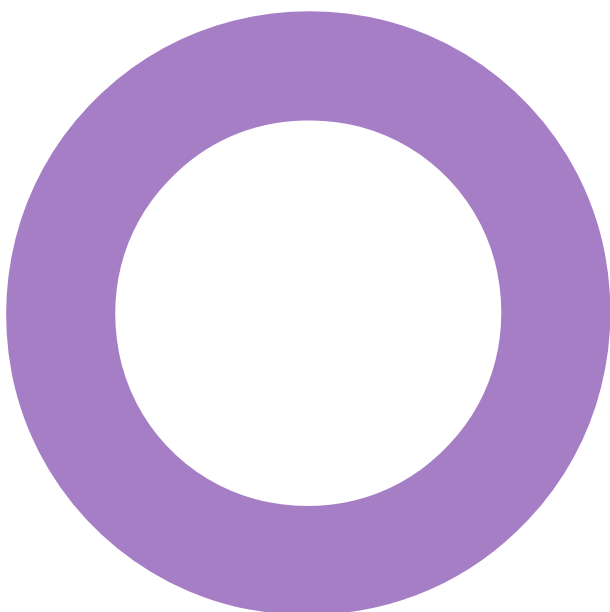


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MEP ENGINEERING
CAR PARK LIGHTING REPORT

REVISION P1 - 23 AUGUST 2021



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
P1	23/08/21	Stage 3 Issue	JK	LS	MSJ

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1. Introduction

1.1 Scope of Report

This report has been prepared to accompany a full planning application for a new surface car park and service building at Begbroke Science Park to demonstrate that the lighting scheme will comply with Local and National Guidelines in terms of light pollution and minimum levels of illumination required to address security and amenity.

1.2 Site Location and Description

Begbroke Science Park is situated in North Oxfordshire, accessed via the A44. The scheme comprises a new surface car park and service building to support the proposed new buildings at Begbroke Science Park which are the subject of a separate reserved matters submission in relation to outline planning permission (ref. 18/00803/OUT).

Figure 1 below shows the site location, and Figure 2 shows the proposed site extents.



Figure 1: Site Location

2. Objectives and Design Criteria

2.1 Objectives

Specific objectives of the proposed lighting scheme when fully designed include:

- Provide adequate illuminance to the roadways and car park areas of this development
- Provide adequate illuminance to walkways and entrances to improve the security of the users
- Mitigate light pollution and light trespass so far as is practicable
- Limit impacts to site ecology, and specifically impact to bats
- Minimise energy consumption through efficient luminaires and suitable lighting control strategy

