



MILLER GOODALL

ACOUSTICS - AIR QUALITY - LIGHTING

LIGHTING ASSESSMENT

On behalf of

Bidwells LLP

For development at

Thomas' College Multi-use Games Area, Richmond Hill

REPORT DATE: 10th December 2024

REPORT NUMBER: 103242v5

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Summary

A lighting design has been prepared to accompany a planning application for the installation of lighting for a Multi-use Games Area (MUGA) at Thomas' College, Richmond Hill.

The lighting design has been prepared to demonstrate the development meets the lighting requirements of Sports England Artificial Sports Lighting Design Guidance Note (2012). The MUGA will offer various sports. All lighting will be switched off when not in use.

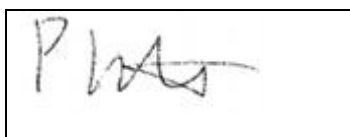
The MUGA has been designed to meet the lighting standards required for the most demanding lighting sport offered at the MUGA, in this case, netball. Details of the lighting design, positioning and illuminance (lux) contour plots are appended to this report. Recommendations for dimming are made as the other sport offered at the MUGA, basketball, has significantly less demanding lighting requirements.

The information provided in this document and the accompanying model, drawings and data outputs demonstrate the scheme will not have an adverse impact with regards to lighting. There is, therefore, no reason for this application to be refused on the grounds of lighting.

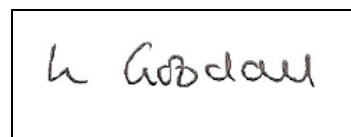
Prepared By Philip Walton

Reviewed By Lesley Goodall

Signed



Signed



Date

10th December 2024

Date

10th December 2024

Record of changes

Version	Date	Change	Initials
1	5 th November 2024	First issue	LG
2	12 th November 2024	Minor clarification updates following client review	PW
3	27 th November 2024	Title update	PW
4	3 rd December 2024	Minor clarification updates following client review	PW
5	10th December 2024	Project description update	PW

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1 Introduction

- 1.1 Miller Goodall Ltd has been instructed to prepare a lighting design to accompany a planning application for lighting a Multi-use Games Area (MUGA) at Thomas' College, Richmond Hill. The site lies within the administrative boundary of the London Borough of Richmond upon Thames (LBRT).
- 1.2 Lighting is required for the MUGA playing surface. Best practice design and mitigation have been incorporated into the design, including selection of appropriate luminaires and optics, heights and placement positions. Measures to reduce obtrusive light and pollution are inherent to the design, meeting the requirements of ILP GNI ^[1].
- 1.3 The lighting design has been modelled using the industry-adopted and widely used 2D lighting software Lighting Reality (version 2.3.1). The Reality Outdoor package has been used as it is suited for area design. Illuminance (lux) contour plots have been prepared.
- 1.4 This report provides detailed information on the guidance applied, design rationale and procedure, and pertinent information on the inputs and outputs of the design.

2 Site Description

- 2.1 The site is located in the grounds of Thomas' College in Richmond Hill, London. An existing unlit MUGA is located within the college grounds (located at x: 518466, y: 174041). The intention is to light the existing MUGA pitch.
- 2.2 The MUGA is surrounded by a trees in all directions, with the open grounds of the college beyond. A building known as 'Red House', containing offices and student study space, is located approximately 15 m to the east of the MUGA. A building known as 'Sir Cyril Taylor Library' (a library and student study space) is located approximately 20 m to the west of the MUGA. The 'Main Building' containing student living areas is located approximately 22 m to the south west of the MUGA.
- 2.3 The nearest dwellings to the MUGA are located over 65 m to the north east of it, beyond the school boundaries.
- 2.4 The site location is shown in **Appendix A**.

¹ Institution of Lighting Professionals, 2021. Guidance Note 01 The Reduction of Obtrusive Light.

3 Proposed Development

- 3.1 The MUGA will cater for a range of sports. The MUGA usage is confined to the pre-curfew period, with no post-curfew activities occurring.
- 3.2 A canopy and sidewalls will be constructed over the existing MUGA, with lighting installed inside the structure of the canopy roof. Consequently, the structure will confine the lighting, preventing it from spilling beyond the pitch area.
- 3.3 Potential adverse effects to receptors surrounding the pitch can, therefore, be screened out. There are also no long-term sensitive receptors in the immediate vicinity of the MUGA, only short term uses comprising an office, library and student study spaces.

