

Luminous Oak Academy
External Lighting Strategy Report

Revision History

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1 Introduction

This report covers the key lighting elements for the external realm at the new Luminous Oak Academy.

The lighting philosophy is based on achieving a good level of maintained illuminance across the site within operational hours, minimising dark areas to create a safe environment whilst avoiding light pollution and light spill to surrounding areas. External lighting shall only switch on when a person / vehicle is detected within operational hours and the lighting levels have faded.

The external lighting scheme will take into consideration the proposed landscaping scheme as well as security and safety for staff, students and visitors for safe access, egress and circulation to key areas.

The exterior lighting system shall be provided in accordance with the following criteria:

Areas	Horizontal Illuminance			Glare
	$\bar{E}_m$ lx	U_o	WP height (m)	GR _L
Walkways exclusively for pedestrians	5	0.25	0	50
Traffic areas for slowly moving vehicles (max 10 km/h, e.g. Bicycles)	10	0.40	0	50
Pedestrian passages, vehicle turning, loading and unloading points	50	0.40	0	50
Parking areas	10	0.25	0	50
Security	5	0.25	0	50



ACRONYMS AND SYMBOLS

Acronym/Symbol	Definition
A	Ampere
AC	Alternating Current
BS	British Standard
CPC	Circuit Protective Conductor
CRT	Contact Requirements Technical
CTS	Contract Technical Specification
CSA	Cross Sectional Area
Cu	Copper
DNO	Distribution Network Operator
kVA	Kilo Volt Ampere
km	Kilometre
LSZH	Low Smoke Zero Halogen
LV	Low Voltage
MCCB	Moulded Case Circuit Breaker
MET	Main Earthing Terminal
m	Metre
mm	millimetre
PFC	Prospective Fault Current
RCCB	Residual Current Circuit Breaker
SP&N	Single-Phase and Neutral
SP&SN	Single-phase and Switched Neutral
SWA	Steel Wire Armour
TN	Terra-Neutral
TP&N	Three-Phase and Neutral
TP&SN	Three-phase and Switched Neutral
V	Volt, unit of voltage
VA	Volt Ampere
XLPE	Cross-Linked Polyethylene
Ω	Ohm, unit of resistance/impedance
Z	Total Impedance (includes reactive and resistive components)
Z_e	External Loop Impedance
Z_s	Internal Loop Impedance



LEGISLATION AND STANDARDS

The Design shall be undertaken in compliance with all relevant current standards including UK Legislation, British and European Standards, that were applicable at the standards baseline date of September 2024. Any updates to relevant standards that are released following the baseline date shall be assessed and implementation to be agreed with the client.

British / European Standards

Document Number	Title
BS EN 60529: 1992 + A2:2013	Degrees of Protection Provided by Enclosures (IP Code).
BS 5467:2016	Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1000V and 1900/3300V for fixed installations. Specification
BS 6004: 2012	Electric Cables. PVC Insulated and PVC Sheathed cables for voltages up to and including 300/500V, for electric power and lighting.
BS 6231: 2006	Electrical cables. Single core PVC insulated flexible cables of rated voltage 600/1000V for switchgear and controlgear wiring
BS 7430: 2011 + A1:2015	Code of Practice for Protective Earthing of Electrical Installations
BS 7671: 2018	Requirements for Electrical Installations. IET Wiring Regulations
BS EN 61000-6-1: 2007	Electromagnetic Compatibility (EMC). Generic Standards. Immunity for residential, commercial and light-industrial environments.
BS 5733: 2010+A1:2014	General Requirements for Electrical Accessories. Specification
BS 951: 2009	Electrical Earthing. Clamps for Earthing and Bonding. Specification.
BS 7655-0: 2006	Specification for Insulating and Sheathing Materials for Cables. General introduction.
BS HD 60629-3:2010+A1:2013, BS88-3:2010	Low-voltage fuses. Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications). Examples of standardised systems of fuses A to F.
BS HD 60629-2:2013, BS88-2:2013	Low-voltage fuses. Supplementary requirements for fuses for use by authorised persons (fuses mainly for industrial application). Examples of standardised systems of fuses A to K.
BS EN 61140: 2016	Protection Against Electric Shock. Common Aspects for Installation and Equipment
BS EN 50122-1: 2011+A4:2017	Railway Applications. Fixed Installations. Electrical Safety, Earthing and the Return Circuit. Protective Provisions Against Electric Shock
BS EN 50522: 2010 (including corrigendum October 2012)	Earthing of power installations exceeding 1kV A.C.
GS 38: 2015 (Fourth Edition)	Electrical test equipment for use on low voltage electrical systems.
BS EN 61000-6-4: 2007+A1:2011	Electromagnetic Compatibility (EMC). Generic Standards. Emission Standard for Industrial Environments
BS EN 61439-2: 2011	Low-voltage Switchgear and Controlgear Assemblies. Power Switchgear and Controlgear Assemblies