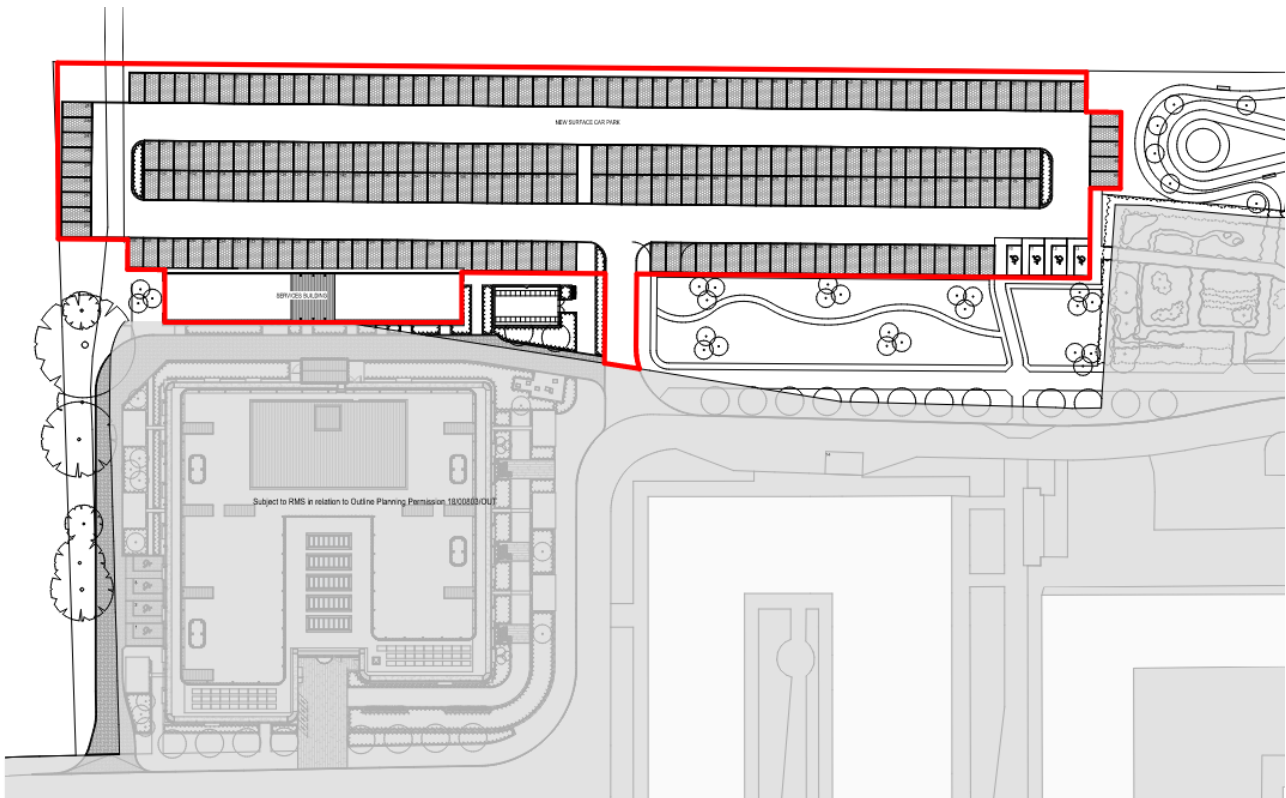


Figure 2: Site Extents

2.2 Relevant Standards & Guidance

Light and people's perception of it, are a complex interaction and vary from person to person. There are therefore recognised standards that are based on current good practice.

The proposed developments external lighting shall be designed in accordance with the following regulations, standards and guidance:

- SLL Code of Lighting
- Society of Light & Lighting Handbook

- CIE Technical Report, CIE 150 – Guide to the Limitation of the Effects of Obtrusive Light from Outdoor Installations
- CIBSE Lighting Guide 6 – The Outdoor Environment
- BS 5489-1:2020 Design of Road Lighting. Part 1: Lighting of Roads and Public Amenity Areas - Code of Practice
- BS EN 13201-2:2015 Road Lighting. Part 2: Performance Requirements
- BS EN 12464-2 Lighting of work places. Part 2: Outdoor work places

Additional guidance on light pollution and limiting impacts on ecology:

- Guidance Notes for the Reduction of Obtrusive Light – ILP
- Guidance Note 08/18: Bats and Artificial Lighting in the UK

The above publications refer to five environmental zones E0-E4 which are based on background brightness, for which a number of limiting technical parameters are given. The Begbroke Science Park will fall within Environmental Zone 2: Rural, Low District Brightness

The legal requirements for good lighting are limited to those aspects relevant to safety and are encompassed in the following UK sets of Regulations:

- Health & Safety at Work etc. Act
- Health & Safety Commission, Approved Code of Practice Regulation 8 Lighting

2.3 Performance Criteria

2.3.1 Quality of Light

Lamps and Luminaires

Lamp types will be selected for their efficacy, colour rendition and longevity to provide an efficient lighting solution with a predictable maintenance regime. Where possible luminaires will be sourced from readily available standard product ranges. Luminaires will be selected for their construction, design, fabrication and ingress protection and will be sited in accessible locations. Particular attention will be paid to selecting luminaires with good optical control to help ensure that light pollution is kept to a minimum.

