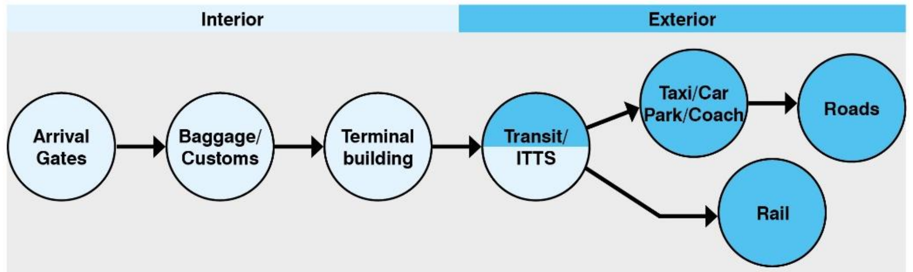



**Figure 18: Exterior Lighting Scope**

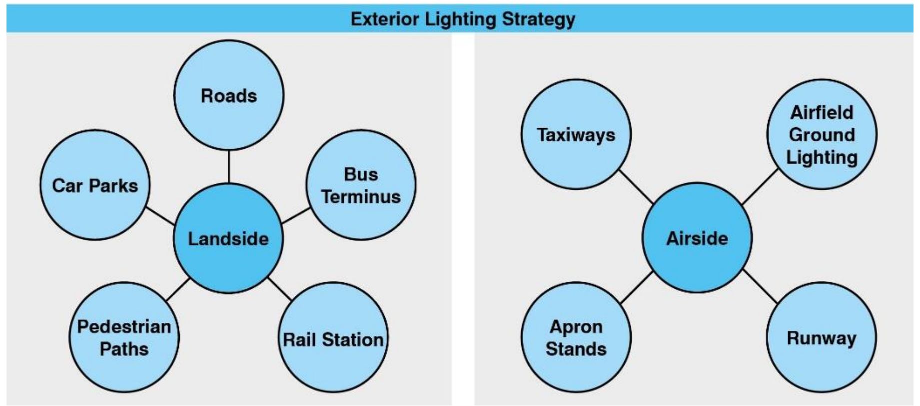


**Figure 19: Proposed lighting classification and indicative layout**

# 10 Roads

## 10.1 Primary Vehicular

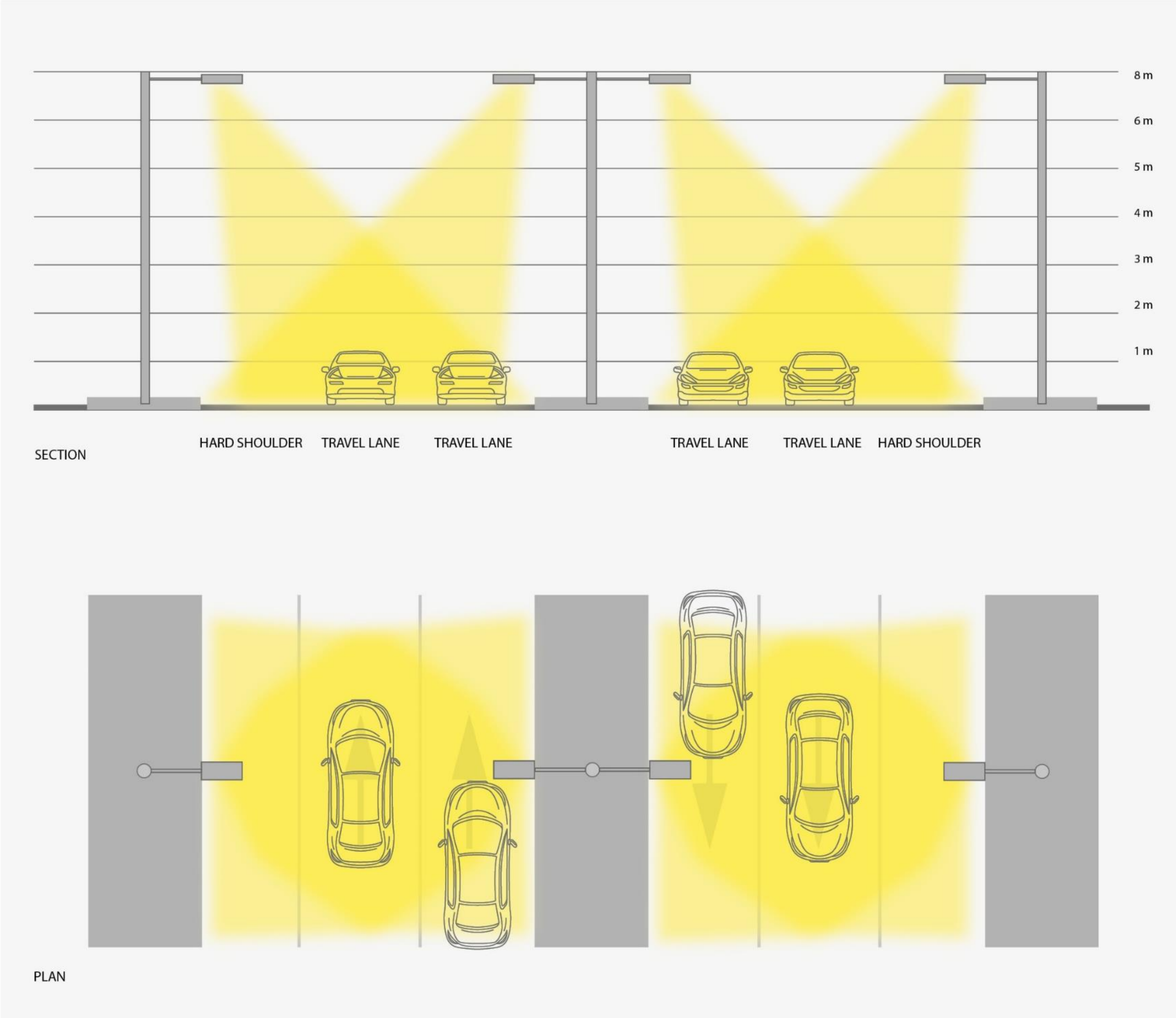
10.1.1 Figure 20 shows a typical arrangement for a primary vehicular road (dual carriageway).

10.1.2 In principle, the following will be considered in development of the lighting design:

- Road lighting will use white light sources.
- A good uniformity over the road will be achieved by utilising road lighting luminaires mounted on columns with an opposite arrangement.
- Dual carriageways can be satisfactorily lit by means of opposite arrangements mounted on the outside edges of the road, or by twin luminaires on the central reserve. The appropriate arrangement will be defined at the next stage of the design and will be dependent on the column height and the width of the road.
- The preferred height of the road lighting luminaires will be 8m above finished ground level and the chosen luminaire will be a ‘flat glass’ type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- Base hinged columns are preferred to minimise high level maintenance.

10.1.3 Refer to Table A1. 4 and Table A1. 5 for specific lighting requirements.

**Figure 20: Primary vehicular lighting arrangement**



## 10.2 Secondary Vehicular

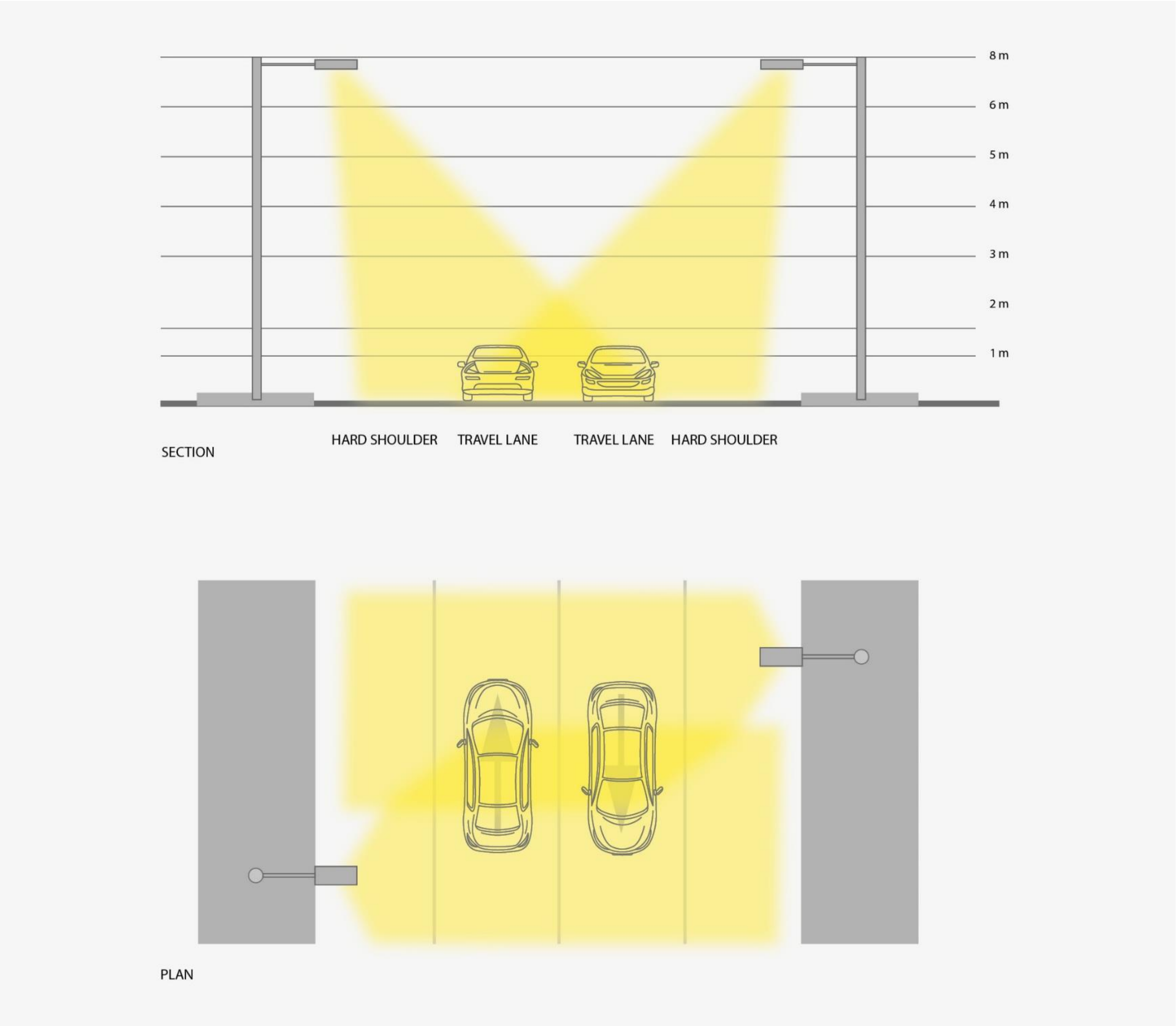
10.2.1 Figure 21 shows a typical arrangement for a secondary vehicular road (single carriageway).

10.2.2 In principle, the following will be considered in development of the lighting design:

- Road lighting will use white light sources.
- A good uniformity over the road will be achieved by utilising road lighting luminaires mounted on columns with a staggered arrangement.
- Single carriageways can be satisfactorily lit by means of staggered arrangement mounted on the outside edges of the road.
- The preferred height of the road lighting luminaires will be 8m above finished ground level and the chosen luminaire will be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- If practicable, base hinged columns are preferred to minimise high level maintenance.

10.2.3 Refer to Table A1. 4 and Table A1. 5 for specific lighting requirements.

**Figure 21: Secondary Vehicular lighting arrangement**



## 10.3 Constrained Sections

10.3.1 Figure 22 and Figure 23 show typical arrangement options for a roadway area with significant constraints on lighting column positioning.

10.3.2 In principle, the following will be considered in development of the lighting design:

- Road lighting will use white light sources.
- A good uniformity over the road will be achieved by utilising road lighting luminaires mounted on high masts positioned where allowable.
- Complex networks of carriageways and junctions can be satisfactorily lit by means of high mast luminaires located in accessible and permissible locations specific to the constrained road segment. The appropriate arrangement will be defined at the next stage of the design and will be dependent on the column height and the width of the road.
- The preferred height of the road lighting luminaires will be up to 20m above finished ground level to allow for sufficient coverage, however lower heights are preferred where possible (two tiered approach), to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas, such as Riverside Garden Park, and surrounding rural landscape, in particular to minimise direct views of the light source.
- If practicable, base hinged columns or raise/lower luminaire cradles are preferred to minimise high level maintenance.

10.3.3 Further consideration will be given to whether the provision of Obstacle Lighting is necessary. Reference will be made to Chapter Q of CAA 139.

10.3.4 Refer to Table A1. 4 for specific lighting requirements.

**Figure 22: Constrained roadway lighting arrangement – Option 1**

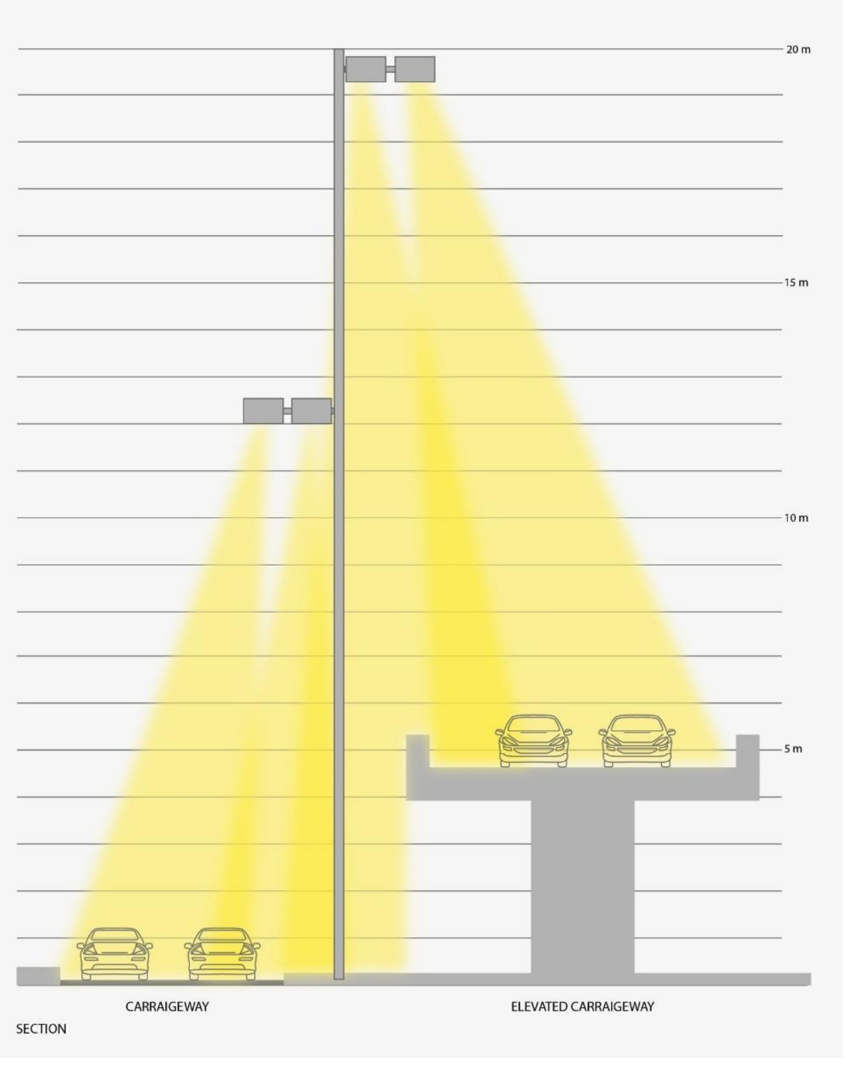
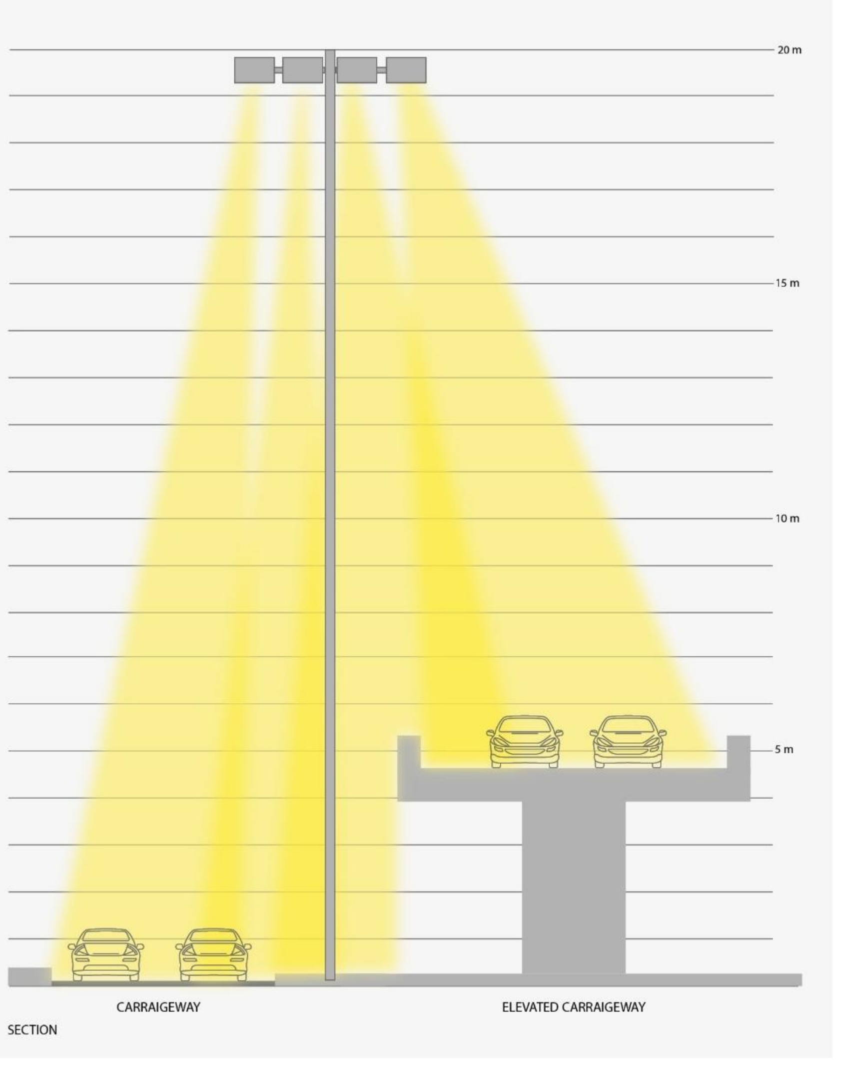



**Figure 23: Constrained roadway lighting arrangement – Option 2**



## 10.4 Runway Vicinity

10.4.1 Supplementary to the typical lighting arrangements described earlier, lighting columns in the vicinity of runways must take due consideration to remain clear of the Obstacle Limitation Surfaces (OLS) and ensure the lighting complies with all necessary safeguarding, avoids glare to pilots or, risks obscuring or causing visual confusion with aeronautical ground lighting (AGL). Refer to Section 17.