4 Relevant Guidance

4.1 National Planning Policy Framework

- 4.1.1 Paragraph 191 of the National Planning Policy Framework² states:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: [...] c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

4.2 Planning Practice Guidance

- 4.2.1 Planning Practice Guidance (PPG) includes guidance on light pollution³. The PPG discusses when and where lighting is needed and important matters to consider in the design, such as dark sky areas and avoiding light pollution. The guidance emphasises *‘it is important to get the right light, in the right place and for it to be used at the right time’*. The lighting industry often observes the three-Rs phrase as the basis for good design practices.

² Ministry of Housing, Communities & Local Government, 2023. National Planning Policy Framework.

³ Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2019. Planning Practice Guidance, Light Pollution.

4.2.2 The PPG is organised by a series of questions and answers, in addition to open-ended questions that encourage the developer and lighting designer to contemplate the design and lighting needs. The PPG continues by outlining good practice such as limiting upward light spill and selecting appropriate luminaire for the task.

4.3 Institution of Lighting Professionals Guidance

Guidance Note 01 The Reduction of Obtrusive Light

4.3.1 The Institution of Lighting Professionals (ILP) GNI [4] provides methodologies to reduce the adverse effects of artificial light. The document identifies best practice installation and designs to limit the environmental effects of poor lighting that may lead to adverse levels of light spill, sky glow and glare to surrounding sensitive uses.

4.3.2 Different environments may be more tolerant of light than others. The ILP has created a series of Environmental Zone (EZ) definitions that comprise limits for pre- and post-curfew⁵ periods. The EZ and illuminance (lux) levels for intrusion into windows (such as dwellings) are provided in **Table 1**.

Table 1: Environmental Zones

Environmental Zone & Definition	Light Intrusion (into windows) Ev (lux)	
	Pre-curfew	Post-curfew
E0: Dark sky parks, UNESCO Starlight Reserves	0	0
E1: Intrinsically dark landscapes. Examples: National Parks, Areas of Outstanding Beauty	2	(1*)
E2: Low district brightness. Examples: rural, small village, relatively dark urban location	5	1
E3: Medium district brightness. Examples: small town centres or urban locations	10	2
E4: High district brightness areas. Examples: town/city centres with high night-time activity levels	25	5

⁴ Institution of Lighting Professionals, 2021. Guidance Note 01 The Reduction of Obtrusive Light.

⁵ The guide does not define a specific curfew. 23:00 to 07:00 is often taken to be curfew, which corresponds to other planning and environmental disciplines such as acoustics, and human sleeping patterns. A stricter curfew may apply, such as dark sky.

Environmental Zone & Definition	Light Intrusion (into windows) Ev (lux)	
	Pre-curfew	Post-curfew

Ev: Vertical illuminance in lux

*Permitted only from public road light installation

The EZ table also includes levels for sky glow, luminaire intensity (luminance) and building luminance. Sky glow, luminance and glare can be controlled through the luminaire selection and design.

Example levels of lux include: daytime (50,000), overcast sky (5,000), office & task (500), street lighting (5 to 20), full moon (0.25 to <1)

4.4 Sports England

4.4.1 Sports England has issued guidance on sport use lighting⁶. The guidance covers a multitude of different sports and provides explanations and recommendations, such as the ideal lighting setup, products, placement and layout, potential costs, and lighting levels that need to be maintained around different areas of the sports playing area.

4.4.2 The inclusion of lighting provides positive benefits to the community and the business, Sports England states:

"Taking bad weather into account, an all-weather court in the South East of England is available for about 2,500 hours of daylight playing time per year. Lighting increases playing time by about 40%, or 1000 hours. Clubs with lighting have an enormous advantage over those without lighting, attracting coaches, more players, extending playing times and providing increased revenue from court fees during the winter months."

4.4.3 Sports England guidance advises that the MUGA lighting design should cater for the sports activity with the most demanding requirements. The document states: *"For instance, a MUGA which is marked out for both Netball and Football will need to be lit to the 400 lux required for Netball."*

5 Design Details

5.1 Environmental Zone

5.1.1 Whilst the site is located in an urban area, Richmond Park and greenery are within the local area. An EZ E2 'Low district brightness. Example: relatively dark urban location' is defined for the site.