BS EN 60721-1: 1996, IEC 60721-1:1996	Classification of Environmental Conditions. Environmental Parameters and their Severities
BS EN 60947-2: 2017	Low-voltage Switchgear and Controlgear. Circuit-breakers
BS EN 61000-6-2: 2005	Electromagnetic Compatibility (EMC). Generic Standards. Immunity for Industrial Environment
BS EN 61000-6-4: 2007+A1: 2011	Electromagnetic Compatibility (EMC). Generic Standards. Emission Standard for Industrial Environment
BS 6121-5: 2005	Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and Armour Glands
BS 7375: 2010	Distribution of Electricity on Construction and demolition sites. Code of Practice

Guidance Documents

Document Number	Title
Guides A to M	CIBSE Design Guides (as applicable)
HS(G) 85: 2013 (Third Edition)	Electricity At Work: Safe Working Practices
HS(G) 38: 1997 (Second Edition)	Lighting at work
IEC/TS 60479-1:2016 (Edition 4.1)	Effects of Current Passing Through The Human Body
L108: 2005	The Control of Noise at Work Regulations 2005

Statutory Instructions

Reference	Title
SI 1989 No. 635	Electricity at Work Regulations 1989.
SI 1974 C37	Health and Safety at Work Act 1974
SI 2002 No. 2665	The Electricity Safety, Quality and Continuity Regulations 2002
SI 2005 No. 1541	The Regulatory Reform (Fire Safety) Order 2005
SI 2006 No. 1521	The Electricity Safety, Quality and Continuity (Amendment) Regulations 2006



European Directives

Reference	Title
Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the	Interoperability of the rail system within the Community (Recast) (Text with EEA relevance)
Directive 2014/30/EU of the European Parliament and of the Council of 26	Harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast) Text with EEA relevance
Commission Regulation (EU) No 1301/2014 of 18 November	Technical specifications for interoperability relating to the ‘energy’ subsystem of the rail system in the Union Text with EEA relevance

Engineering Recommendations

Reference / Title
Energy Networks Association (ENA) Engineering Recommendation P24 (1984) – AC Traction Supplies to British Rail
Energy Networks Association (ENA) Engineering Recommendation G12 (Issue 4 Amendment 1 December 2015) – Requirements for the Application of Protective Multiple Earthing to Low Voltage Networks
Energy Networks Association (ENA) Technical Specification 41-24 (Issue 1 2016) – Guidelines for the Design, Installation, Testing and Maintenance of Main Earthing Systems in Substations

Where any product is specified to comply with a British Standard for which there is no equivalent European Standard, it may be substituted by a product complying with a grade or category within a national standard of another Member State of the European Community or an International Standard recognised within the UK specifying equivalent requirements and assurances in respect of materials, safety, reliability, fitness for purpose, compatibility with adjacent construction, availability of compatible accessories, and, where relevant, appearance.



REFERENCE DOCUMENTATION

Reference documentation considered in producing this document:

- Reference Document 1** Department for Education – Generic Design Brief Output Specification – May 2020.
- Reference Document 2** Department for Education – Technical Annex 2E: Daylight and Electric Lighting output Specification.
- Reference Document 3** Department for Education – Technical Annex 2G: Electrical Services, Communications, Fire and Security Systems Output Specification.



2 Design Commentary

2.1 Light Pollution

The external lighting shall be designed to prevent upward light pollution and spill lighting to neighbouring areas. Using lower wattage, more energy efficient LED luminaires as well as optimising mounting heights localising distribution and avoids light spillage into surrounding areas. Luminaires shall be selected to limit glare using eyelid cut offs, lanterns mounted horizontally and directional reflectors.

2.2 Lighting Requirements

It is important that the lighting application provides an aesthetic quality in addition to the appropriate levels of illuminance required for the key areas the luminaire shall be serving. The intention is to light the circulation and pedestrian routes to provide safe and secure access around the site. Lighting levels will be suitable for pedestrian, vehicular access and the operation of the CCTV system. The lighting system shall maintain average illuminance in accordance with the relevant standards as detailed typically on the external services drawing.

Lighting is installed to provide sufficient illumination for safe circulation and promote a feeling of safety for access and egress from the building to the car park and service areas.

2.3 Perimeter Lighting

Final Exits – Emergency lighting bulkheads shall provide lighting for safe egress from the building in accordance with BS 5266. General illumination of the main entrance, rear entrance and main school entrance shall be controlled via a time clock, photocell and presence detection. It is not envisaged to have general illumination to each individual emergency exit. All external luminaires outside of the building envelope are dark sky compliant, a single downlight is within the undercroft to one of the exits.