10.4.2 As the northern runway is closer to the core airport infrastructure it may therefore present a more onerous coordination scenario than the existing southern runway OLS.

10.4.3 Obstacle Lighting will be required for objects within the lateral boundaries of the OLS as per Chapter Q of CAA 139. Typical examples of structures requiring obstruction lighting are tall buildings, high-mast apron lighting systems and telecoms towers.

10.4.4 The location of lighting columns will be coordinated with the positions of Approach Lighting pylons to ensure they do not clash with or impede their operation (Figure 24 and Figure 25).

10.4.5 Refer to the CAA 139 (seeTable A1. 1) for specific requirements.

**Figure 24: Coordination of AGL and road lighting systems will be considered**

**Figure 25: Lighting arrangement in the vicinity of runways with Approach pylon**

# 11 Pedestrian Zone Lighting

## 11.1 Objective

11.1.1 The objective of pedestrian crossing illumination is to improve distinctive visual identification of the crossing users to approaching car drivers, as well as providing safe illumination of the crossing surface. Figure 27 shows a typical arrangement for a pedestrian crossing.

11.1.2 In principle, the following will be considered in development of the lighting design:

- Pedestrian crossing lighting will illuminate any pedestrian who is approaching, at and on the crossing in such a manner as to make them clearly visible to the approaching driver.
- A good uniformity over the road will be achieved by utilising road lighting luminaires mounted on the outside edges of the road with a staggered arrangement. The road lighting luminaires will be of side asymmetric distribution specifically designed for this application to provide appropriate illumination on the horizontal and vertical plane.
- At pedestrian crossings it is best practice to have supplementary luminaires mounted on an extended beacon pole either located on an offset bracket or designed to wrap around the pole. This aids the lighting of the crossings, reduces street clutter and improves all-round visibility.
- Base hinged columns are preferred to minimise high level maintenance.

11.1.3 As pedestrian crossings are considered to be conflict areas for the purpose of lighting, it is recommended that the carpet and adjacent footway '*waiting area'* are illuminated to a higher level than of the road to draw the attention of the approaching driver to the proximity of a pedestrian crossing and to illuminate the pedestrian on the crossing and adjacent footways

11.1.4 The chosen luminaire is recommended to be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.

11.1.5 Refer to ILP TR 12 listed in Table A1. 1 for specific lighting requirements. In summary, Figure 26 is an adaptation from ILP TR12 Lighting of Pedestrian Crossings. It shows the three recommended vertical grids that should be calculated, each 1.5 meters high and the width of the crossing mat, located as follows:

- Grid 1: At the centre of the crossing running along the centre line of the road
- Grid 2: Along the kerb edge with the measurement field facing across the road
- Grid:3 At the rear of the waiting area or 1.8 meters back from the kerb, whichever is less, and again with its axis along the road line.

**Figure 26: Pedestrian crossing (diagram adapted from TR12)**

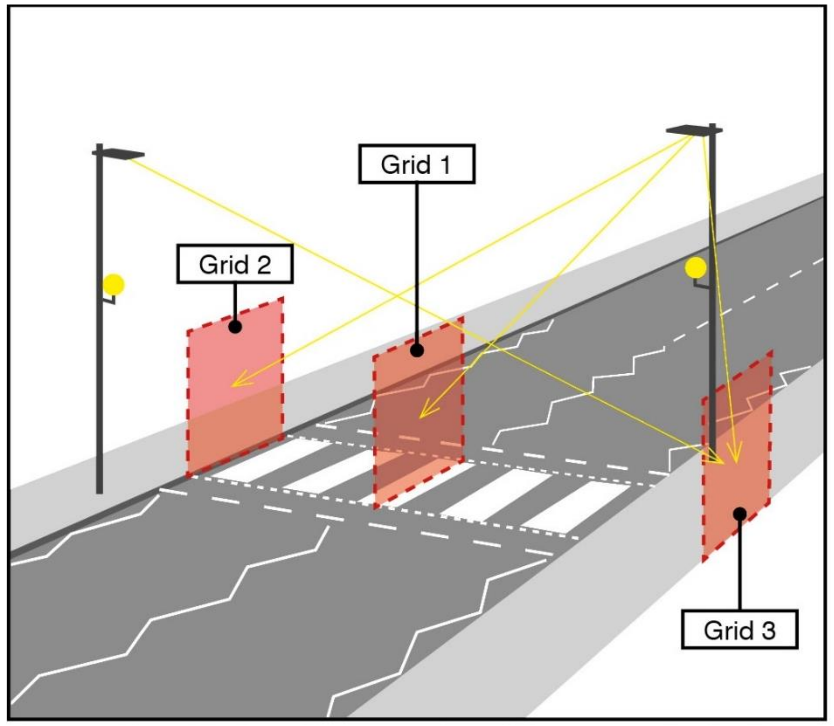
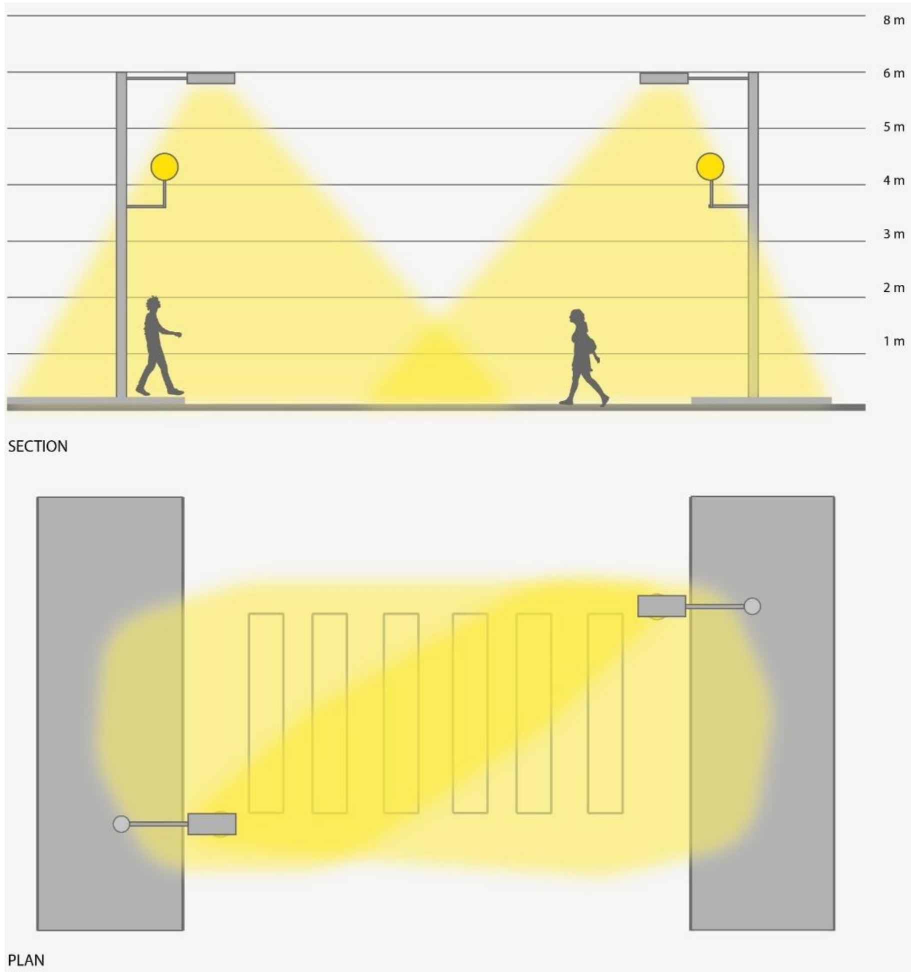



**Figure 27: Pedestrian Crossing typical lighting arrangement**



## 11.2 Primary & Secondary Pedestrian

11.2.1 Figure 28 shows a typical lighting arrangement for primary and secondary paths exclusive to pedestrians.

11.2.2 Typically primary footpaths would be designated by lighting class P1/P2 or HS1 (See Annex A.1.3) and secondary footpaths P3/P4 or HS2/3.

11.2.3 In principle, the following will be considered in development of the lighting design:

- Pedestrian path lighting will use white light sources which will be dimmable.
- A good uniformity over the ground will be achieved by utilising luminaires with a side throw that directs the light towards the ground and not upwards. The chosen luminaire will be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.
- A single sided beam or a dual sided beam can be used depending on the width of the path. The paths can be satisfactorily lit by means of opposite or staggered arrangements mounted on the outside edges of the road, or by twin luminaires on the central path only.
- The preferred height of the pedestrian paths lighting luminaires will be 4m and 3m above finished ground level for primary and secondary pedestrian respectively, as these heights are closer to human scale than the taller luminaires used for road lighting.
- Illumination performance will improve the users' perceptions of safety with particular attention paid to provide good facial illuminance.
- If practicable, base hinged columns are preferred to minimise high level maintenance.

11.2.4 Refer to Table A1. 6 for specific lighting requirements.

**Figure 28: Typical lighting arrangement for Primary and Secondary pedestrian paths**

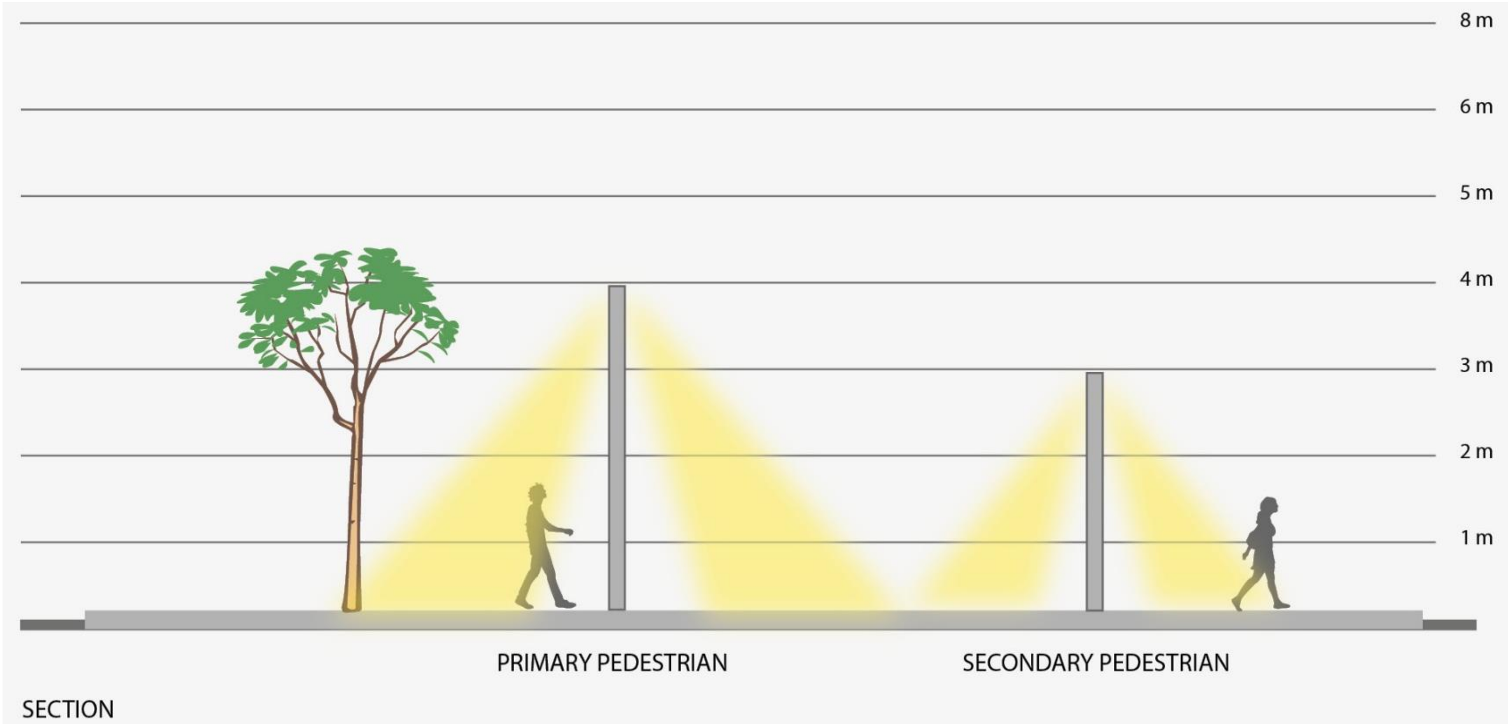
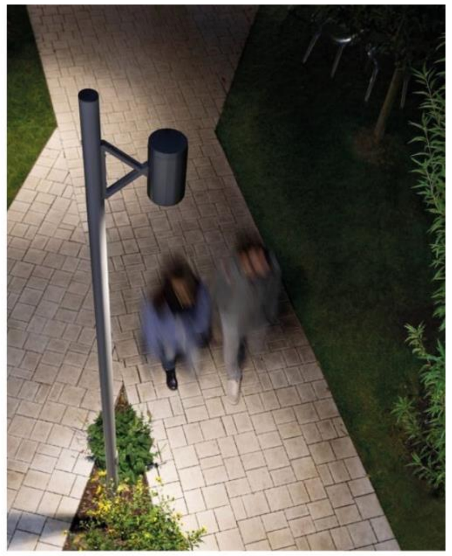



**Figure 29: Precedents of pedestrian paths**



## 11.3 Pedestrian paths adjacent to vehicular routes

11.3.1 In instances where pedestrian pathways, either primary or secondary, are adjacent to any vehicular routes, consideration will be given to pedestrian path lighting provided via the road lighting luminaire or a luminaire mounted off the road lighting column. This will de-clutter the roads and paths and promote consistency in luminaire equipment (Figure 30).

11.3.2 In principle, the following will be considered in development of the lighting design:

- The height of the luminaires for pedestrian paths will follow the same strategy of either 4m (primary paths) or 3m (secondary paths) that is closer to the human scale, whereas the road lighting luminaires will follow the strategy of 8m.
- The luminaire chosen will be a ‘flat glass’ type with 0% uplight and no tilt above horizontal level.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- Illumination performance will improve the users’ perceptions of safety with particular attention paid to provide good facial illuminance.
- If practicable, base hinged columns are preferred to minimise high level maintenance.