⁶ Sports England, 2012. Design Guidance Note, Artificial Sports Lighting

5.2 Lighting Requirements

5.2.1 **Table 2** identifies the recommended lighting levels for the proposed MUGA under the Sports England guidance⁶.

Table 2: Lighting Levels

Task Area	Lighting Standard	
	Recommended Average	Uniformity
	Horizontal Lux	
Netball	400	0.7 (70%)

5.2.2 Not all sports at the MUGA require the same level of lighting. The lighting design provides the highest grade of lighting play. Dimming for sports that require less lighting needs would be beneficial.

5.3 Equipment and Placement Details

5.3.1 The lighting design comprises ten Urbis Schreder Omnistar Kit ECO⁷ luminaires positioned at equal positions symmetrically on each side of the canopy structure.

5.3.2 The LED plate is flat glass, and the luminaire length is approximately 50 cm, ensuring a large spread and even distribution of LEDs to reduce potential glare effects. All luminaires are 4000 kelvin colour temperature (code: NW740).

5.3.3 This product comprises trademark registered features to reduce glare effects, titled 'LensoFlex[®]4'. The Urbis Schreder website provides further details of this specialist feature:

"LensoFlex[®]4 maximises the heritage of the LensoFlex[®] concept with a very compact yet powerful photometric engine based upon the addition principle of photometric distribution. The number of LEDs in combination with the driving current determines the intensity level of the light distribution. [...] LensoFlex[®]4 optics can feature backlight control to prevent intrusive lighting, or a glare limiter for high visual comfort."

⁷ Urbis Schreder. Product details available at: <https://www.schreder.com/en/products/omnistar-kit-industrial-sport-large-area-lighting>

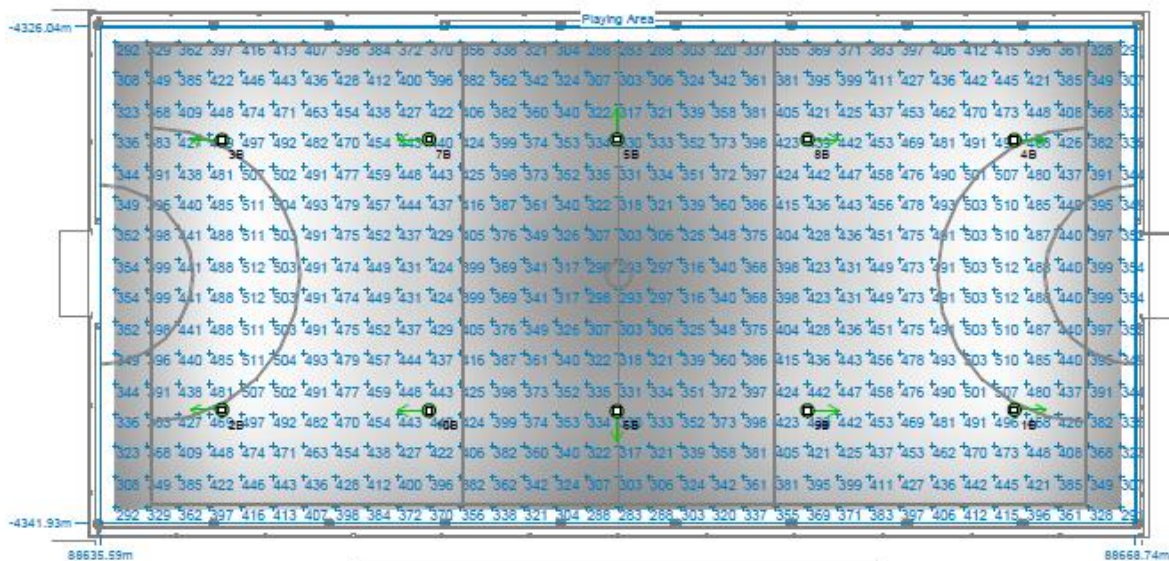
- 5.3.4 The luminaires are installed at 9 m above ground level, into the canopy roof concave and angled directly downwards. CAD drawings have been used to define the luminaire positions, so they align to the canopy's concave shape, height and fixing option.
- 5.3.5 The product offers several mounting options: post slip-over, bracket, surface mounting and direct ceiling mounting. The mounting style is unknown at this stage. The canopy supplier and installer will determine the mounting style; this will be specified at the luminaire procurement stage.
- 5.3.6 The product offers Ingress Protection (IP) IP66, Impact Rating (IK) IK10 and has a Colour Rendering Index (CRI) >70.
- 5.3.7 The equipment inventory included in the design is provided in **Table 3**.