Colour Temperature

The colour temperature of a light source is conventionally stated in the unit of absolute temperature, Kelvin, having the unit symbol K. Temperatures above 4000K are cool in colour, with bluish white light, while colour temperatures around 4000K are more neutral white in tone, providing a modern feel. Colour temperatures in the 2400K-3000K range have a warmer effect, creating a traditional atmosphere.

Guidance from the ILP states that luminaires with a warm white spectrum are preferential as bats are more affected by the blue light component, therefore luminaires with a colour temperature of 2700K-3000K will be used.

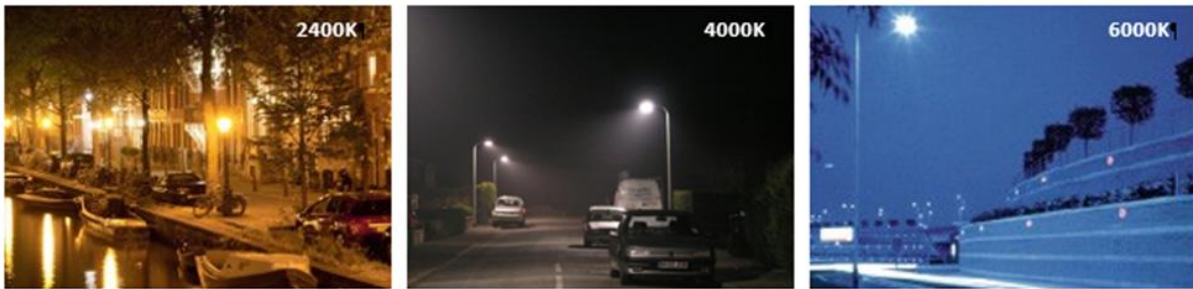


Figure 3: Colour Temperature Comparison

2.3.2 Obtrusive Light

Light pollution, or obtrusive light, has the potential to cause physiological and ecological issues. It takes various forms:

- Sky glow: the brightening of the night sky above our towns and cities,
- Glare: the uncomfortable brightness of a light source in contrast to the background
- Light Trespass: the spilling of light beyond the boundary of the property on which the light source is located
- Light Ingress: the passage of light into buildings from an external source(s)

Obtrusive light is a nuisance to both humans and wildlife, it is a waste of energy and contributes to greenhouse gas emissions. The problems of unnecessary, obtrusive light can and should be reduced or eliminated at the design stage. When specifying luminaires, careful consideration is given to minimising upward light and the use of optical units with precise light intensity distribution: thus, ensuring that spill and glare are minimised.

Luminaires selected for this development will have no upward light component and will all be LED with optics designed for precise projection of light.

During the design phase of a lighting installation the following measures should be considered to reduce the occurrence of obtrusive light:

Over-lighting: This is avoided by conducting thorough calculations and carefully selecting the most appropriate lighting equipment and lamp types.

Lighting Control: To ensure luminaires are only switched on when necessary, a lighting control performance specification is produced.

Follow Guidance: For the purpose of this study it is considered that the development is an area of 'Low district brightness' (Zone E2). Therefore, the relevant maximum values highlighted from the tables below should be applied.

Table 2.1 Environmental zones

Zone	Surroundings	Lighting environment	Examples
E0	Protected	Dark	IDA Dark Sky Parks, UNESCO Starlight Reserves
E1	Natural	Intrinsically dark	Areas of Outstanding Natural Beauty, relatively uninhabited rural areas
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town and city centres, commercial areas

Source: CIE 150: 2003.