11.3.3 Refer to Table A1. 5 for specific lighting requirements.

**Figure 30: Typical lighting arrangement for Pedestrian paths combined with vehicular**

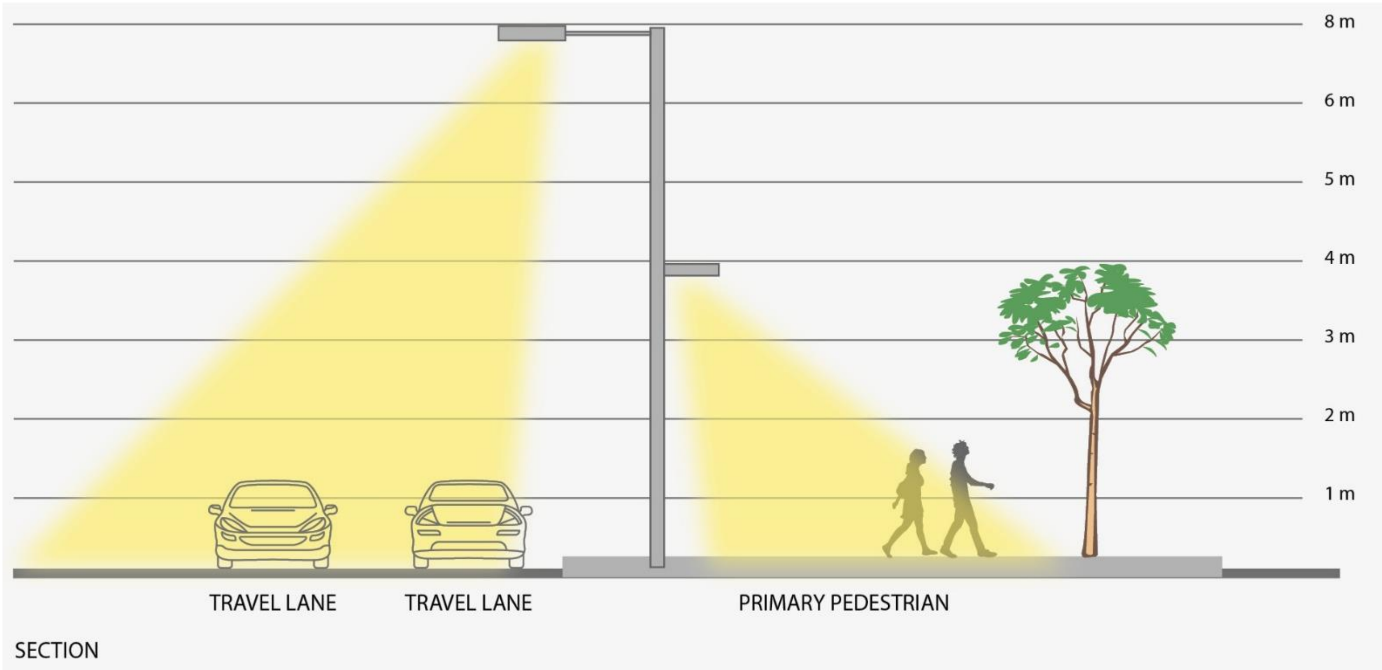



**Figure 31: Precedents of pedestrian paths near vehicular routes**

## 11.4 Rural pedestrian paths

11.4.1 Typically, rural footpaths will be designated by lighting class P5/6 (see Annex A.1.3) and align with national walking routes or designated public rights of way. However, the requirement for lighting to rural pedestrian pathways will be subject to an assessment undertaken by the Designer in conjunction with the Project Team and an ecologist.

11.4.2 The assessment will consider the existing lighting condition and any planned works in the local context; it is expected that lighting will not typically be required to low traffic rural routes and the preference is to keep them unlit to minimise the impact on biodiversity. Where lighting is identified as a requirement, special consideration will be taken to ensure that the lighting provided is controlled and low level.

11.4.3 Figure 32 shows two options of a typical lighting arrangement for rural paths exclusive to pedestrians.

11.4.4 In principle, the following will be considered in development of the lighting design:

- Rural pedestrian path lighting will use white light sources which will be dimmable, ideally with presence detection technology.
- A good uniformity over the ground will be achieved by utilising either luminaires or bollards with a side throw that directs the light towards the ground and not upwards. The luminaire and/or bollard chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.
- The height of the lighting luminaires for rural pedestrian paths will follow the same strategy of 3m (secondary paths) that is closer to the human scale
- A single sided beam or a dual sided beam can be used depending on the width of the path. The paths can be satisfactorily lit by means of opposite or staggered arrangements mounted on the outside edges of the path, or by twin luminaires on the central path only.

11.4.5 Refer to Table A1. 6 for specific lighting requirements.

**Figure 32: Typical lighting arrangement for rural pedestrian paths (Primary and Secondary)**

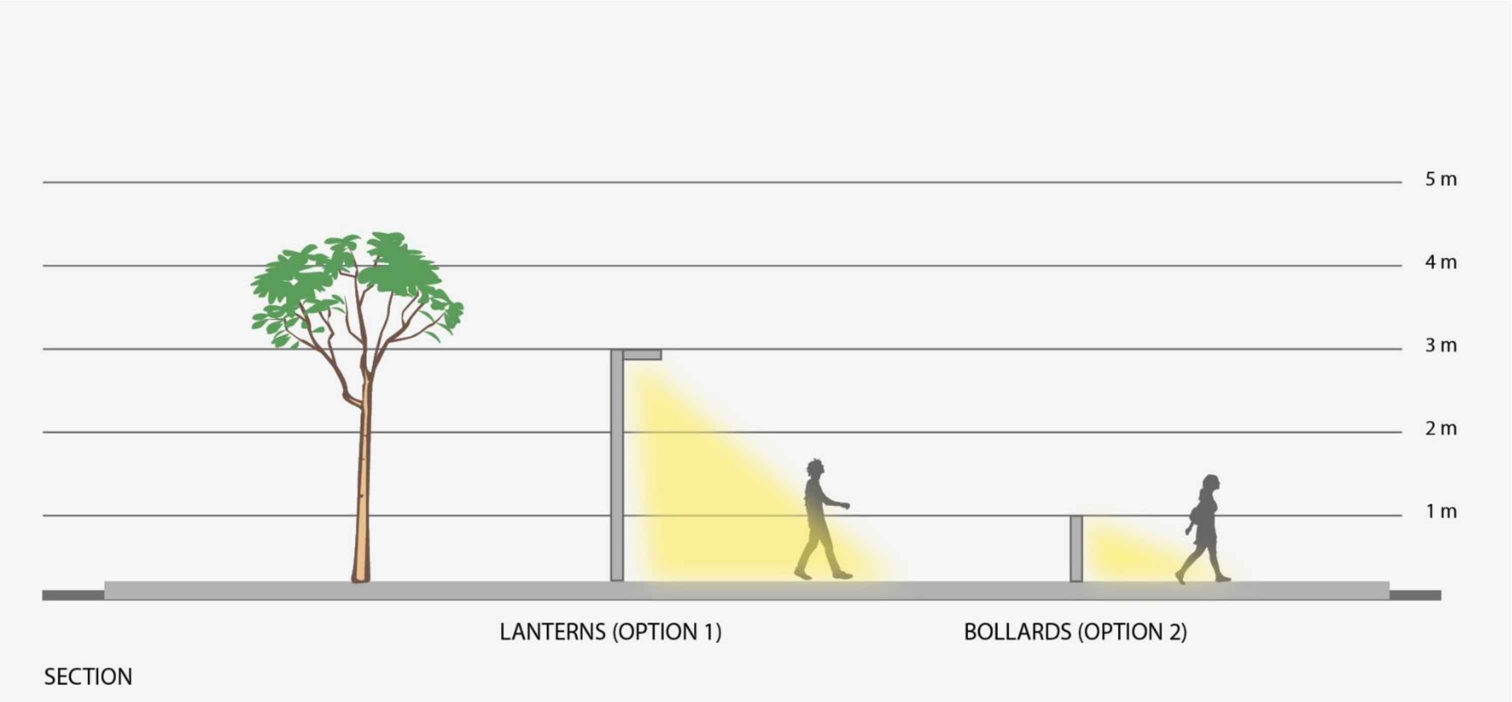
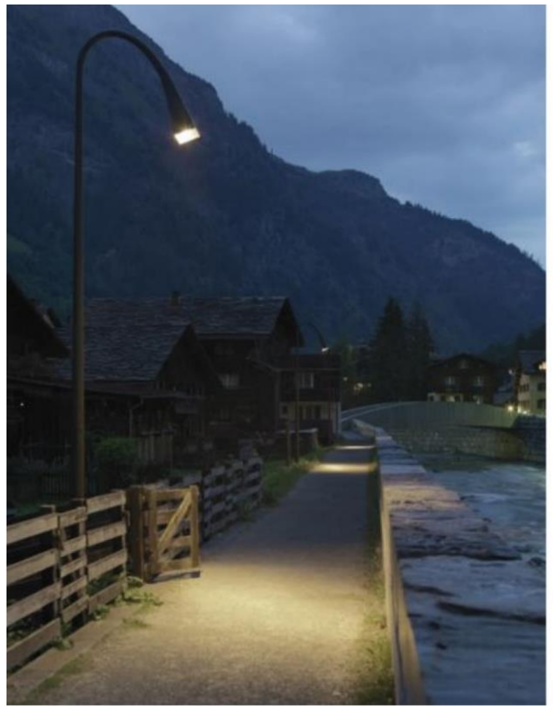



**Figure 33: Precedents of rural pedestrian paths**



## 11.5 Rural pedestrian paths or near sensitive habitats

11.5.1 This Framework places a respect for the environment and ecology at its core. It sets out to minimise its environmental impact and provide a more sustainable approach, while recognising the need to activate certain parts of site for improved active travel and to support the use of rural footpaths.

11.5.2 The following principles form the basis of design of lighting with respect to rural footpaths and adjacent sensitive ecological habitats:

- Preventing spill light onto waterways, ecologically sensitive habitats, minimise obtrusive light and further degradation of the night sky.
- Minimising energy consumption in both design and operation of the lighting.
- Providing responsive control of lighting and reduced light levels in off-peak scenarios.

11.5.3 Figure 34 suggests lighting arrangements for footpaths near watercourses or sensitive habitats and the key considerations are summarised below.

**Accessibility and Safety**

- Function focussed lighting to horizontal surface/ground plane. The primary function to identify objects/hazards along the footpath.
- Controlled lighting ensuring no glare to pedestrians or cyclists.
- Uniform lighting to enhance way-finding and extend view ahead for improved perception of safety.

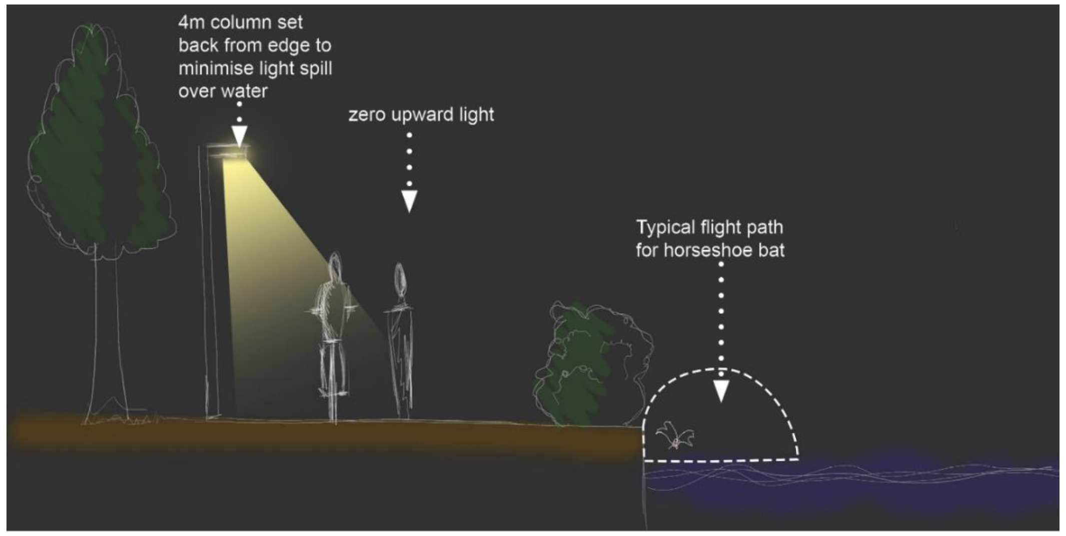
**Design**

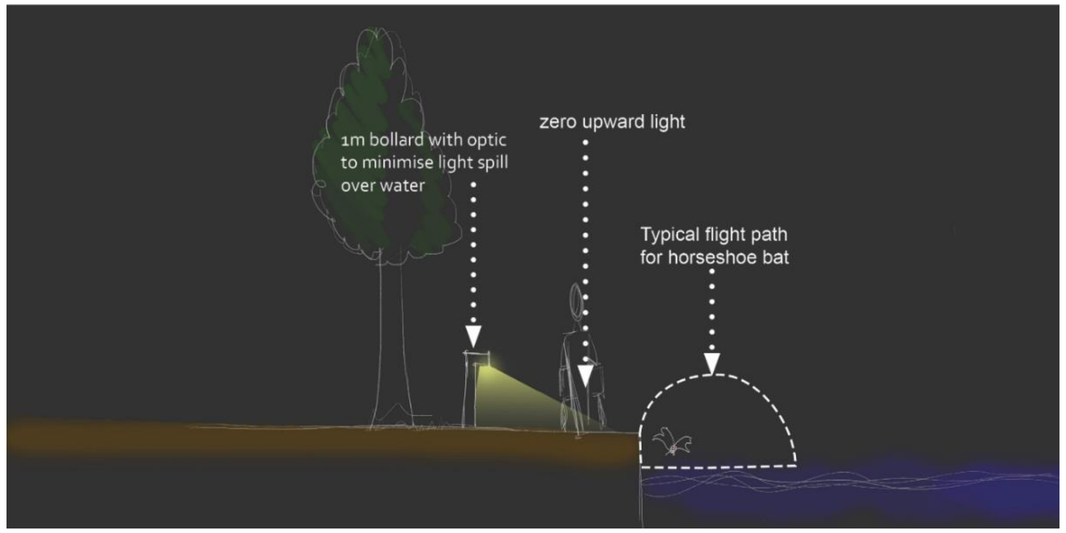
- Depending on the significance of the location and occupancy of the footpath, the Operational Lighting Framework will differ.
- Lighting columns/bollards in urban locations
- Solar lighting in less populated locations, or where power supplies are not locally available.
- Consider high and low level lighting to minimise spill light (e.g. Figure 34).

**Sustainability & Ecology**

- Precise lenses, baffles and light shields to restrict the potential for obtrusive light on the water and to protect the dark corridors.
- Lighting only be provided to defined 'moments' along the riverside path to avoid over-illuminating.
- Baseline lighting survey and impact assessment required for lighting proposals. Consultation with an ecologist.
- Intelligent control strategy to be considered to energise lights only when required.
- Consideration of innovative lighting solutions (e.g. Red LED Figure 4).

**Figure 34: Lighting options near watercourses (or sensitive habitat**



## 11.6 Shared Pedestrian Path and Cycleway

11.6.1 In instances where pedestrian pathways, either primary or secondary, are shared with cycleways, it is recommended that lighting will be provided in a manner consistent with the lighting of primary pedestrian routes, while meeting the required lighting standards for shared routes (Figure 35). This will promote consistency in luminaire equipment and lighting treatment.

11.6.2 In principle, the following will be considered in development of the lighting design:

- The height of the lighting luminaires for shared routes will follow the same strategy of primary paths at 4m to remain at the human scale.
- Particular attention will be given to glare and vertical illumination to support safe navigation on these routes.
- The luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- If practicable, base hinged columns are preferred to minimise high level maintenance.