Table 3: Equipment Inventory

Product	Type & Optic	Lumen Output (flux klm)	Wattage	Quantity
Urbis Schreder	Optic '5303' – medium	70.31	508	10
OMNISTAR KIT ECO	distribution			

- 5.3.8 The luminaire placement at the MUGA is shown in **Figure 1**. The Reality Outdoor model outputs and further design details are shown in **Appendix B**.

Figure 1: Luminaire Placement



5.4 Maintenance Factor

5.4.1 The luminaire will gradually experience a loss of light output due to natural degradation of the product over its installation lifespan. This is corrected at the design stage by applying a maintenance factor. This ensures that the installed design will meet the intended lighting standards towards the end of the product lifespan after any potential degradation occurs.

5.4.2 The maintenance factor (f_m) is calculated by multiplying four parameters: the luminous flux factor (f_{LF}), survival factor (f_s), luminaire maintenance factor (f_{LM}) and surface maintenance factor (f_{SM}). The surface maintenance factor is for interior only, therefore, a value of '1' is applied for outdoor. A description of the three relevant parameters is provided below:

- Luminous Flux Factor (f_{LF}): this value is obtained from the manufacturer's datasheet. The value is typically displayed as median useful life L##, which is the length of time during which 50% of a population of operating LED based luminaires of the same type have flux degraded to less than their initial luminous flux.
- Survival Factor (f_s): this relates to the replacement of luminaires after they have failed. If the luminaires are directly replaced for new (without delay), then a factor of 1 can be assumed. However, the ILP GN11/20 ^[8] proposes a standard value of 0.97, which represents an arbitrary 3% failure rate of LED.
- Luminaire Maintenance Factor (f_{LM}): this represents the dirt build-up and other deterioration of the optic surface/material during the installation lifespan. Luminaire maintenance factors are defined in Annex C of BS 5489-1:2020. This parameter selection depends on column height, the EZ and cleaning schedule.

5.4.3 The calculated maintenance factor and one applied to the lighting design is provided in **Table 4**.

Table 4: Maintenance Factor

Parameter	Data Source	Value
Luminous flux factor (f_{LF})	Urbis Schreder OMISTAR ^[7]	0.95
Survival factor (f_s)	ILP GN 11	0.97
Luminaire maintenance factor (f_{LM})	Taken from BS 5489-1:2020 Annex C	>6 m, E2, 72 month clean: 0.92
Calculation: $f_{LF} * f_s * f_{LM}$		$0.92 * 0.97 * 0.95$
Maintenance Factor (f_m) – Final Value		0.85

⁸ Institution of Lighting Professionals, 2020. Guidance Note 11, Maintenance Factor Determination of LED Luminaires

5.5 Wattage

5.5.1 With regard to the equipment inventory listed in **Table 3**, the total power requirement of the design is 5080 watts (5.1 kW). This assumes full operational requirements at installation. No revisions are made for switch-off or dimming.

6 Reality Outdoor Model Results

6.1 The Reality Outdoor model outputs are shown in **Appendix B**. A summary of the design levels achieved is provided in **Table 5**.

Table 5: Lighting Model Design Results

Task	BS Target	Design/Result Achieved
MUGA Playing Area	400 average horizontal lux, 0.7 (70%) Uniformity	405.13 average horizontal lux, 0.70 (70%) uniformity

6.2 The recommended design levels are met.

7 Operational Controls

7.1.1 Sports England guidance⁶ indicates that basketball requires approximately 5.5* less lighting than netball. Other sports, such as football, would require similar reductions. Therefore, incorporating dimming into the installation could provide significant energy and running cost reductions if different sports are played.

7.1.2 Dimming to 20% (80% reduction compared to full operation) reduces lighting levels to 81 average horizontal lux on the playing surface. This would meet the recommended 75 lux lighting level (0.7 uniformity is also achieved, well above the basketball minimum level of 0.5). Dimming to 30% would be sufficient for football. Detailed statistics can be provided from the model if a specific dimming profile will be set by the operator.