Figure 4: LG 6 - Environmental Zones

Light Technical Parameter	Application Conditions	Environmental Zones			
		E1	E2	E3	E4
Illuminance in vertical plane (E_v)	Pre-curfew:	2 lux	5 lux	10 lux	25 lux
	Post-curfew:	0* lux	1 lux	2 lux	5 lux

Figure 5: CIE 150 - Maximum Values of Vertical Illuminance on Properties

Car Park Illuminance

Type of area and usage	Values in lux	
	\bar{E}	U_o
Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0.25
Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0.25
Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose sports and building complexes	20	0.25

Figure 6: BS 5489-1:2020 - Maintained Lighting Levels for Outdoor Car Parks

As the car park will be for the sole use of the building users, it is anticipated that the car park use will be fairly light but may pick up at peak times.

3. Calculation Results

3.1 Model

A lighting model was prepared in Relux in order to check the compliance of the design with the aforementioned criteria, ensuring adequate illumination of the car park, as well as examining the obtrusive light to minimise the ecological impact of the design.

The model was based on the landscape designers and architect's layouts. Relux was used to give a realistic indication of the development when constructed. The parameters considered in the model are as follows:

- All column mounted luminaires will be mounted at 4000mm.



Figure 7: Calculation Surfaces

3.2 Results Overview

Average Illuminance: 10.2 lx

Minimum Illuminance: 3.1 lx

Maximum Illuminance: 26.1 lx

Uniformity: 0.31 U₀

3.3 Obtrusive Light

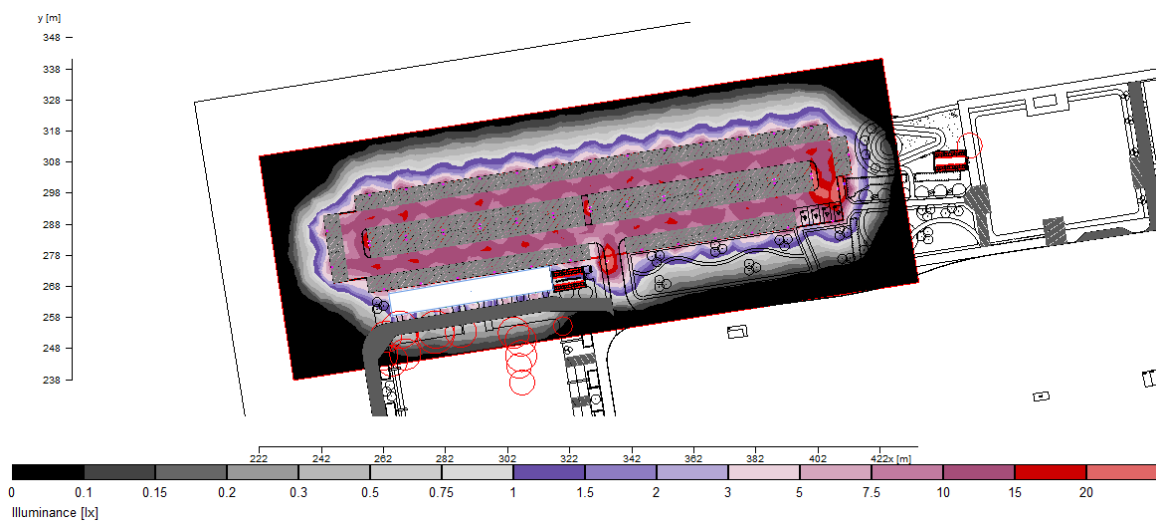


Figure 8: Site Illuminance False Colour Rendering

See associated drawing BBSP-HLEA-XX-XX-DR-E-708-002 for detailed isoline layout showing extents of light spill.