11.6.3 Refer to Table A1. 5 and Table A1. 6 for specific lighting requirements.

**Figure 35: Typical lighting arrangement for a shared pedestrian path and cycleway**

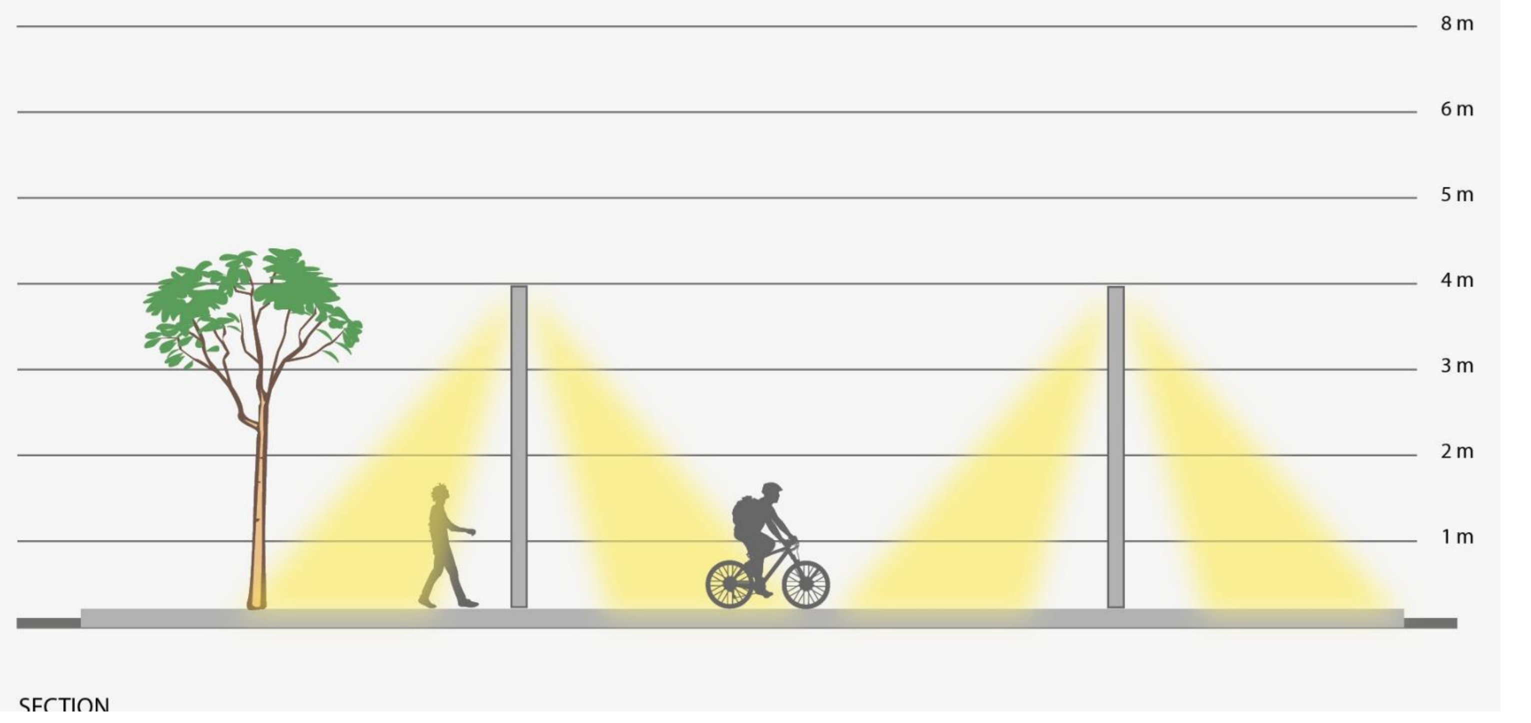



**Figure 36: Precedents of shared pedestrian path and cycleway**

# 12 Coach station and bus stops

## 12.1 Coach station

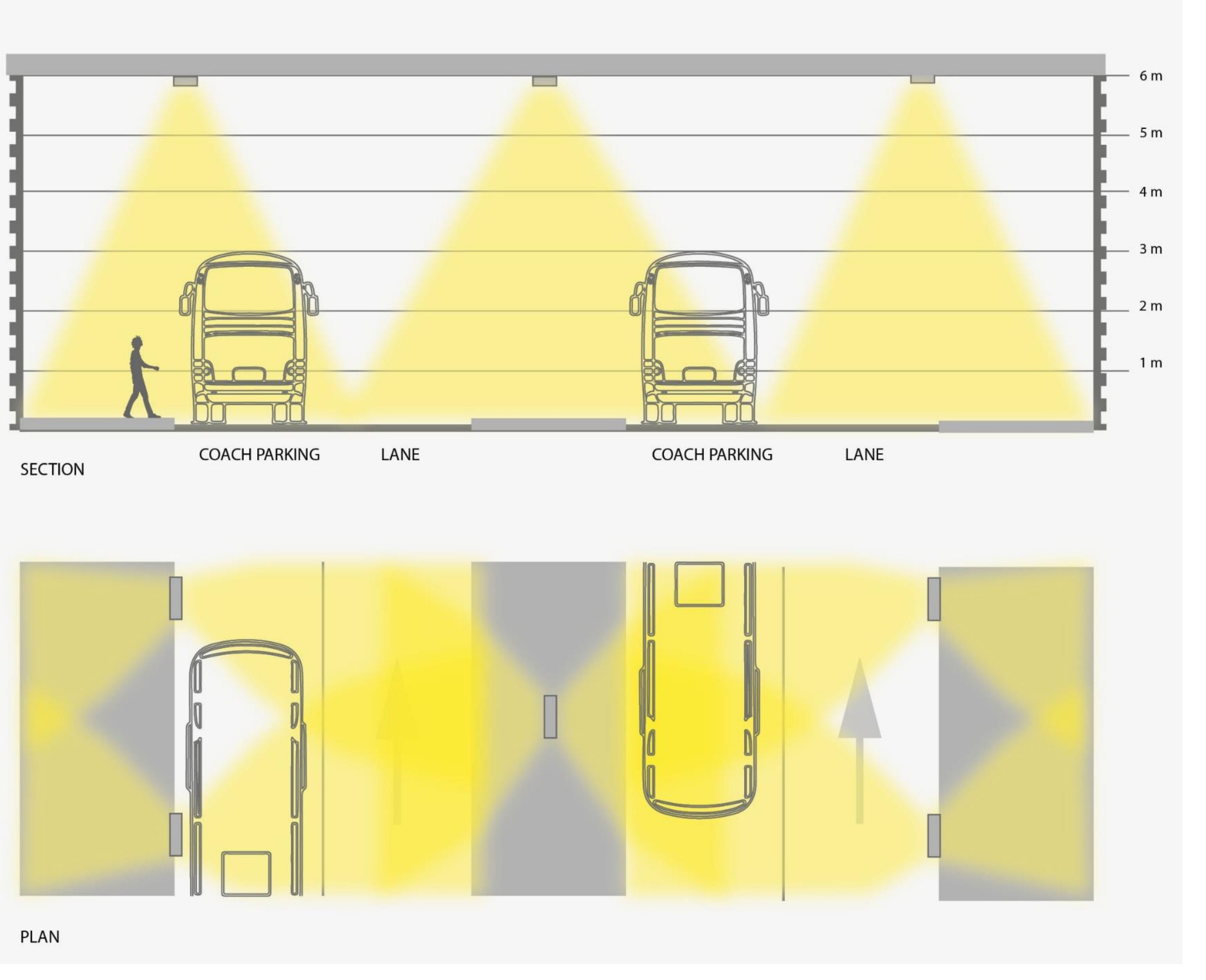
12.1.1 Figure 37 shows a typical lighting arrangement for a coach station undercroft.

12.1.2 In principle, the following will be considered in development of the lighting design:

- The area under the canopy will be illuminated by the use of luminaires at canopy level. Lighting will use white light sources which will be dimmable. A good uniformity over the space will be achieved.
- The lighting will have reduced output during off peak periods, dimming the lighting uniformly down to an appropriate level. Lighting under the canopy will be switched off where daylighting levels permit.
- Lighting will be controllable around the vehicle entrances, to account for visual adaptation when entering from a bright daylight environment.
- Luminaires will not be installed above the coach parking lanes/ spaces to provide lighting from both sides when the coach is parked. This also enables safer servicing of the luminaires without obstruction of the road by access equipment.
- Raise/lower luminaire systems could be considered to minimise high level maintenance access.
- The luminaire chosen will be a ‘flat glass’ type with 0% uplight and no tilt above horizontal level to minimise light obtrusion and environmental impact.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.

12.1.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 37: Coach station typical lighting arrangement**



## 12.2 Bus stop

12.2.1 Figure 38 shows a typical lighting arrangement for a bus stop.

12.2.2 In principle, the following will be considered in development of the lighting design:

- The area will be illuminated by the use of column mounted luminaires with luminaires integrated into the bus shelter design. Lighting will use white light sources which will be dimmable.
- The lighting will have reduced output during off-peak periods, dimming the lighting uniformly down to an appropriate level. Lighting will be switched off where daylighting levels permit.
- A good uniformity over the road and bus stop will be achieved by utilising road lighting luminaires mounted on columns with a staggered arrangement.
- The preferred height of the road lighting luminaires will be 6m above finished ground level to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source
- If practicable, base hinged columns are preferred to minimise high level maintenance. Mid-hinge columns (Figure 39) may also be considered because these fold down into a smaller area and which will have lower impact on the car park space clearance requirements when lowering.

12.2.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 38: Bus stop typical lighting arrangement**

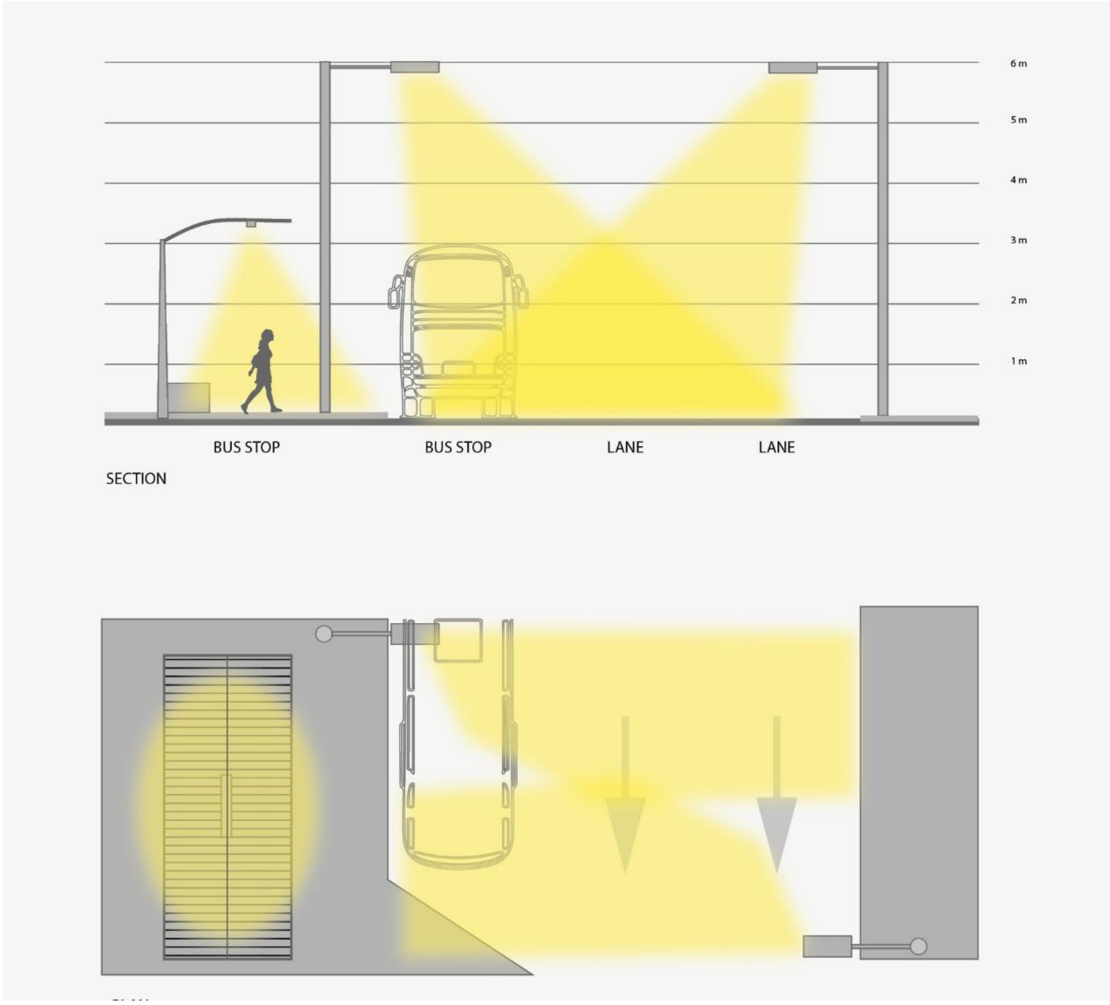
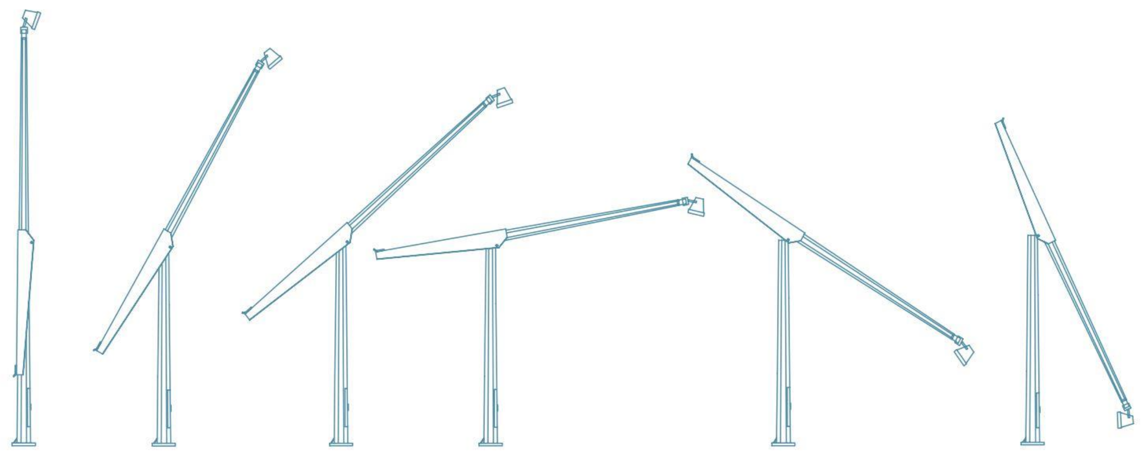



**Figure 39: Mid-hinge lighting columns**



# 13 Car Parks

## 13.1 General

13.1.1 For many, the surface car parks are the first and last impressions of the users of the airport. The car parks serve two types of user who each have particular requirements, for example:

- Vehicle users need to navigate safely to the car park space and avoid pedestrians
- Pedestrians need to walk to/from their car to the terminal or bus stop. They need to easily identify the walking routes and feel safe as they travel.

13.1.2 The needs of the drivers and general illumination of the roadways and parking bays are described later in this section. Reference will also be made to Sections 11.2 and 11.3 for dedicated illumination of the primary walking routes through the car parks.

13.1.3 Consideration will be given to the lighting of Terminal shuttle bus-stops to make them easily identifiable and to readily orientate users towards them (e.g. Figure 40). The lighting performance will consider the avoidance of significant contrast with the surroundings (e.g. Figure 41) particularly where the ambient illumination is lower e.g. long-stay.

## 13.2 Single bay

13.2.1 Figure 42 shows a typical arrangement for a car park, single parking bay and access.

13.2.2 In principle, the following will be considered in development of the lighting design:

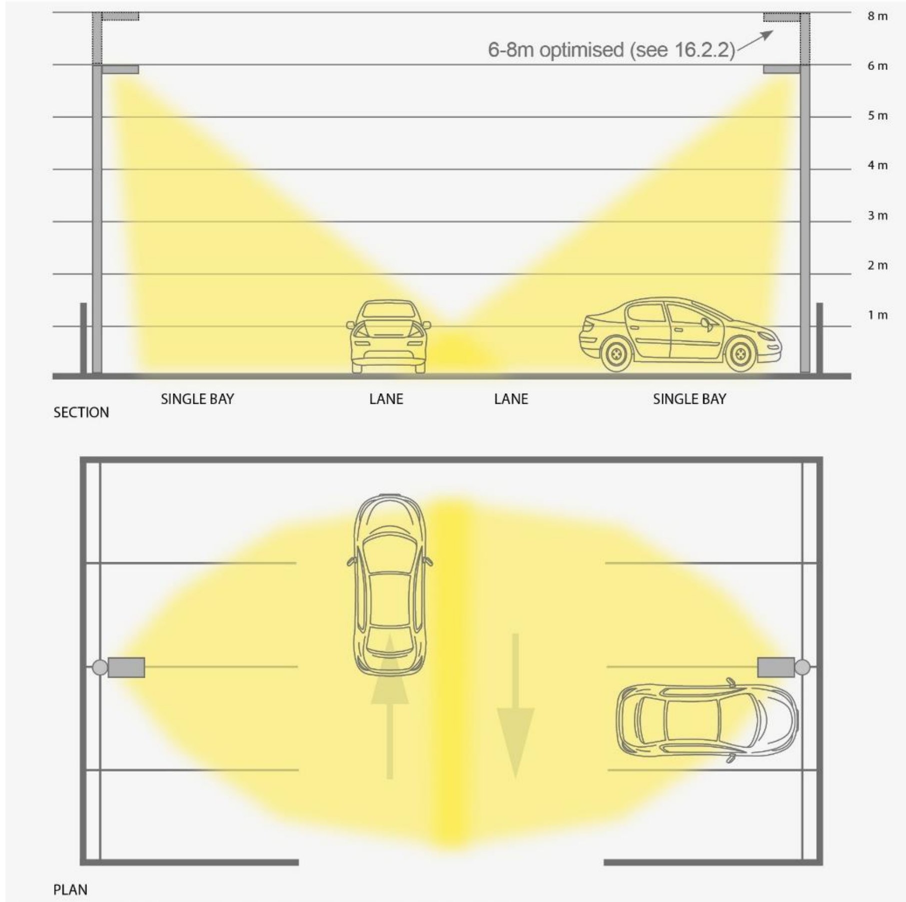
- Car park lighting will use white light sources which will be dimmable.
- Good uniformity over the space will be achieved by utilising column mounted luminaires located on the back edge.
- Columns will be aligned with the parking space lines to minimise chance of collision. Column height will be 6-8m, optimised for efficient spacing and uniformity and dependant on the scale of the car park. 6m is preferred at the perimeter to reduce back-spill light beyond.
- The preferred height of the column mounted luminaires will not exceed 8m above finished ground level to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a ‘flat glass’ type with 0% uplight and no tilt above horizontal level.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- If practicable, base hinged columns are preferred to minimise high level maintenance. Mid-hinge columns (Figure 39) may also be considered because they fold down into a smaller area and which will have lower impact on the car park space clearance requirements when lowering.