7.1.3 The lighting should be switched off when not in use.

8 Mitigation

8.1 Embedded mitigation includes the use of appropriate heights, equipment selection, placement of columns and optics. The proposals comprise products with excellent upward light control and glare control. No further mitigation is required given the structure will obstruct outward light spill.

9 Designers Risk Assessment

9.1 This design has been prepared for a planning application. Specifics surrounding installation, connection and maintenance have yet to be defined.

9.2 In accordance with the Construction Design and Management Regulations 2015, the following assumptions and considerations should be noted. The Institution of Lighting Professionals has also published Guidance Note 4 (2016) '*CDM 2015 Overview*' to aid this process.

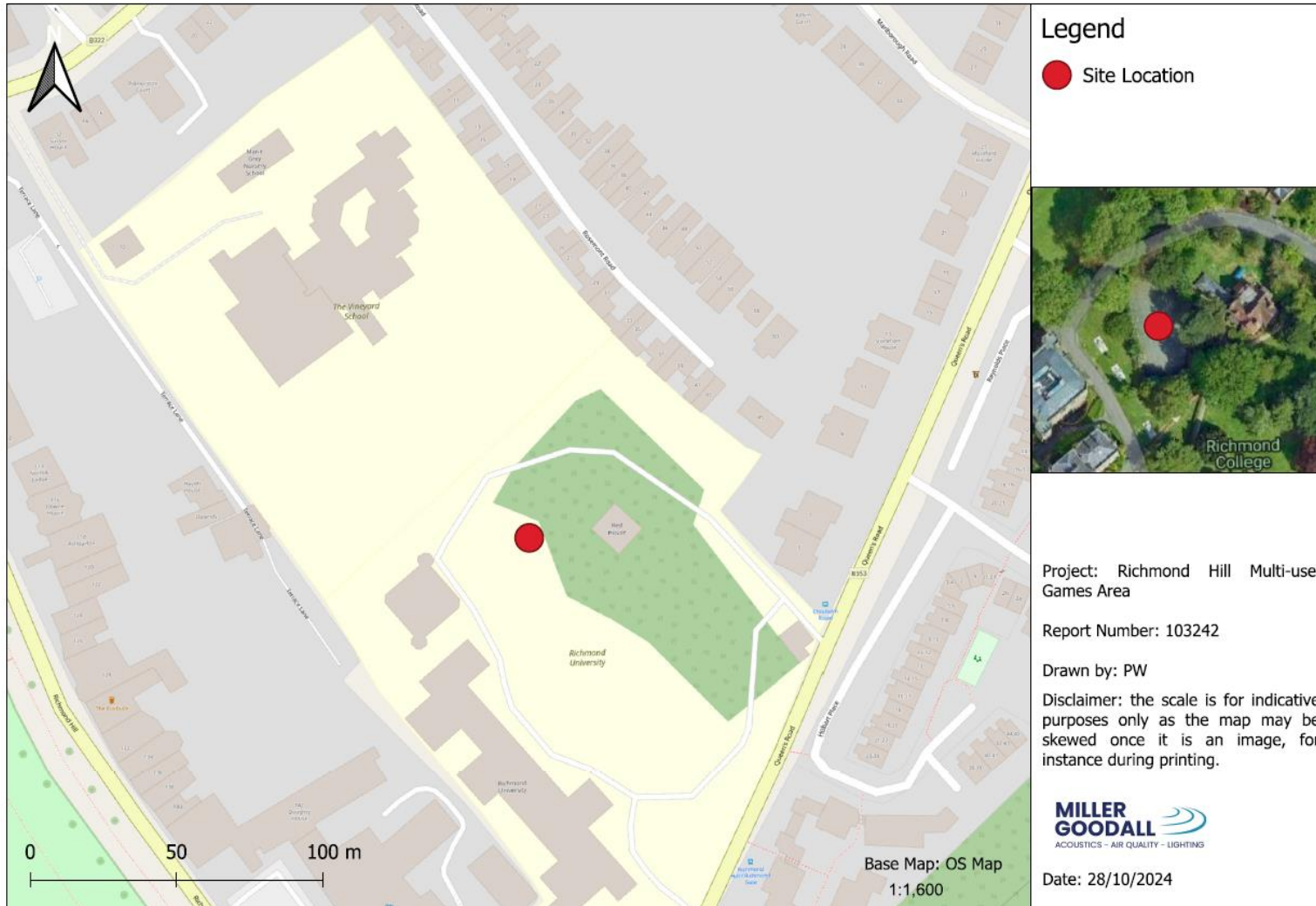
- The design and output calculations are based on the products used, presented in **Appendix B**. Any revisions to this may alter the final lighting profile and should be accounted for in a redesign.
- The design is based on detail from the applicant that the structure is covered at the roof and sides. Any deviations to this structure may require redesign.
- The luminaires are placed to reflect the canopy dimensions provided to us. The mounting options will be configured by the canopy supplier.
- The design provided in this report and appendices is for the purpose of the planning application. It is not a finalised construction design.
- The design does not account for installation or electrical installation considerations, site conditions or provide an installation or maintenance risk assessment.
- The contractor shall liaise with the District Network Operator (DNO) (UK Power Networks) and/or appointed electrical engineer to organise or action electrical amendments and connections. Competent person(s) certified to handle electrical installations shall install the equipment.
- The contractor shall identify any overhead or underground obstacles or infrastructure that may pose risk or harm associated with the installation of the design before the physical installation (i.e. utility drawings).
- Future maintenance should be carried out according to appropriate standards, health & safety procedures and the manufacturer's requirements/standards.
- All electrically supplied items of street furniture shall be earthed and bonded in accordance with BS 7430.