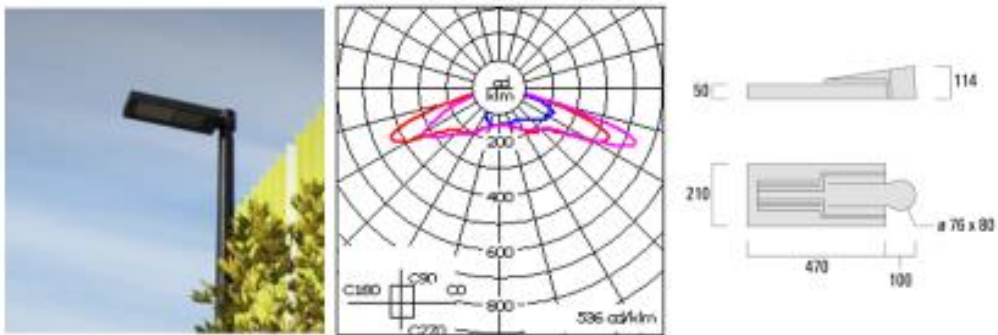
3.4 Luminaire Schedule



LUMINAIRE DATASHEETS

Begbroke Science Park Luminaire reference: EX1

*E denotes 3hr Emergency integral battery to BS EN 60598-2-22:1996+A2:2008.

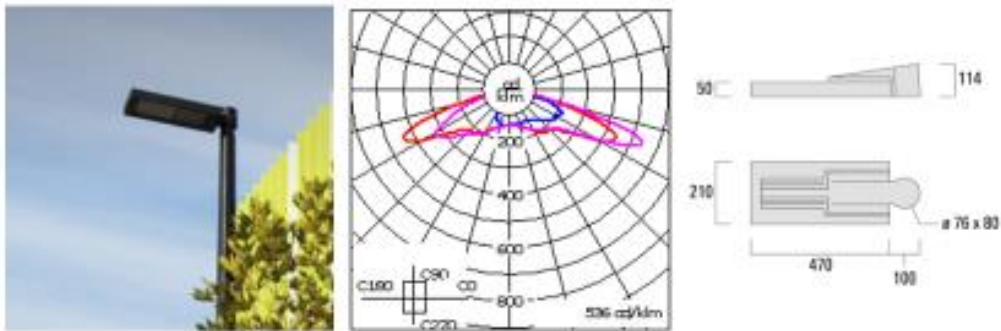


Manufacturer	We-ef	Rated input power (in W) & Power Factor	24 W >0.90
Manufacturer Contact Details	Sarah Taylor Sarah.taylor@fagerhult.co.uk	Rated luminous flux (in lm)	2796 lm
Product Ref.	VFL520	LED luminaire efficacy (in lm/W)	116.5 lm/W
Control Method	Photocell	Rated life (in h) & Failure fraction & Ambient temp (ta)	90000h L90B10 at 25°C
IP Rating & IK Impact Protection Ratings	IP66 IK08	Correlated Colour Temperature (CCT in K)	2700 K
Weight & Dimensions	4.7 kg 470 x 210 x 114 mm	Rated Colour Rendering Index (CRI)	80
RAL colour	RAL 7016	MacAdam (initial and maintained)	3
General Notes	Roadways Side throw distribution Mounted at 4000mm	Drive Current	700mA

Note: Prices quoted are manufacturers trade price (£Sterling) excluding V.A.T. Product codes, quantities and prices are for reference only and should be confirmed prior to order placement. Dimensions and technical details are for information only. Installation data should be obtained direct from manufacturer.

Begbroke Science Park
Luminaire reference: EX2

*E denotes 3hr Emergency integral battery to BS EN 60598-2-22:1996+A2:2008.