13.2.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 40: Shelter illumination**

**Figure 41: High contrast with surroundings**

**Figure 42: Single parking bay typical lighting arrangement**



## 13.3 Surface Double Bay

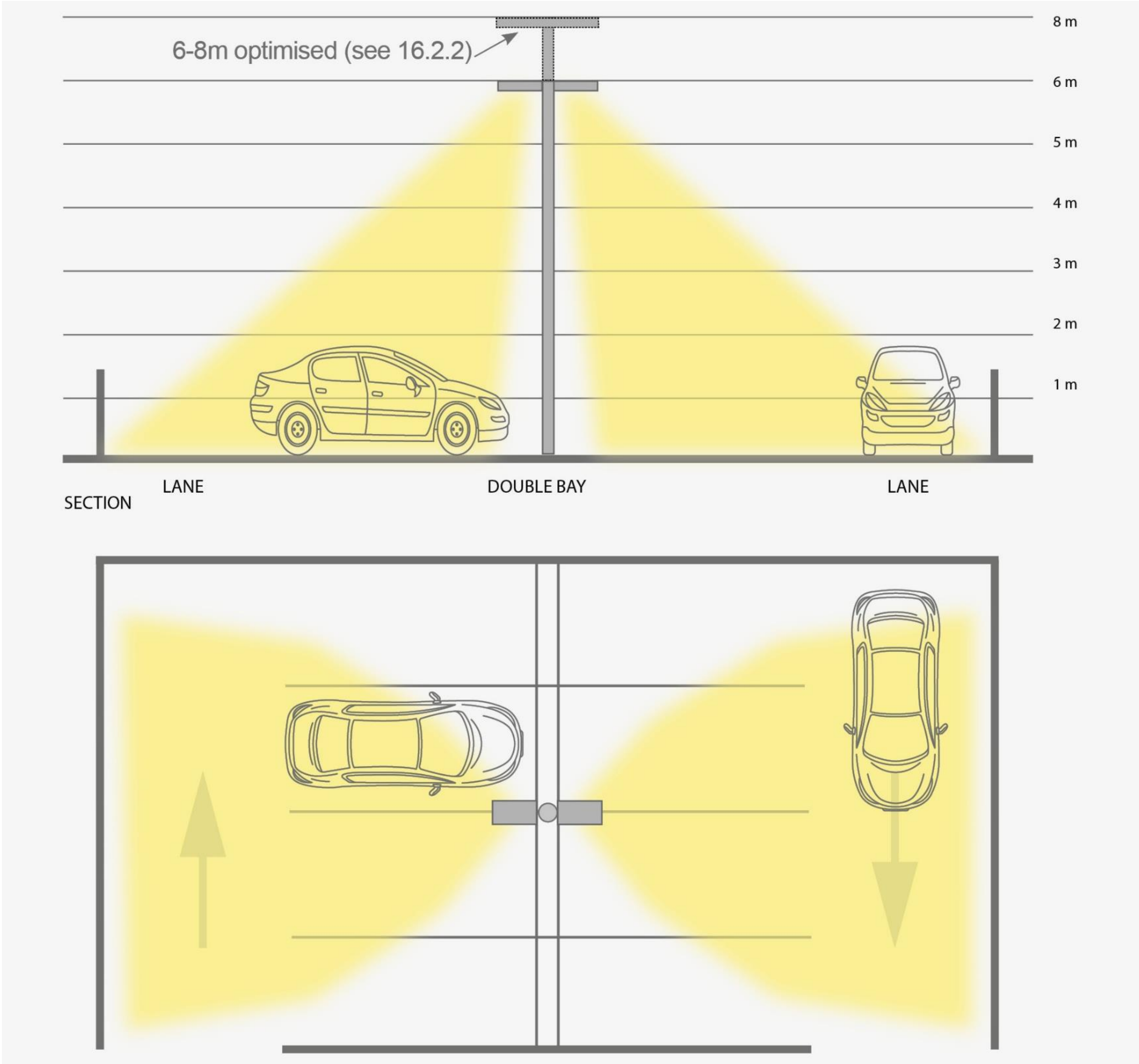
13.3.1 Figure 43 shows a typical arrangement for a car park, double parking bay and access.

13.3.2 In principle, the following will be considered in development of the lighting design:

- Car park lighting will use white light sources which will be dimmable.
- A good uniformity over the space will be achieved by utilising luminaires mounted on columns located in between the parking spaces.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- Columns will be aligned with the parking space lines to minimise chance of collision.
- Column height will be 6-8m, optimised for efficient spacing and uniformity and dependant on the scale of the car park. 6m is preferred at the perimeter to reduce back-spill light beyond
- The preferred height of the column mounted luminaires will not exceed 8m above finished ground level to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level.
- If practicable, base hinged columns are preferred to minimise high level maintenance. Mid-hinge columns (Figure 39) may also be considered because they fold down into a smaller area and which will have lower impact on the car park space clearance requirements when lowering.

13.3.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 43: Double parking bay typical lighting arrangement**



## 13.4 Surface with PV Array Canopy

13.4.1 The Gatwick Energy Strategy considers the application of photovoltaic (PV) arrays on the surface car parks in the form of canopies above the car parking spaces.

13.4.2 In this instance, the standard car park column lighting solution may be compromised by the canopies which will shadow the car park bays and connecting roadways.

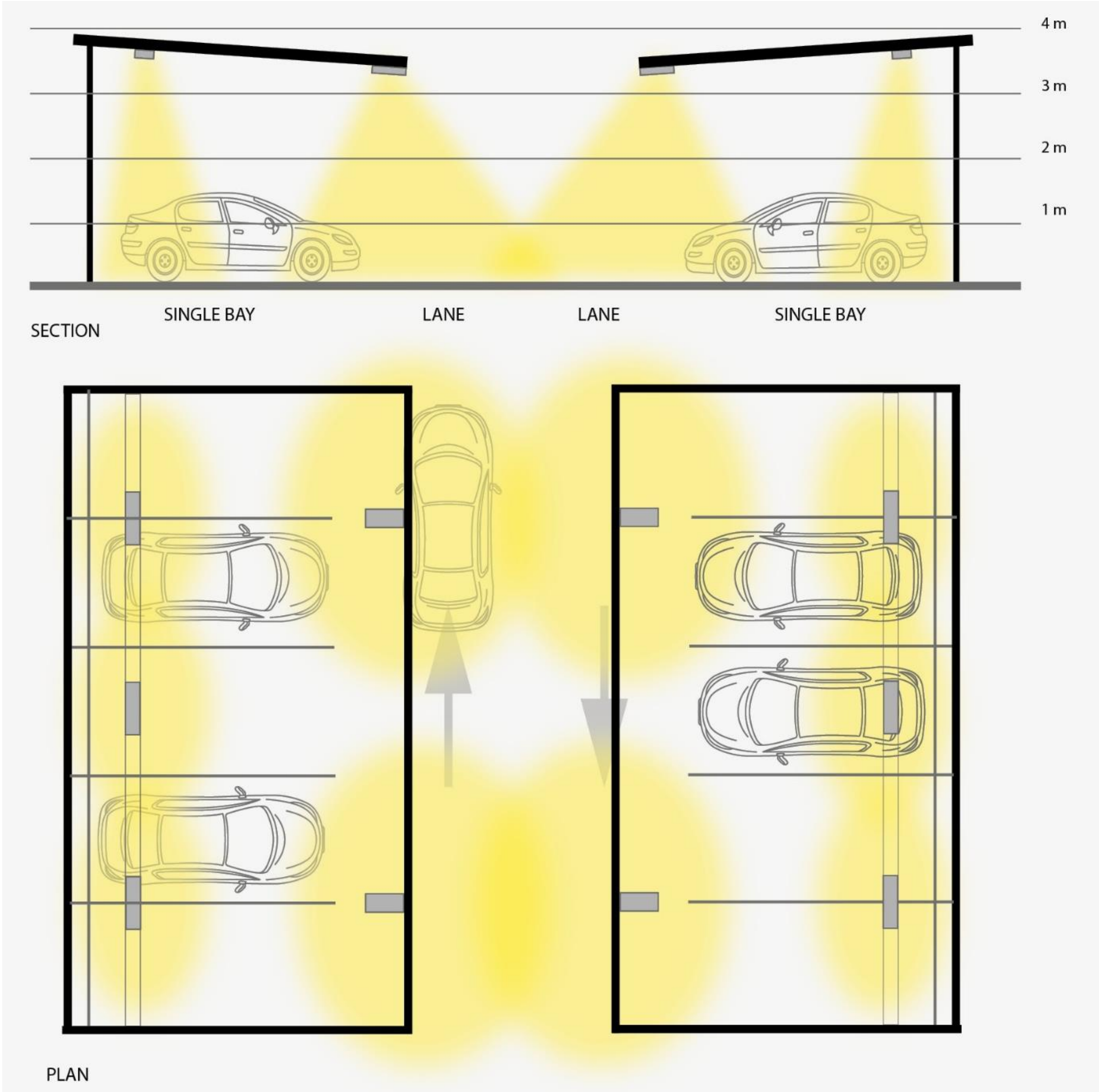
13.4.3 In this scenario, lighting may be integrated within the canopy edge and underside in order to illuminate the car park bays and the connecting roadways (Figure 44). The rear mounted lighting could be triggered by presence detection to only work when customers access the rear of the car parking bay.

13.4.4 This solution has the advantage of removing high level maintenance of 8-10m lighting columns. Lighting could be integrated into the construction of the PV canopy and be directly powered from the array thus avoiding additional cabling and electrical distribution infrastructure.

13.4.5 Supplementary lighting may still be required to serve the walking routes connecting the car parks to the terminal or shuttle bus-stops.

13.4.6 Refer to Table A1. 2 for specific lighting requirements.

**Figure 44: Parking beneath PV array canopies**



# 14 Decked Car Parks

## 14.1 Open roof, single parking bay

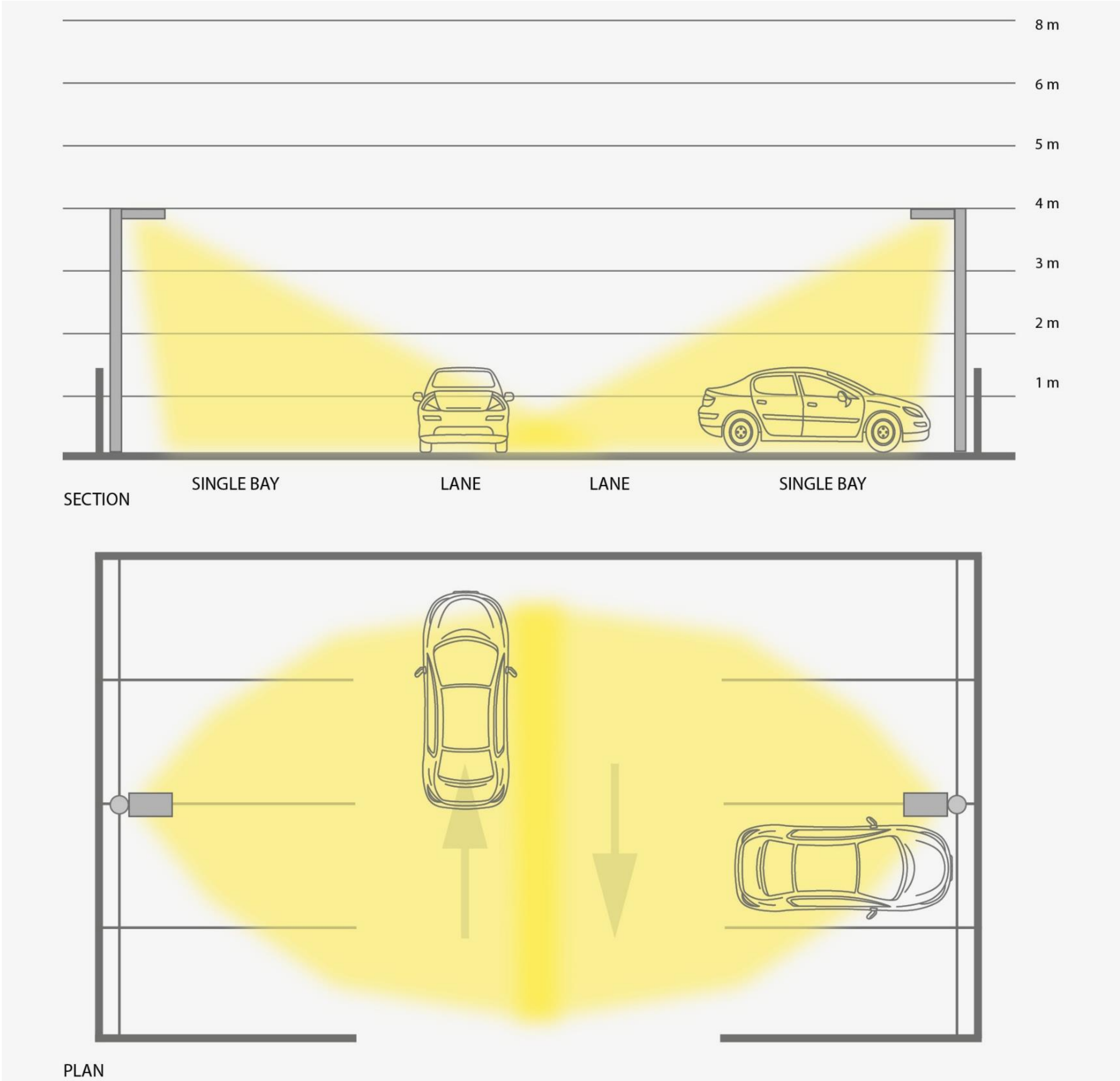
14.1.1 Figure 45 shows a typical arrangement for an open roof car park, single parking bay and access.

14.1.2 In principle, the following will be considered in development of the lighting design:

- Car park lighting will use white light sources which will be dimmable.
- A good uniformity over the space will be achieved by utilising luminaires mounted on columns at the perimeter of the car park.
- Columns will be aligned with the parking space lines to minimise chance of collision.
- The preferred height of the column mounted luminaires will not exceed 4m (where practicable) above finished deck level to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level.
- Barrier design will limit vehicle headlight spill externally.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- If practicable, base hinged columns are preferred to minimise high level maintenance. Mid-hinge columns (Figure 39) may also be considered because they fold down into a smaller area and which will have lower impact on the car park space clearance requirements when lowering.

14.1.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 45: Single bay parking spaces lighting arrangement (open roof)**



## 14.2 Open roof, double parking bay

14.2.1 Figure 47 shows a typical arrangement for an open roof car park, double parking bay and access. Car Park H has a maximum height limitation and therefore lower height columns (e.g. 3m) will be utilised with supplementary low level lighting opposite (Figure 46).

14.2.2 In principle, the following will be considered in development of the lighting design:

- Car park lighting will use white light sources which will be dimmable.
- A good uniformity over the space will be achieved by utilising luminaires mounted on columns located in between the parking spaces.
- Columns will be aligned with the parking space lines to minimise chance of collision.
- The preferred height of the column mounted luminaires will not exceed 4m (where practicable) above finished deck level to minimise light obtrusion and environmental impact. Equally the luminaire chosen will be a 'flat glass' type with 0% uplight and no tilt above horizontal level.
- Barrier design will limit vehicle headlight spill externally.
- Precise lenses, baffles and light shields will be used to further restrict the potential for obtrusive light to ecologically sensitive areas and surrounding rural landscape, in particular to minimise direct views of the light source.
- If practicable, base hinged columns are preferred to minimise high level maintenance. Mid-hinge columns (Figure 39) may also be considered because these fold down into a smaller area and which will have lower impact on the car park space clearance requirements when lowering.

14.2.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 46: Car Park H (alternative arrangement)**

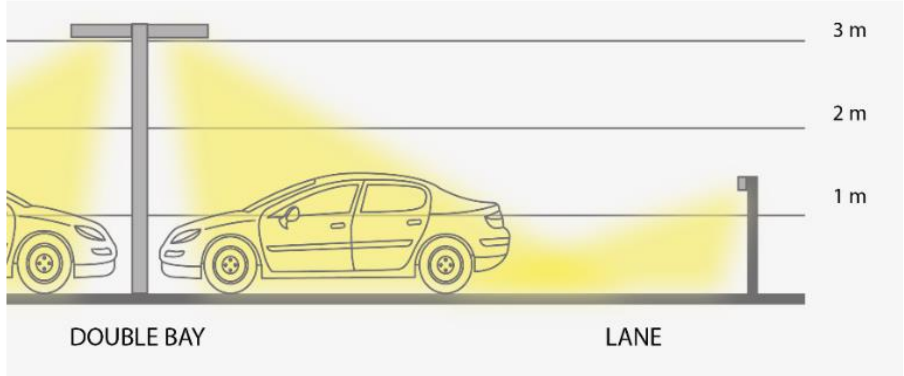
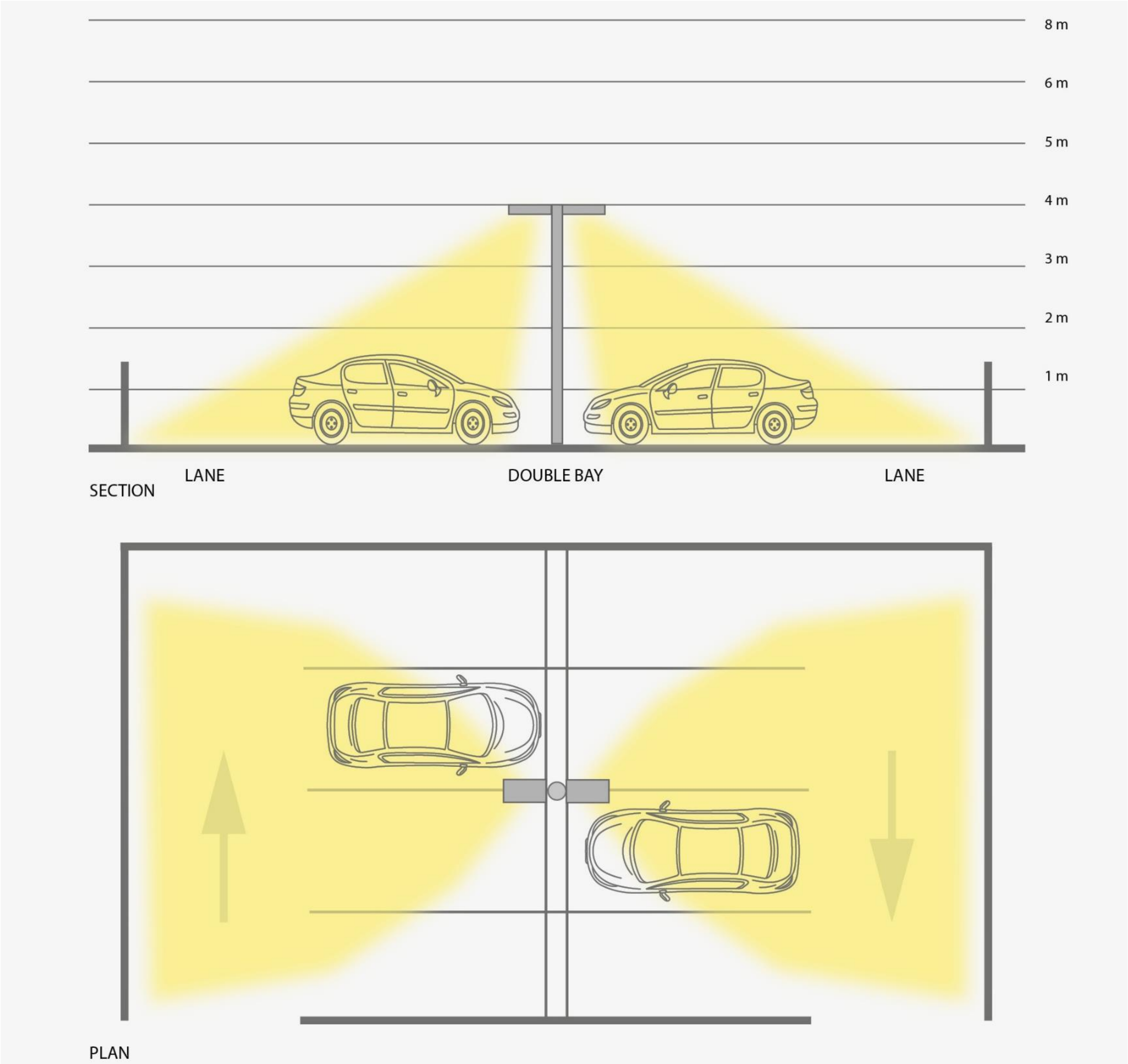