10 Summary

- 10.1 This lighting design report presents the technical details of the lighting design for a proposed multi-use games area (MUGA) at Thomas' College. The MUGA will host various sports and a lighting design has been prepared for the most light-demanding activity. A canopy and sidewalls will be constructed over the existing MUGA, which will obstruct outward light spill beyond the playing area.
- 10.2 The relevant lighting requirements of the Sports England Artificial Sports Lighting Design Guidance Note for MUGA's is met. Lighting levels for netball are presented and recommendations for dimming are made given the large lux level difference required for each sport.
- 10.3 All lighting will be switched off when not in use.
- 10.4 There is, therefore, no reason for this application to be refused on the grounds of lighting.

APPENDICES

Appendix A: Site Location



Appendix B: Lighting Reality: Reality Outdoor, Design Output

DATE: 29 October 2024
DESIGNER: Philip Walton
PROJECT No: 103242
PROJECT NAME: Richmond Hill MUGA



Design created using AutoCAD file: SS24-008 - Thomas' College - Canopy Project - Proposal

Lighting Standard
Sports England Design Guidance Note: MUGA (Basketball & Netball only)
Netball Standard: 400 horizontal average lux, 0.7 uniformity

Outdoor Lighting Report

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Playing Area	88635.59	-4341.93	33.15	15.89	1.00	0.99
2	Light Spill	88581.47	-4397.40	136.70	127.16	1.49	1.50

Luminaires

Luminaire B Data

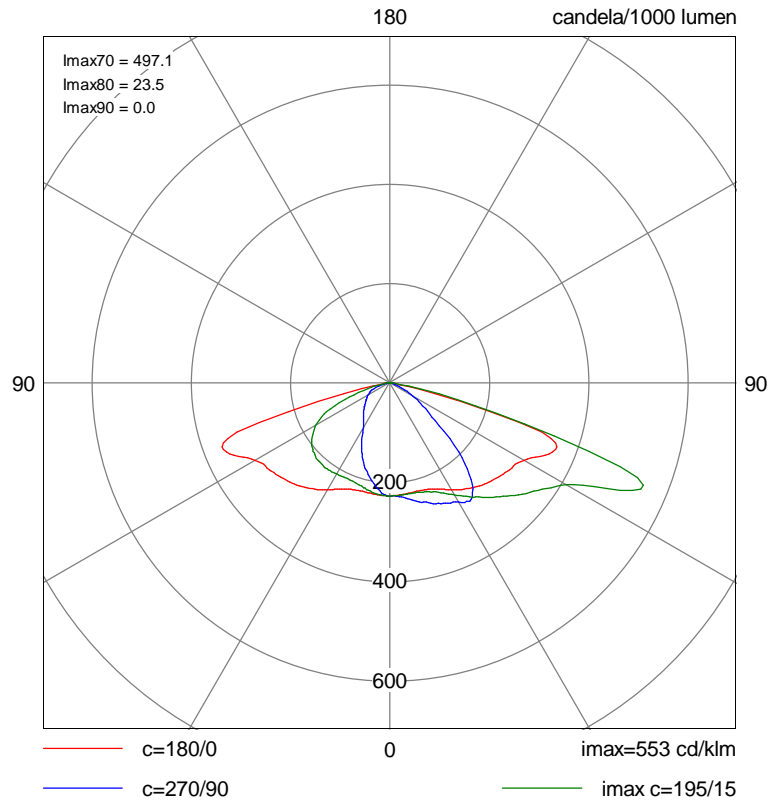
Supplier	
Type	OMNISTAR KIT ECO 5303 160 LH351C@1000mA NW 740 230V 01-71-002
Lamp(s)	160 LH351C@1000mA NW 740 230V 01-71-002 [CJOISCSTDA], valid fr
Lamp Flux (klm)	70.31
File Name	508W 7x6 II-Medium 488692 Flat glass 230V EF .ies
Maintenance Factor	0.85
Imax70,80,90(cd/klm)	497.1, 23.5, 0.0
No. in Project	10