2.4 Walkway Lighting and Car Park Lighting

General walkways shall consist of a combination of 6m tubular route mounted columns street lanterns with asymmetrical distribution, providing directional illumination focusing on the walkways and minimising light spillage.

Steps leading to the main entrance from the car park shall consist of wall mounted brick type luminaires, with 3hr emergency back up to provide illumination for safe egress from the building.

The car park lighting shall consist of 6m tubular route mounted columns street lanterns with asymmetrical distribution, providing directional illumination focusing on the car park area and minimising light spillage.



All lighting columns are to be kept away from mature trees to minimise disruption to the existing Bat population.

The existing tree lines to the south boundary have car parking spaces directly in-front of the trees and therefore would be impossible to limit the light spill to edge of the parking bay and keep functional lighting for safe movement.

The lux levels will be in a range of 2-5 Lux to the edges of the carpark.

The strategy is to limit the lighting hours to times of darkness via photocell and between the working hours of 07:30 – 16:30 via timeclock and only when the movement of a vehicle or person is detected which will switch the lights for a notational period of 5 minutes (The time period can be adjusted longer or shorter as required to allow for safe passage around walkways and carpark).



2.5 Service Road

It is envisaged that the service road retains its existing columns.

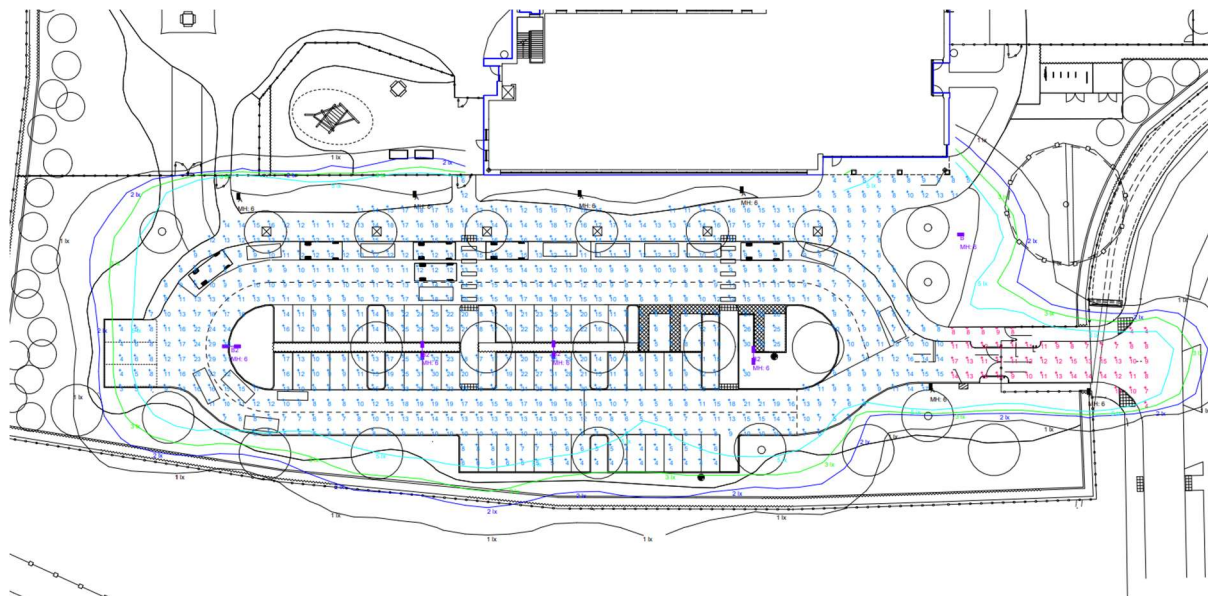


3 Light Spill

The external lighting has been designed to direct the illuminance to reduce light spill utilising eyelid profiles, horizontal downward lighting and directional reflectors.

4 Direction of Illuminance

The external lighting has been designed to direct the illuminance to reduce glare and upward lighting.