**Figure 47: Double bay parking spaces lighting arrangement (open roof)**



# 15 MSCP

## 15.1 Drop-off/Pick-Up (Forecourt)

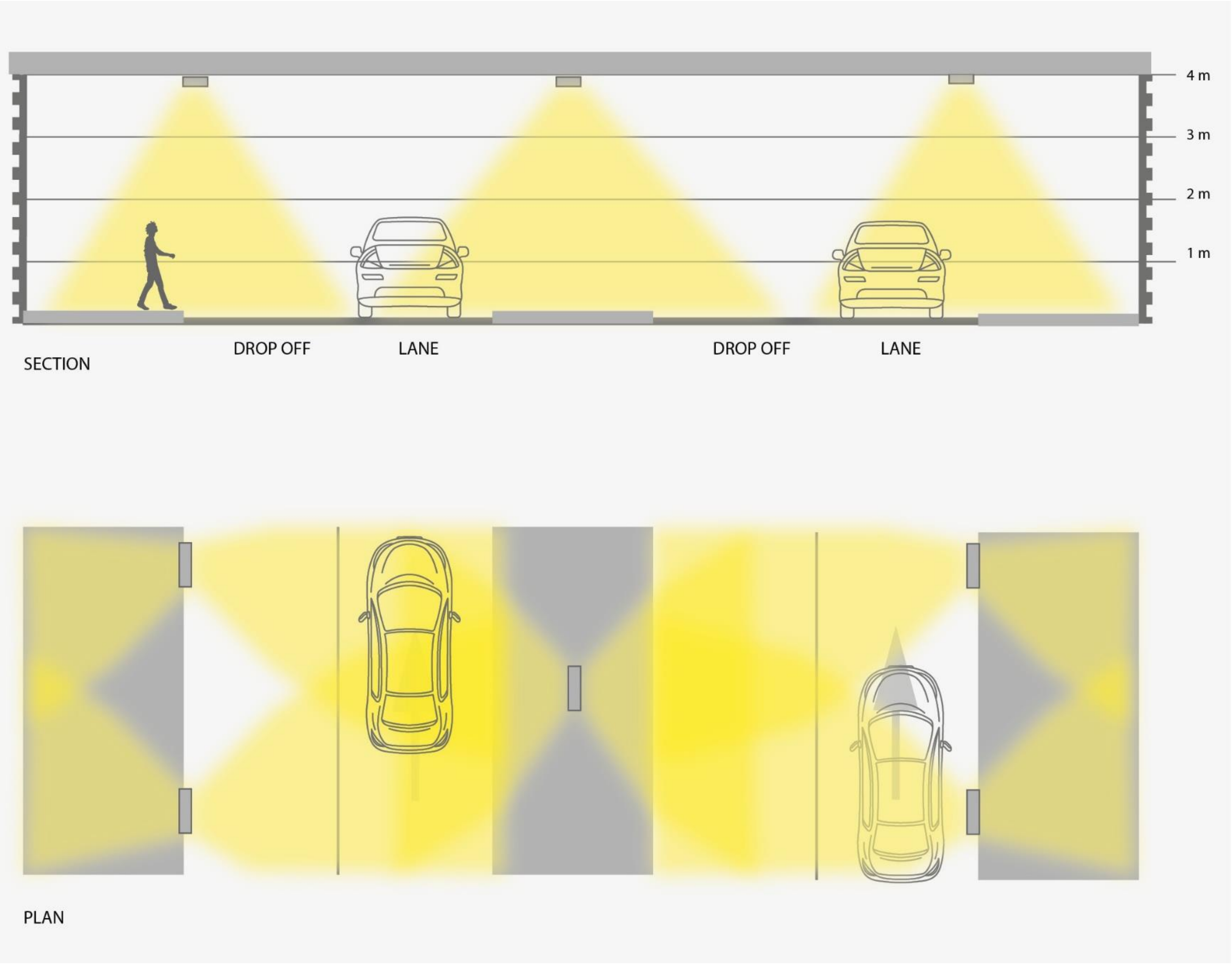
15.1.1 Figure 48 shows a typical lighting arrangement for a drop-off/pick-up area and access.

15.1.2 In principle, the following will be considered in development of the lighting design:

- Drop-off/pick-up area lighting will use white light sources which will be dimmable. A good uniformity over the space will be achieved, with higher illuminance over the drive lane and walkways.
- Lighting will be controllable around the vehicle entrances, to account for visual adaptation when entering from a bright daylight environment.
- The lighting will have reduced output during off-peak periods, dimming the lighting uniformly down to an appropriate level.
- Perimeter lighting will be switched off where daylighting levels permit.
- Luminaires will be installed to the side of the road and along the travel lanes and drop-off to ease maintenance and minimise vehicle movement disruption.

15.1.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 48: Drop-off/Pick-up typical lighting arrangement**



## 15.2 Car-park (interior)

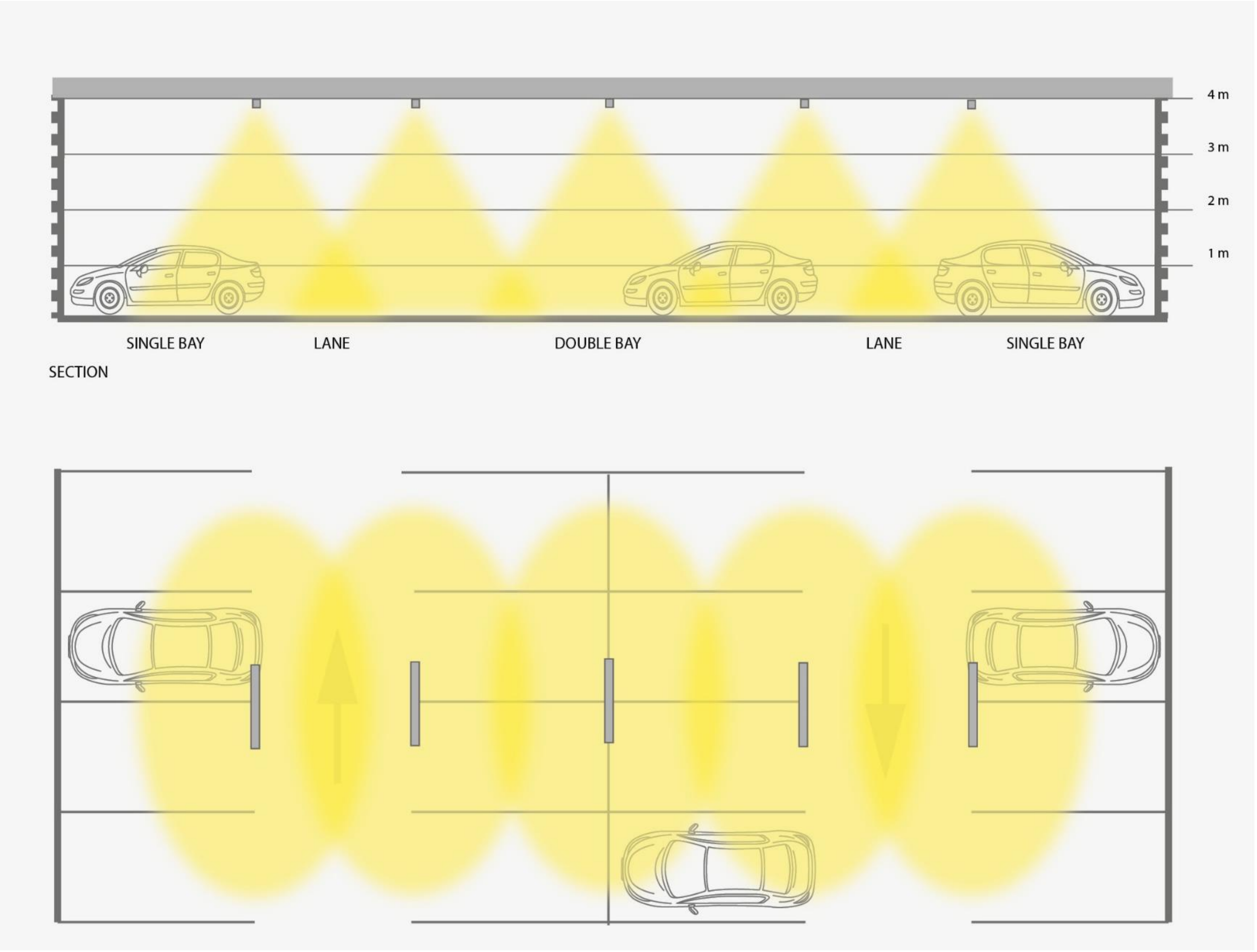
15.2.1 Figure 49 shows a typical lighting arrangement for an interior car park, parking bays and access.

15.2.2 In principle, the following will be considered in development of the lighting design:

- Car park lighting will use white light sources which will be dimmable. A good uniformity over the space will be achieved, with higher illuminance over the drive lane and walkways.
- Lighting will be controllable around the vehicle entrances, to account for visual adaptation when entering from a bright daylight environment.
- The lighting will have reduced output during off peak periods, dimming the lighting uniformly down to an appropriate level. When a passenger walks onto a floor through any access point the illumination for that floor will ramp up to full output, reducing again after a reasonable length of time.
- Perimeter lighting will be switched off where daylighting levels permit.
- Luminaires will be installed to the side of the drive lanes to ease maintenance and minimise vehicle movement disruption.

15.2.3 Refer to Table A1. 2 for specific lighting requirements.

**Figure 49: Interior car park typical lighting arrangement**



# 16 Hotel and Office Buildings

## 16.1 Views

16.1.1 Tall buildings and structures at Gatwick Airport are currently visible in views from the edges of local settlements, transport corridors, public rights of way and open space. Overflying aircraft are also visible from locations throughout the study area. Due to a combination of the relatively flat landform and mature vegetation, the airport is relatively well contained in mid to long distance views.

16.1.2 As such, the external illuminated character of such buildings within the Project scheme will conform to a general standard of performance to ensure cohesion within the overall Project.

16.1.3 Specific lighting requirements for the illumination of hotel and office façades and entrances can be found in the following key CIBSE and ILP guidance documents

- SLL LG6 (External Lighting)
- ILP GN01 (Obtrusive Light)
- ILP PLG05 (Illuminated Advertisements)

16.1.4 Further details of these documents and other relevant documents can be found in the Technical Addendum in Annex A.

## 16.2 Entrances and Façades

16.2.1 The external illuminated character of hotel and office buildings within the Project site is primarily governed by the following aspects of design:

- Branding and signage requirements as agreed with Gatwick.
- Planning conditions applied by the local planning office
- Level of illumination of the building fabric.
- Prominence of the building location relative to potential sensitive receptors.

16.2.2 All external lighting to such buildings will preferentially utilise static illumination. Where dynamic illumination is warranted and agreed for use with Gatwick stakeholders, it will be used in moderation and with sufficiently long transition intervals so as not to be perceived as distraction in the form of strobing or movement.

16.2.3 The use of coloured lighting may be permitted for branding or architectural purposes but requires approval from Gatwick stakeholders to ensure that the scheme maintains an appropriate character for its place within the development.

16.2.4 Uplighting will be limited and controlled to ensure that it is localised and does not contribute to obtrusive light. Furthermore it must be designed to not distract from, or adversely affect, the AGL systems.

16.2.5 Lighting will not be dangerous or confusing to pilots or Air Traffic Control. Searchlighting and similar forms of focused projection such as the use of lasers, etc. are prohibited.

## 16.3 Light Intrusion

16.3.1 In addition to the consideration of external receptors, light obtrusion and operational use, the design of façade illumination will also ensure that it does not result in light intrusion into the hotel accommodation of staff and guests.

## 16.4 Energy

16.4.1 Specific energy targets will vary by scheme. Refer to Gatwick Technical Standards for specifics and the Decade of Change report for the long term ambition of Gatwick.

16.4.2 Additionally, project schemes may also aim for external accreditation, such as BREEAM. Such schemes typically include targets for the control of obtrusive light, the use of energy efficient luminaires, and the provision of lighting control to automatically dim or deactivate lighting when not required.

## 16.5 Lighting Controls

16.5.1 Recognising the 24 hour nature of the site, a balance will be considered in deciding the lighting controls to allow for a reduction in non-essential lighting provision during non-peak hours, while ensuring that there is sufficient illumination for wayfinding and functional navigation. Refer also to Section 4.

## 16.6 Obstacle Lighting

16.6.1 Coordination is required with Gatwick stakeholders and the safeguarding team to determine if the provision of Obstacle Lighting is necessary on tall buildings or structures. Reference will be made to Chapter Q of CAA 139 for guidance on the requirements.

# 17 Aircraft stands

## 17.1 Description

17.1.1 The lighting installation for the aircraft stand will typically comprise high-mast floodlighting located located in specific areas in the airfield apron and subject to OLS limitations (refer also to CAA 139 regulations).

## 17.2 Guidance

17.2.1 Design constraints of the airfield planning and the services infrastructure will affect both the height and position of the floodlight masts. The masts will also be sited so that floodlights do not create glare, which could adversely affect visibility of ground staff, pilots or Air Traffic Control (ATC) tower operatives.

17.2.2 The ATC tower must be able to view all aircraft movements both in the air and on the ground at all times while it remains operational. Direct view of apron lighting from the ATC tower will be avoided.

17.2.3 Floodlight masts are normally configured to provide lighting of the stand from two directions to avoid shadowing. Consideration will be given to electrical circuitry and lighting control design on a stand by stand basis to allow shut-down without affecting the operation of adjacent stands.

17.2.4 Gatwick Airport uses two types of stands - pier-served stands and remote stands. The preferred lighting arrangement illustrated at the Figure 50 is a typical high-mast floodlighting column configuration for a pier-served stand. The principle illustrated applies to remote stands as well.

17.2.5 The recommended light source for the aircraft stand lighting will have a long lifetime expectancy and good quality of colour rendering.

17.2.6 Lighting to the back of stand roads service area, and inter-stand roads can be provided by the high-mast floodlighting columns. Appropriate attention will be taken to positions of shadows (e.g. under air-bridges), where additional lighting will be provided if required.

17.2.7 Refer to the relevant CAA, EASA and ICAO standards listed within Table A1. 1 for specific Aircraft Stand lighting requirements.

17.2.8 The current Gatwick Technical Standards may also be referenced for information, however, its contents relate to older lighting technologies and have generally been superseded by the standards noted above.

17.2.9 Limiting glare to pilots, ground staff and safety critical operatives such as air traffic control is essential when designing the airport lighting systems. High power lighting systems, such as apron lighting systems, will be designed to limit glare. ICAO offers some guidance for mounting height and aiming of apron lighting systems which is summarised in the diagrams in Figure 51 and and Figure 52. Of particular note is the floodlight mounting height which is recommended to be at least 2x the pilot height.

17.2.10 Anecdotally, LEDs are perceived to have a greater glare impact, perhaps due to their compact size and high intensity. Best practice with LEDs recommends the highest tilt angle and/or peak intensity (in the case of asymmetric floodlights) should not exceed 65°. This will also be a consideration when selecting the mounting height.

17.2.11 There is no specific reference to glare control metrics in the CAA, EASA or ICAO standards. However, BS EN 12464-2 makes reference to $R_G$<50 for apron areas and this is recommended to be applied to the design of new lighting systems.