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	B	88664.84	-4338.30	9.00	0.00	0.00	0.00	0.00			
2	B	88639.49	-4338.30	9.00	180.00	0.00	0.00	0.00			
3	B	88639.49	-4329.67	9.00	180.00	0.00	0.00	0.00			
4	B	88664.84	-4329.67	9.00	0.00	0.00	0.00	0.00			
5	B	88652.12	-4329.64	9.00	90.00	0.00	0.00	0.00			
6	B	88652.12	-4338.33	9.00	270.00	0.00	0.00	0.00			
7	B	88646.11	-4329.65	9.00	180.00	0.00	0.00	0.00			
8	B	88658.22	-4329.65	9.00	0.00	0.00	0.00	0.00			
9	B	88658.22	-4338.32	9.00	0.00	0.00	0.00	0.00			
10	B	88646.11	-4338.32	9.00	180.00	0.00	0.00	0.00			

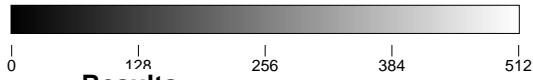
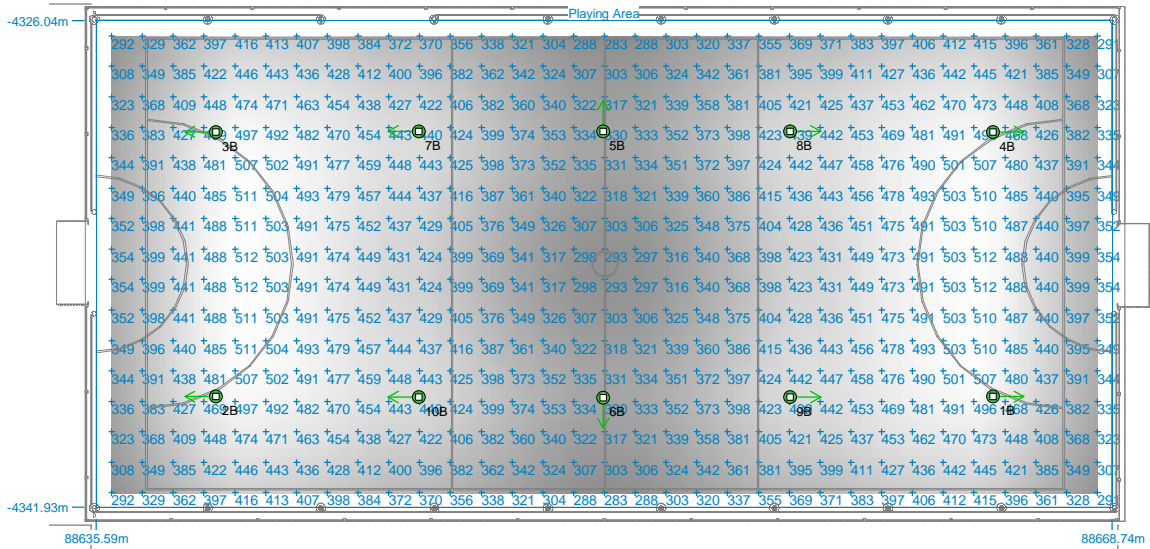
Polar Diagram

Luminaire B OMNISTAR KIT ECO 5303 160 LH351C@1000mA NW 740 230V 01-71-002



Horizontal Illuminance (lux)

Playing Area



Results

Eav	405.13
Emin	283.32
Emax	511.99
Emin/Emax	0.55
Emin/Eav	0.70

Glossary of Terms

Arrangement The pattern in which the luminaires are sited in plan (e.g. regular, along one edge or around the perimeter, staggered, opposite etc).