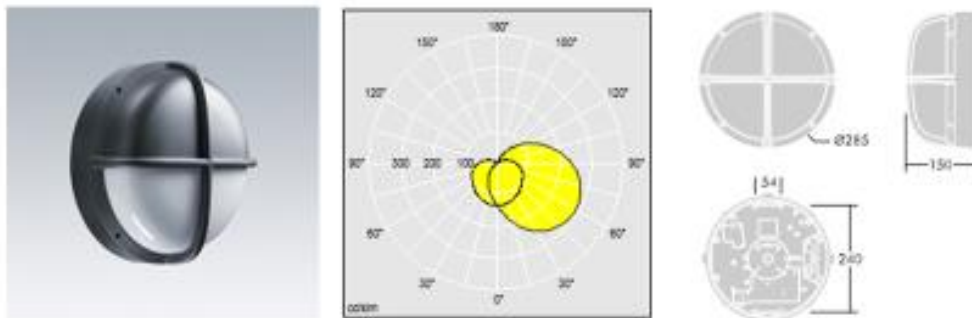


Manufacturer	We-eif	Rated input power (in W) & Power Factor	12 W >0.90
Manufacturer Contact Details	Sarah Taylor Sarah.taylor@fagerhult.co.uk	Rated luminous flux (in lm)	1512 lm
Product Ref.	VFL520	LED luminaire efficacy (in lm/W)	126 lm/W
Control Method	Photocell	Rated life (in h) & Failure fraction & Ambient temp (ta)	90000h L90B10 at 25°C
IP Rating & IK Impact Protection Ratings	IP66 IK08	Correlated Colour Temperature (CCT in K)	2700 K
Weight & Dimensions	4.7 kg 470 x 210 x 114 mm	Rated Colour Rendering Index (CRI)	80
RAL colour	RAL 7016	MacAdam (initial and maintained)	3
General Notes	Car Park Asymmetric forward throw distribution Mounted at 4000mm	Drive Current	700mA

Note: Prices quoted are manufacturers trade price (£Sterling) excluding V.A.T. Product codes, quantities and prices are for reference only and should be confirmed prior to order placement. Dimensions and technical details are for information only. Installation data should be obtained direct from manufacturer.

Begbroke Science Park
Luminaire reference: EX6

*E denotes 3hr Emergency integral battery to BS EN 60598-2-22:1998+A2:2008.



Manufacturer	Thorn	Rated input power (in W) & Power Factor	7 W 0.95
Manufacturer Contact Details	Ryan Chadwick Ryan.Chadwick@zumto-belgroup.com	Rated luminous flux (in lm)	400 lm
Product Ref.	EyeKon LED	LED luminaire efficacy (in lm/W)	60 lm/W
Control Method	Photocell & Motion Detector	Rated life (in h) & Failure fraction & Ambient temp (ta)	50000h L90 at 25°C
IP Rating & IK Impact Protection Rating	IP65 IK10	Correlated Colour Temperature (CCT in K)	2700 K
Weight & Dimensions	2.34 kg Ø285 x 150 mm	Rated Colour Rendering Index (CRI)	80
RAL colour	RAL 7016	MacAdam (initial and maintained)	3
General Notes	Wall Mounted Stores & Bike Shelters	Drive Current	-

Note: Prices quoted are manufacturers trade price (£Sterling) excluding V.A.T. Product codes, quantities and prices are for reference only and should be confirmed prior to order placement. Dimensions and technical details are for information only. Installation data should be obtained direct from manufacturer.

3.5 Controls

The external lighting installation will be automatic with user intervention where required. Lighting will be controlled via centralised photocell and programmable time clock lighting control system, located adjacent to external lighting distribution boards. Override / isolation switches will be provided alongside the boards to allow for routine maintenance and testing.

The lighting installation will be zoned to allow different areas to be controlled independently.

- Control Zone 1 : Car Park

The external lighting will be switched on at dusk via the centralised photocell, and switch off as detailed below. Please note that these times could be changed within the external lighting system to meet the Client's requirements.

- Control Zone 3 : Car Park - Dusk to Midnight, 6.00am to daylight

The external lighting control system shall be managed by a central control system that shall allow the on/off times to be modified as the requirements of the buildings users and Begbroke site develops over time.



JESSICA KEATES
ENGINEER

+44 1865 670353
jessicakeates@hoarelea.com

HOARELEA.COM

Old Iron Works
35a Great Clarendon Street
Oxford
OX2 6AT
England