17.2.12 Base hinged columns or raise/lower luminaire cradles may be considered to mitigate the safety risks associated with high-level maintenance, but may not be practicable in all scenarios. Their application will be subject to a risk assessment contributed to be the designer and end-user. The use of LED technology will help reduce maintenance frequency.

17.2.13 It is noted the LED drivers are typically the component most likely to fail. Some manufacturers are offering remote drivers and these will be considered to be installed at ground level (rather than integral to the luminaires) to minimise high-level maintenance.

17.2.14 Consideration will be given to determining if the provision of Obstacle Lighting is necessary on the high mast systems in view of their proximity to the runway. Reference will also be made to Chapter Q Visual Aids For Denoting Obstacles of CAA 139.

**Figure 50: Aircraft stands lighting arrangement**

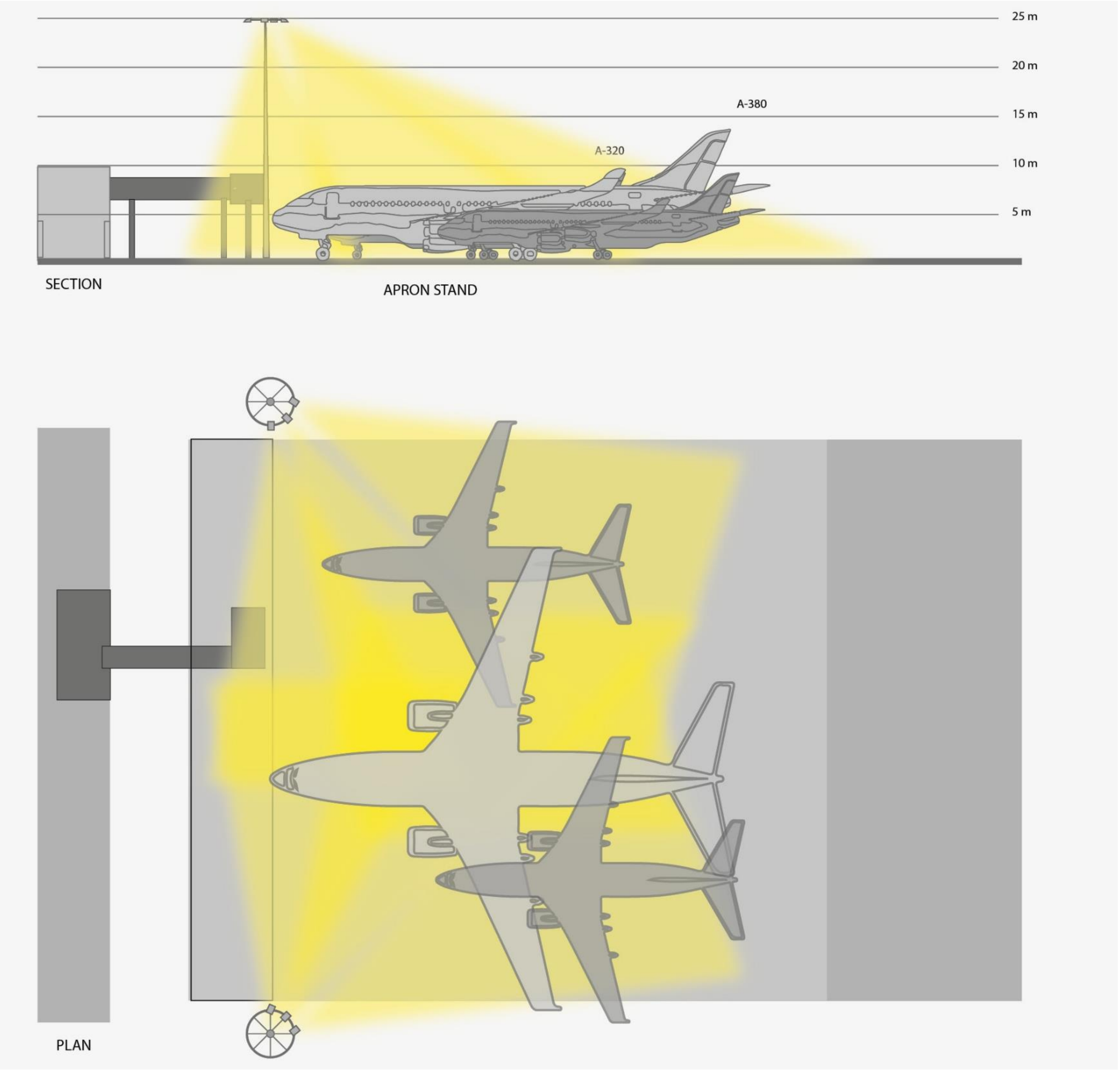


**Figure 51: Aircraft stands mounting height recommendations (ICAO Aerodrome Design Manual Part 4, Figure 13-5)**

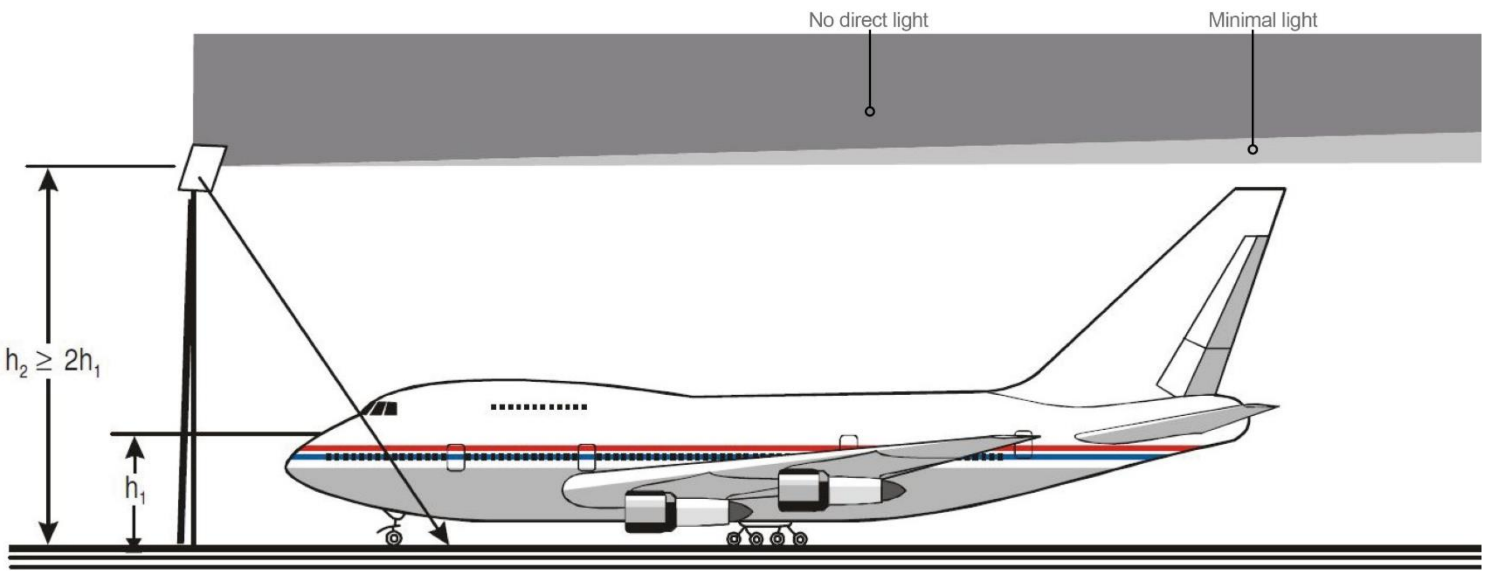
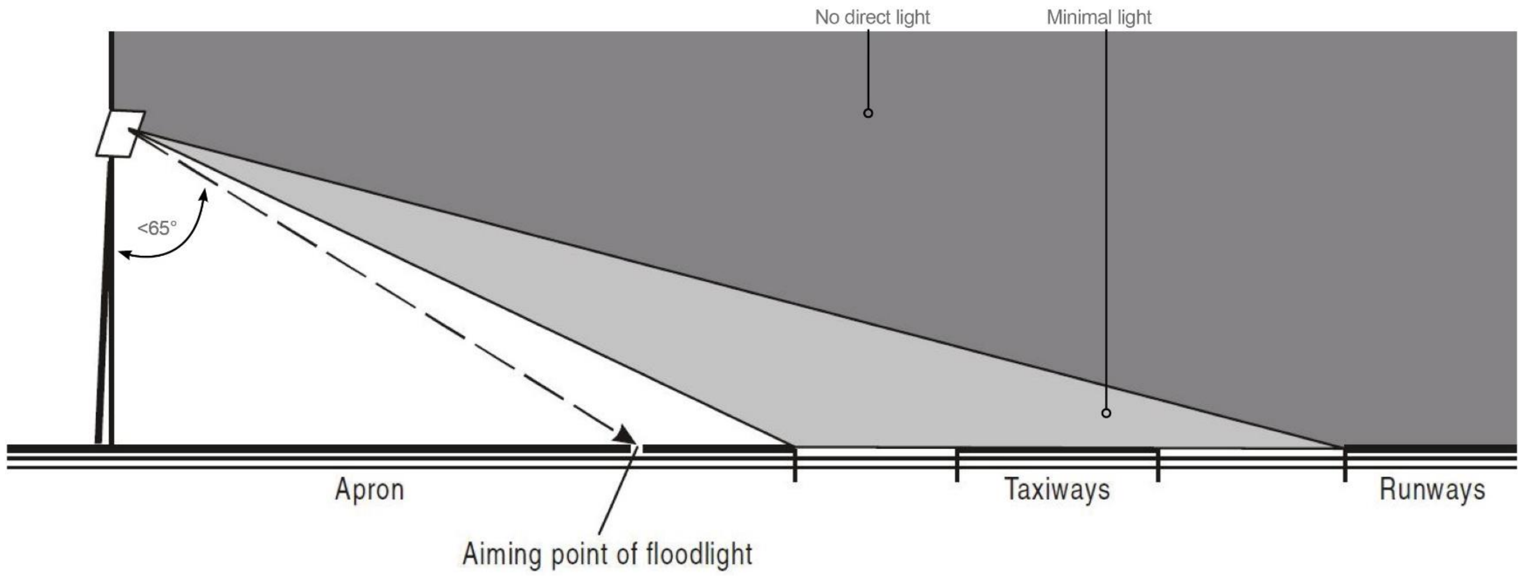



**Figure 52: Aircraft stands, aiming to avoid glare (ICAO Aerodrome Design Manual Part 4, Figure 1-6)**




# 18 Aeronautical Ground Lighting

## 18.1 Specialist AGL

18.1.1 Aeronautical ground lighting will be provided in line with the project requirements and will include consideration of the Runway (including Approach Lighting System) and Taxiway Lighting, covering the following works:

- Amendments to the existing standby runway for use as the Northern runway and repositioning of the centreline.
- Reconfiguration of taxiways.
- Pier and stand alterations (including the proposed new pier).
- Reconfiguration of airfield facilities.

18.1.2 Aeronautical Ground Lighting will be procured from a specialist AGL manufacturer.

18.1.3 In addition to meeting the AGL requirements, the following will be considered:

- Glare and visibility to nearby sensitive receptors, in relation to Approach Lighting; the opportunity to provide mitigation will be investigated where practicable.
- The road lighting designer will ensure that road lighting columns in the vicinity of AGL systems such as Approach Lighting pylons do not clash or obstruct the operation of the AGL.
- The lighting designer will coordinate with the AGL designer and systems to ensure that the lighting design does not cause glare, form dangerous or confusing patterns, or obstruct the operation of AGL.

18.1.4 Refer to the relevant CAA, EASA and ICAO standards listed within Table A1. 1 for specific lighting requirements.

# Annex 1

## Standards and Guidance

A1.1 The reference standards and guidance documents used for the Operational Lighting Framework are described Table A1. 1 and will be considered in the Project lighting design.

A1.2 The following sections summarise the key documents, however the lighting designers will not be limited to the data found in these sections and will refer to each complete standard/guidance document when preparing their lighting designs. The designer will refer to the latest version of these documents, or that which supersedes it.

**Table A1. 1 Standards and Guidance documents**

| Document No. | Title |
|---|---|
| BS 5489-1 | Design of road lighting Part 1: Lighting of roads and public amenity areas — Code of practice. |
| BS EN 12464-2 | Light and lighting - Lighting of work places Part 2: Outdoor work places. |
| BS EN 12464-1 | Light and lighting - Lighting of work places Part 1: Indoor work places. |
| BS EN 13201-1 | Road Lighting - Part 1: Guidelines on selection of lighting classes. |
| BS EN 13201-2 | Road Lighting - Part 2: Performance requirements. |
| BS 8300-1 | Design of an accessible and inclusive built environment - Part 1: External environment — Code of practice |
| BS 8300-2 | Design of an accessible and inclusive built environment - Part 2: Buildings — Code of practice |
| BSI PAS 463 | Guide: Design for the mind. Neurodiversity and the built environment |
| ILP GN01 | Guidance Notes for the Reduction of Obtrusive Light. |
| ILP GN08 | Bats and artificial lighting in the UK; Bats and the Built Environment series. |
| ILP GN11 | Determination of Maintenance Factors |
| ILP PLG 02 | The Application of Conflict Areas on the Highway. |
| ILP PLG 03 | Lighting for Subsidiary Roads: Using white light sources to balance energy efficiency and visual amenity. |
| ILP PLG 04 | Guidance on Undertaking Environmental Impact Assessments. |
| ILP PLG 05 | The Brightness of Illuminated Advertisements. |
| ILP PLG 23 | Lighting for Cycling Infrastructure. |
| ILP TR 12 | Lighting of Pedestrian Crossings. |
| ILP TR 24 | Guidance on the Development of Public Lighting Policy. |
| CIBSE SLL LG6 | Lighting Guide LG6: The exterior environment. |
| CIBSE SLL LG12 | Emergency Lighting. |
| CIBSE SLL LG15 | Lighting Guide LG15: Transport buildings. |
| CIBSE SLL LG21 | Lighting Guide LG21: Protecting the night-time environment |
| CIBSE TM66 | Circular Economy Assessment Method, TM66 Toolset |
| CAA 139 | CS & GM for Aerodromes (Regulation (EU) No 139/2014 as retained in (and amended by) UK law |
| CAP 393 | Air Navigation: The Order and Regulation. |
| ICAO Annex 14 | International Civil Aviation Organisation: Aerodromes Volume I Aerodrome Design and Operation. |
| ICAO Doc 9157, AN/901 | Aerodrome Design Manual, Part 4: Visual Aids |
| 20000-XX-Q-XXX-STD-000050 Rev.02 | Gatwick Airport Ltd - Interior and Exterior Lighting Technical Standard. |
| SP-EE-002-05* | Gatwick Airport Ltd - Airside Electrical Engineering Reference Specification - Apron Floodlighting. |
| 20000-XX-Q-XXX-STD-000037 Rev.01 | Gatwick Airport Ltd - Emergency Lighting Technical Standard. |
| Decade of Change | Gatwick Airport Ltd - second Decade of Change Report (June 2021). |
| IEEE 1789 | IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers. |
| BS EN 1838 | Lighting applications - emergency lighting |
| Historic England | External Lighting for Historic Buildings |
| CIBSE HIST | Guide to Building Services for Historic Buildings - Sustainable Services for Traditional Buildings |
| Health and Safety Executive | The Construction (Design and Management) Regulations 2015 |

*Standard predates current lighting technologies and standards. Where possible, lighting criteria have been adhered to; otherwise modern industry standards have been followed.

A1.3 The following tables have been compiled from the standards and guidance documents described in Table A1. 1, to present the minimum maintained recommended general lighting requirement for the airport.

A1.4 Table A1. 2 presents the exterior airside and landside illuminance recommendations for the various external areas of the airport.

**Table A1. 2: General lighting requirements - Airport exterior areas**

| Type of area, task or activity | Illuminance Em (lux) | Uniformity Uo | Glare RG | Colour Rendering Ra | Notes/Specific Requirements |
|---|---|---|---|---|---|
| **Airport Landside - External Car Parks** | | | | | |
| Long stay Car Park (Light Traffic) | 5 | 0,25 | 55 | 20 | Illuminance at ground level or deck level for open roof car parks. |
| Mid stay Car Park (Light Traffic) | 5 | 0,25 | 55 | 20 | Illuminance at ground level or deck level for open roof car parks. |
| Short stay Car Park (Light Traffic) | 10 | 0,25 | 50 | 20 | Illuminance at ground level or deck level for open roof car parks. |
| Staff Parking (Light Traffic) | 5 | 0,25 | 55 | 20 | Illuminance at ground level or deck level for open roof car parks. |
| **Airport - Airside** | | | | | |
| Aircraft stand Horizontal | 20 | 0.25 | - | - | |
| Aircraft stand Vertical | 20 | - | - | - | Illuminance at 2m above the apron in relevant directions. |
| Other apron areas - Horizontal | 10 | 0.25 | - | - | 50% of average illuminance on aircraft stands. |
| **Airport - Other areas** | | | | | |
| Hangar Apron | 20 | 0,10 | 55 | 20 | |
| Terminal Apron | 20 | 0,25 | 50 | 20 | |
| Loading Areas | 20 | 0,25 | 50 | 40 | For reading labels $E_m$ = 50 lux |
| Fuel Depot | 50 | 0,25 | 50 | 40 | |

**Table A1. 3: General lighting requirements - Airport interior areas**

| Type of area, task or activity | Illuminance $E_m$ (lux) | Uniformity $U_o$ | Glare $R_G$ | Colour Rendering $R_a$ | Notes/Specific Requirements |
|---|---|---|---|---|---|
| **Airport Landside - Internal Car Parks** | | | | | |
| In/Out Ramps (daytime) | 300 | 0,4 | 25 | 40 | Illuminance at floor level.<br>Safety colours will be recognisable. |
| In/Out Ramps (night-time) | 75 | 0,4 | 25 | 40 | Illuminance at floor level.<br>Safety colours will be recognisable. |
| Traffic Lanes | 75 | 0,4 | 25 | 40 | Illuminance at floor level.<br>Safety colours will be recognisable. |
| Parking Areas | 75 | 0,4 | - | 40 | Illuminance at floor level.<br>Safety colours will be recognisable.<br>A high vertical illuminance increases recognition of people's faces and therefore the feeling of safety. |
| Ticket Office / Machine | 300 | 0,6 | 19 | 80 | Reflections in the window should be avoided.<br>Glare from the outside will be prevented. |

## Road Lighting Classes

A1.5 Table A1. 4 is an extract from BS EN 13201-2:2015 and describes the minimum maintained lighting requirements for the various road classes to be applied to roadways and pedestrian paths within the Project.