Average Illuminance Illuminance (lux) averaged over the specified area, road

Average Luminance Luminance (cd/m²) averaged over the specified area or solid angle

Base Plate [of the lighting column] Plate below ground level fixed to a planted lighting column to prevent the column sinking into the ground and to help prevent the column overturning

Beam Angle The total angle over which the luminous intensity of a beam drops to 50% of the peak value

Bracket A component used to support a luminaire at a definite distance from the axis of the lower straight position of a column

BS British Standard

Calculation Grid A series of calculation grids set out in grid formation. Modelled at 1.5 * 1.5 m grid spacing.

Candela SI unit of luminous intensity (cd).

Carriageway That part of the road normally used by vehicular traffic

Colour Appearance The apparent colour of light emitted by a particular light source – often expressed in terms of 'cool' (4000 Kelvin (K)), 'intermediate' (3500 K) and 'warm' (3000 K). These terms are generalisations but are commonly used to describe light colour appearances

Colour Rendering Index (Ra) Measure of the degree to which the colour and appearance of an object appears 'naturally' when compared to a basis of reference e.g. artificial light, daylight.

Colour Temperature Temperature of the light measured in Kelvin (K)

Conflict Area Areas where different classes mix or cross. Examples such as road intersections, roundabouts, queuing locations, pedestrian crossings.

Contrast The difference in appearance of two or more parts of a field seen simultaneously or successively. E.g. brightness contrast, one object appearing more in dark than the other.

Curfew The time after which stricter requirements will apply. Planning conditions covering hours of operation or cessation lighting post-curfew will often be specified by a planning authority. There is no set definition of curfew and it can vary by location, however, 23:00 to 07:00 is often cited.

Disability Glare Glare that impairs the vision of objects without necessarily causing discomfort

Discomfort Glare Glare that causes discomfort without necessarily impairing the vision of an object

District Network Operator (DNO) The company responsible for the distribution of electrical energy in a predefined area

Environmental Zone Designated zone (area) where additional controls on exterior lighting are imposed

Glare Condition of vision in which discomfort or a reduction in the ability to see details or objects, caused by unsuitable distribution or range of luminance, or to extreme contrast

Horizontal Illuminance The illuminance on a horizontal plane at a specified height (ground level, unless otherwise specified)

Illuminance The amount of light (lumens) landing on a surface area. Measured as lux. The lighting of surfaces, object or surroundings so they may be seen

Light Pollution The spillage of light into areas where it is not desired

Light Trespass Light, normally measured in illuminance (lix) that impacts onto a surface outside of the area designed to be lit by the installation concerned

Lighting Column Support intended to hold one or more luminaires, consisting of a post, possibly an extension piece and a bracket.

Lumen SI unit of luminous flux. Luminous flux emitted in unit solid angle (steradian) by a uniform point source having a luminous intensity of 1 cd

Luminaire Apparatus which distributes, filters or transforms the light transmitted from one or more lamps. The light source i.e. LED

Luminance The amount of light that reaches the eye by reflection or direct transmission from an area

Lux SI unit of illuminance

Maintenance Factor The depreciation of light from a luminaire over the life cycle of it

Obtrusive Light Light outside the area to be lit that causes annoyance, discomfort, distraction or a reduction in the ability to see essential information e.g. at signal lights

Photometer Meter used to measure light. Minolta T10 is used by Miller Goodall Ltd to record illuminance (lux) levels

Sky Glow The brightening of the night sky that results from the reflection of radiation, scattered from the constituents of the atmosphere (e.g. gaseous molecules, aerosols and particulate matter), in the direction of observation

Spacing The distance between luminaires in an installation

Spill Light (stray light) Light emitted by an installation, which falls outside the boundaries that is being lit

Upward Light Ratio (ULO) Proportion of the light flux of a luminaire and/or installation that is emitted at and above the horizontal when the luminaire is mounted at an installation position. A measurement of sky glow.

Vertical Illuminance The illuminance on a vertical plane at a specified point