5 Lux Plots

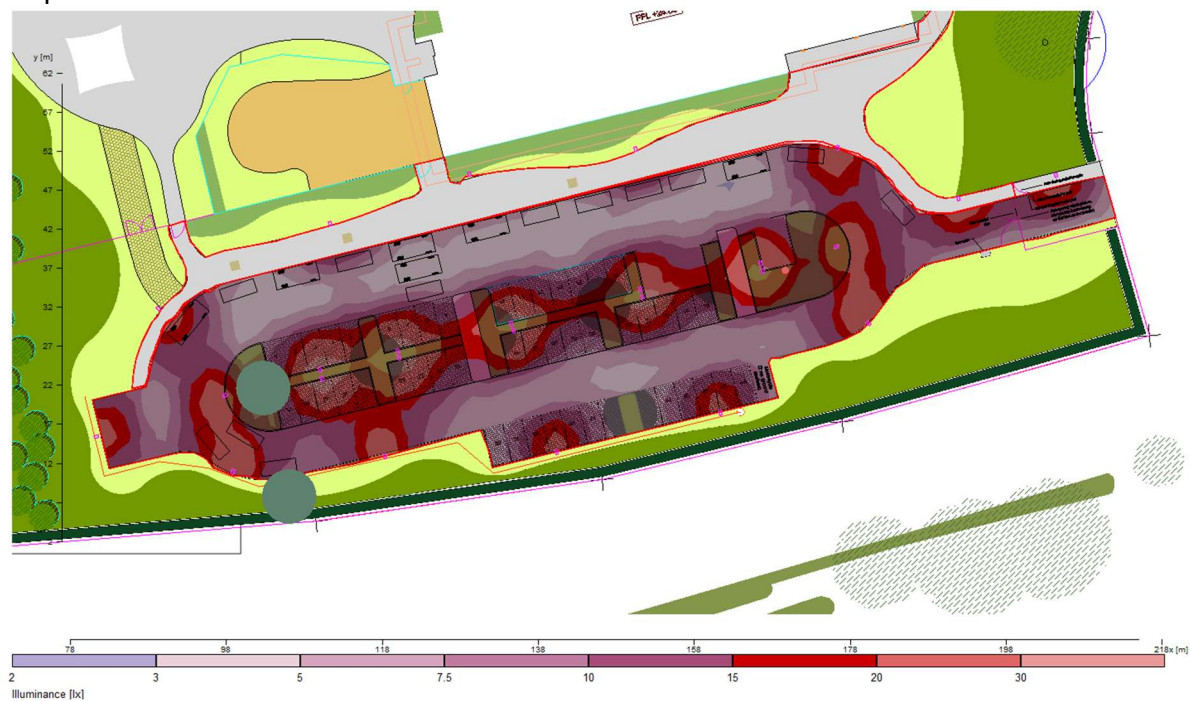
Walkways



General		
Calculation algorithm used		Average indirect fraction
Height of evaluation surface		0.50 m
Maintenance factor		0.80
Total luminous flux		77859 lm
Total power		505 W
Total power per area (10000.00 m²)		0.05 W/m²
Illuminance		
Average illuminance	$\bar{E}_m$	13.9 lx
Minimum illuminance	E_{min}	4.6 lx
Maximum illuminance	E_{max}	77.5 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	1:3.06 (0.33)
Diversity U_d	E_{min}/E_{max}	1:17 (0.06)



Carpark



General

Calculation algorithm used
Height of evaluation surface
Height (phot. centre) [m]:
Maintenance factor

Total luminous flux
Total power
Total power per area (10000.00 m²)

Average indirect fraction
0.50 m
5.95 m
0.80

62775 lm
375 W
0.04 W/m²

Illuminance

Average illuminance	$\bar{E}_m$	13.7 lx
Minimum illuminance	E_{min}	3.9 lx
Maximum illuminance	E_{max}	38.3 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	1:3.48 (0.29)
Diversity U_d	E_{min}/E_{max}	1:9.76 (0.1)



6 Ecology

The external lighting design has been produced taking into consideration the ecology report which identifies the recommendation of utilising directional lighting with narrow white beams, only illuminating the required areas on the ground. Further recommendation for LED's were identified which are to be directional, white and instantaneous. The lighting shall be controlled via a photocell and time clock and presence detection, giving facility to control the amount of operational time.



7 Conclusion

The external lighting strategy details the complete lighting scheme, combining functional area lighting. The above information highlights that this area is illuminated to the relevant guidance's.

The scheme has also taken into consideration the ecological impact of artificial lighting, and as such designed to provide a level of illuminance, controlled to provide safe egress to the building and key circulation areas, in addition to the recommendations within the Ecology report.

As the car park is directly adjacent to the new southern boundary tree line, the lighting levels exceed maximum lighting levels of 1 lux. However, between April & October the car park lighting will be set to not operate. During that period, it will only be activated by PIR sensor to detect movement of people and vehicles during the hours of darkness and will stay illuminated for a notional period of 5 minutes. This is to allow the building to be safely accessed for uncommon and emergency situations. Between November and March, the lighting will be limited to the hours of darkness via photocell and between the working hours of 07:00-19:00 via timeclock.

the external lighting is primarily located in the carpark area and to emergency fittings adjacent to the building exits. the lighting layout for the whole site is appended to the external lighting report which shows the majority of the site to be unaffected by the proposed lighting arrangement.