A1.6 The M classes are intended for drivers of motorised vehicles for use on traffic routes, allowing medium to high driving speeds. The main lighting criteria of these classes are based on the road surface luminance of the carriageway.

A1.7 The P classes or the HS classes are intended for pedestrians and pedal cyclists on footways, cycleways, emergency lanes and other road areas lying separately or along the carriageway of a traffic route, and for residential roads, pedestrian streets, parking places, etc. The lighting criteria of the P classes are based on the horizontal illuminance on the road area and are expressed by the average and the minimum illuminance.

A1.8 The lighting criteria of the HS classes are based on the hemispherical illuminance of the road area and are expressed by the average hemispherical illuminance and the overall uniformity of this illuminance.

A1.9 The requirements of the lighting classes reflect the category of road user in question or the type of road area. Thus the M classes (Table A1. 4) are based on the road surface luminance, while the P and HS classes (Table A1. 5 and Table A1. 6) are based on the illuminance of the road area.

A1.10 Table A1. 5 presents the P classes. Note in particular the requirements for facial illumination where necessary to support CCTV surveillance.

**Table A1. 4: Extract from BS EN 13201-2:2015 (Table 1 - M lighting classes)**

| Class | Luminance of the road surface of the carriageway for dry road surface conditions | | | Disability glare (dry conditions) | Lighting of surroundings (dry conditions) |
|---|---|---|---|---|---|
| | L (minimum maintained) cd/m² | $U_o$ (minimum) | $U_1$[a] (minimum) | $f_{TI}$[c] (maximum) % | $R_{EI}$[d] (minimum) |
| M1 | 2.00 | 0.40 | 0.70 | 10 | 0.35 |
| M2 | 1.5 | 0.4 | 0.7 | 10 | 0.35 |
| M3 | 1.0 | 0.4 | 0.6 | 15 | 0.3 |
| M4 | 0.75 | 0.4 | 0.6 | 15 | 0.3 |
| M5 | 0.50 | 0.35 | 0.4 | 15 | 0.3 |
| M6 | 0.30 | 0.35 | 0.4 | 20 | 0.3 |

a) to provide for uniformity, the actual value of the maintained average illuminance will not exceed 1.5 times the minimum E value indicated for the class.

c) The values stated in the column fTI are the maximum recommended for the specific lighting class, however, they may be amended where specific national requirements appertain.

d) This criterion will be applied only where there are no traffic areas with their own lighting requirements adjacent to the carriageway. The values shown are tentative and may be amended where specific national or individual scheme requirements are specified. Such values may be higher or lower than the values shown, however care should be taken to ensure adequate illumination of the areas is provided.

# Hemispherical illuminance

A1.11 On pedestrian paths, hemispherical illuminance 'HS' classes will be recommend as alternatives to horizontal illuminance 'S' and 'P' classes, in accordance with the British Lighting Standards BS EN 13201-2:2015 (Table A1. 5).

A1.12 Hemispherical illuminance calculations consider the amount of light falling onto (and modelling) objects in space. They provide an indication of the amount of light falling onto 3-dimensional objects and people and so can provide a clearer understanding of the way in which an object can be seen and understood after dark and help enhance the perception of safety of the pathway user.

A1.13 As such, hemispherical illuminance criteria are considered an appropriate option for pedestrian areas, where the illumination and uniformity levels applied to objects in space can be more critical than those on the ground plane alone. Hemispherical illuminance classes are particularly usefully applied in situations where luminaire mounting heights are very low.

A1.14 Table A1. 6 is an extract from BS EN 13201-2:2015 and describes the lighting requirements of hemispherical Illuminance for each class.

**Table A1. 5: Extract from BS EN 13201-2:2015 (Table 3 - P classes)**

| Class | Horizontal Illuminance | | Additional requirements if facial recognition is necessary | |
|---|---|---|---|---|
| | $\bar{E}$[a] (minimum maintained) lux | $E_{min}$ (maintained) lux | $E_{v,min}$ (maintained) lux | $E_{sc,min}$ (maintained) lux |
| P1 | 15.0 | 3.0 | 5.0 | 5.0 |
| P2 | 10.0 | 2.0 | 3.0 | 2.0 |
| P3 | 7.5 | 1.5 | 2.5 | 1.5 |
| P4 | 5.0 | 1.0 | 1.5 | 1.0 |
| P5 | 3.0 | 0.6 | 1.0 | 0.6 |
| P6 | 2.0 | 0.4 | 0.6 | 0.2 |
| P7 | Performance not determined | Performance not determined | - | - |

[a] to provide for uniformity, the actual value of the maintained average illuminance will not exceed 1.5 times the minimum E value indicated for the class

**Table A1. 6: Extract from BS EN 13201-2:2015 (Table 4 - HS lighting classes)**

| Class | Hemispherical Illuminance | |
|---|---|---|
| | $E_{hs}$ (minimum maintained) lux | $U_o$ (minimum) |
| HS1 | 5.0 | 0.15 |
| HS2 | 2.5 | 0.15 |
| HS3 | 1.0 | 0.15 |
| HS4 | Performance not determined | Performance not determined |

# Obtrusive Light and Environmental Impact

A1.15 This Framework satisfies the recommendations of ILP Guidance Note 01: Guidance Notes for the Reduction of Obtrusive Light and PLG 05: The Brightness of Illuminated Advertisements.

A1.16 Table A1. 7 is an extract from ILP GN01, and describes the lighting environment appropriate for each environmental zone.

A1.17 Environmental zones have been selected for the Project; generally it has been assumed that the terminals and car parks at Gatwick Airport fall under Zone E3 and the remaining areas will fall into Zone E2 (Section 7.2).

A1.18 Table A1. 8 and Table A1. 13 describe requirements around obtrusive lighting falling into properties and the visibility of lighting installations from properties.

A1.19 Obtrusive light will consider road users as part of the exterior lighting installation. Table A1. 12 describes the obtrusive light limitations for road lighting and Table A1. 10 describes requirements around upwards flux for road and amenity lighting installations (e.g. car parks, public spaces).

A1.20 Definitions:

- TI: The measure of disability glare (the reduction in visibility caused by intense light sources in the field of view) expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare.

A1.21 Lv : The luminance that would need to be superimposed on a scene in object space to reduce the scene’s contrast by an amount equal to the added retinal illuminance from scattered light on the scene’s retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view.Table A1. 11 describes maximum façade and signage luminance and Table A1. 12 describes luminance limits for the use of illuminated signage, advertisements and media façades.

**Table A1. 7: Extract from ILP Guidance Note 01 (Environmental Zones)**

| Zone | Surrounding | Lighting Environment | Examples |
|---|---|---|---|
| E0 | Protected | Dark (SQM 20.5+) | Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places. |
| E1 | Natural | Dark (SQM 20 to 20.5) | Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc. |
| E2 | Rural | Low district brightness (SQM~15 to 20) | Sparsely inhabited rural areas, village or relatively dark outer suburban locations. |
| E3 | Suburban | Medium district brightness | Well inhabited rural and urban settlements, small town centres of suburban locations. |
| E4 | Urban | High district brightness | Town/city centres with high levels of night-time activity. |

**Table A1. 8: Extract from ILP Guidance Note 01 (Maximum values of vertical illuminance on properties)**

| Light technical parameter | Application conditions | Environmental zone | | | | |
|---|---|---|---|---|---|---|
| | | E0 | E1 | E2 | E3 | E4 |
| Illuminance in the vertical plane ($E_v$) | Pre-curfew | n/a | 2 lx | 5 lx | 10 lx | 25 lx |
| | Post-curfew | n/a | < 0.1 lx (1) | 1 lx | 2 lx | 5 lx |

(1) If the installation is for public (road) lighting then this may be up to 1 lux.

**Table A1. 9: Extract from ILP Guidance Note 01 (Maximum values of threshold increment and veiling luminance from non-road lighting installation)**

| Road Classification (1) | Threshold Increment (TI) | Veiling Luminance (2) ($L_v$) |
|---|---|---|
| No road lighting | 15% based on adaptation luminance of 0.1cd/m$^2$ | 0.037 |
| ME6 / ME5 | 15% based on adaptation luminance of 1cd/m$^2$ | 0.23 |
| ME4 / ME3 | 15% based on adaptation luminance of 2cd/m$^2$ | 0.40 |
| ME2 / ME1 | 15% based on adaptation luminance of 5cd/m$^2$ | 0.84 |

(1) Road classifications as given in CIE 115:2010

(2) The veiling luminance values specified in this table are based upon on a permissible TI value of 15%

A1.22 UFR (Table A1. 10) is defined as the ratio between the luminous flux above the horizon (resulting directly from all the luminaires, reflected from the surface area intentionally lit, and reflected from the surrounding surface areas lit unintentionally because of spill light), to the luminous flux above the horizon in the hypothetical ideal situation where the luminaires have no direct light radiated above the horizon, and all their light is concentrated only to the surface area lit intentionally and that area has exactly the required lighting level. Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULR and UFR.

A1.23 The values for surface illuminance (Table A1. 11) apply to both pre- and post-curfew, except that in Zones 0 and 1 the values will be zero post curfew. The values for signs do not apply to signs for traffic control purposes.

**Table A1. 10: Extract from ILP Guidance Note 01 (Maximum UFR for installations of >4 luminaires)**

| Light technical parameter | Type of installation | Environmental zone | | | | |
|---|---|---|---|---|---|---|
| | | E0 | E1 | E2 | E3 | E4 |
| Upward flux ratio (UFR)/% | Road | n/a | 2% | 5% | 8% | 12% |
| | Amenity | n/a | n/a | 6% | 12% | 35% |
| Upward Light Ratio (ULR) | All | 0% | 0% | 2.5% | 5% | 15% |

**Table A1. 11: Extract from ILP Guidance Note 01 Maximum permitted values of average surface luminance (cd/m2)**

| Light technical parameter | Application conditions | Environmental Zone | | | | |
|---|---|---|---|---|---|---|
| | | E0 | E1 | E2 | E3 | E4 |
| Building façade luminance ($L_b$) cd/m² | Taken as the product of the design average illuminance and reflectance divided by π | < 0.1 | < 0.1 | 5 | 10 | 25 |
| Sign luminance ($L_s$) (ILP GN01) cd/m² | Taken as the product of the design average illuminance and reflectance divided by π, or for self-luminous signs, its average luminance. | < 0.1 | 50 | 400 | 800 | 1,000 |

**Table A1. 12: Extract from ILP PLG 05 (Maximum permitted recommended luminance for illuminated advertising)**

| Illuminated Area (m²) | Zone E0 | Zone E1 | Zone E2 | Zone E3 | Zone E4 |
|---|---|---|---|---|---|
| Up to 10 | 0 cd/m² | 100 cd/m² | 400 cd/m² | 600 cd/m² | 600 cd/m² |
| Over 10 | 0 cd/m² | n/a | 200 cd/m² | 300 cd/m² | 300 cd/m² |

**Table A1. 13: Extract from ILP Guidance Note 01 (Limits for the luminous intensity of luminaires)**

| Light technical parameter | Application conditions | Luminaire group (projected area $A_P$ in m²) (3) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0<AP ≤0.002 | 0.002<AP ≤0.01 | 0.01<AP ≤0.03 | 0.03<AP ≤0.13 | 0.13<AP ≤0.50 | AP>0.5 (4) |
| Maximum luminous intensity emitted by luminaire (I in cd) | E0 Pre-curfew Post-curfew | 0 (2)<br>0 | 0<br>0 | 0<br>0 | 0<br>0 | 0<br>0 | 0<br>0 |
| | E1 Pre-curfew Post-curfew | 0.29 d (1)<br>0 | 0.63 d<br>0 | 1.3 d<br>0 | 2.5 d<br>0 | 5.1 d<br>0 | 2,500<br>0 |
| | E2 Pre-curfew Post-curfew | 0.57 d<br>0.29 d | 1.3 d<br>0.63 d | 2.5 d<br>1.3 d | 5.0 d<br>2.5 d | 10 d<br>5.1 d | 7,500<br>500 |
| | E3 Pre-curfew Post-curfew | 0.86 d<br>0.29 d | 1.9 d<br>0.63 d | 3.8 d<br>1.3 d | 7.5 d<br>2.5 d | 15 d<br>5.1 d | 10,000<br>1,000 |
| | E4 Pre-curfew Post-curfew | 1.4 d<br>0.29 d | 3.1 d<br>0.63 d | 6.3 d<br>1.3 d | 13 d<br>2.5 d | 26 d<br>5.1 d | 25,000<br>2,500 |

(1) d = distance between the observer and glare source (m).

(2) 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions.

(3) Ap is the apparent surface of the light source seen from the observer position.

(4) Upper limits for each zone will be taken as those with column Ap>0.5.

For further information refer to Annex C of CIE 150.

# Annex 2

## Reference Documents

A1.24 This report has been produced with reference to the following documents:

- Documents listed in Table A1. 14.
- TR020005-000043-GTWK-Scoping-Opinion - Scoping Opinion to the Planning Inspectorate: Proposed Gatwick Airport Northern Runway
- TR020005-000005-GTWK - Scoping Report (Vol 1 Main Text)
- TR020005-000006-GTWK - Scoping Report (Vol 2 Figures)
- TR020005-000007-GTWK - Scoping Report (Vol 3 Appendices)
- Decade of Change Policy to 2030
- West Sussex Highways - Lighting of Developer-Promoted Highway Schemes in West Sussex
- Surrey Highways - Developer Street Lighting Notes and Specifications Section 38 and 278 Works for Adoption
- 230118 01 NRP Temporary Compound Strategy

## Glossary

**Table A1. 14: Glossary of Terms**

| Term | Description |
|---|---|
| AGL | Aeronautical Ground Lights |
| ANO | Air Navigation Order |
| AONB | Area of Outstanding Natural Beauty |
| ATC | Air Traffic Control |
| ATCT | Air Traffic Control Tower |
| BAP | Biodiversity Action Plan |
| BREEAM | Building Research Establishment Environmental Assessment Method |
| BS | British Standard |
| CAA | Civil Aviation Authority |
| CAP | Civil Aviation Publication |
| CARE | Central Area Recycling Enclosure |
| CCTV | Closed Circuit Television |
| CDM | Construction Design Management |
| CEAM | Circular Economy Assessment Method |
| CIBSE | Chartered Institution of Building Services Engineers |
| CLO | Constant Light Output |
| CMS | Central Management System (Lighting Control) |
| CPRE | Campaign to Protect Rural England |
| CPTED | Crime Prevention Through Environmental Design |
| EASA | European Union Aviation Safety Agency |
| EN | Euro-norm (standard) |
| EPD | Environmental Product Declaration |
| EU | European Union |
| GAL | Gatwick Airport Limited |
| GN | Guidance Note |
| GWP | Global Warming Potential |
| HER | Historic Environment Records |
| HSE | Health and Safety Executive |
| HSG | Health and Safety (Executive) Guidance |
| ICAO | International Civil Aviation Organisation |
| IDA | International Dark-Sky Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| ILP | Institute of Lighting Professionals |
| IoT | Internet of Things |
| ISO | International Organization for Standardisation |
| ITTS | (Gatwick) Inter Terminal Transit System |
| LCA | Life Cycle Assessment |
| LED | Light Emitting Diode |
| LUC | Land Use Consultants |
| MSCP | Multi-storey car park |
| NEMA | National Electrical Manufacturers Association |
| NOAA | National Oceanic and Atmospheric Administration |
| OLS | Obstacle Limitation Surfaces |
| PAS | Publicly Available Specification |
| PEP | Product Environment Profile |
| PIER | Preliminary environmental information report |
| PLG | Professional Lighting Guide |
| PV | Photovoltaic (Array) |
| SDCM | Standard Deviation Colour Matching |
| SDG | (UN) Sustainable Development Goals |
| SLL | (CIBSE) Society of Light and Lighting |
| SQM | Sky Quality Meter |
| TM | Technical Memorandum |
| TR | Technical Report |
| UFR | Upward Flux Ratio |
| ULR | Upward Light Ratio |
| UN | United Nations |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| Zhaga | Industry-wide consortium aiming to standardise specifications for interfaces between LED luminaires and light engines |