TECHNICAL REPORT RELATING TO A LIGHTING INSTALLATION TO EXISTING HOCKEY PITCH AT EASTCOTE HOCKEY CLUB

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Site Location: Eastcote Hockey Club, Kings College Road, Ruislip, HA4 7JZ.

Design Standards

The floodlighting proposals have been assessed using the guidance outlined the following publications: -

BS EN 12193 Light and Lighting - Sports Lighting (2007) BS EN 12193 sets the minimum lighting levels for sports within Europe.

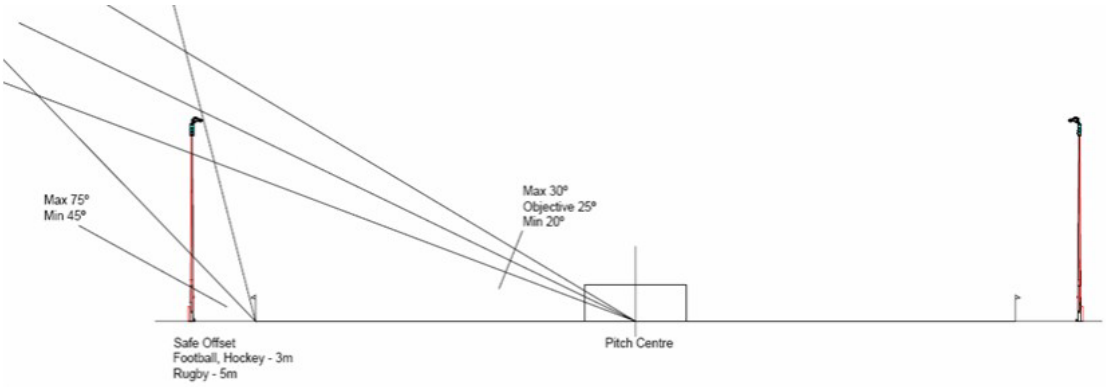
It classifies sports into three standards. Class III – Training and recreational use

Class II – High quality coaching and low-level competition

Class I – National standard coaching and high-level competition

CIBSE Lighting Guide LG4 - Sports Lighting (2006) CIBSE Lighting Guide LG4 provides in depth guidance shows the design principals which should be adopted by lighting engineers. This includes the methodology for calculating the floodlight mounting height and the setting out of mast locations required to optimise the lighting system.

To meet the requirements of the sport's governing body, Federation of International Hockey (FIH), the playing area must achieve an average maintained Illuminance (Eave) 350 Lux as well as a Uniformity Ratio of > 0.70 (Emin/Eave) and > 0.50 (Emin/Emax).



Calculation method for floodlight mounting height for CIBSE LG4

By following the design methods outlined in CIBSE LG4 the floodlight mounting height of 15m will be used to ensure that floodlights are elevated to optimise their performance and reduce upward waste light. Light will also be directed downwards on to the playing surface and will minimise spill light towards residential properties.

Obtrusive Light Limitations

The Institute of Lighting Professionals has produced a guidance document to be used by lighting professionals, planning authorities and people with and interest in reducing the environmental impact of lighting installations. The ILP 'Guidance notes for the reduction of obtrusive light '2020 categorises the environment into five zones. The categorisation is according to the amount of urbanisation, the existing background illumination and the degree of protection required to maintain the current environmental zone. The environmental zone categories are shown in Table 2 and the obtrusive light limitations in Tables 3 and 4.

Table 2: 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 3 (CIE 150 table 2): 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 lx	2 lx	5 lx

Table 4 (CIE 150 table 3 (amended)): Limits for the luminous intensity of bright luminaires[4].

Light technical parameter	Application conditions	Luminaire group (projected area A_p in m^2)					
		$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p>0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E0						
	Pre-curfew	0	0	0	0	0	0
	Post-curfew	0	0	0	0	0	0
	E1						
	Pre-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10 *d*	7,500
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500
	E3						
	Pre-curfew	0.86 *d*	1.9 *d*	3.8 *d*	7.5 *d*	15 *d*	10.000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	1,000
	E4						
	Pre-curfew	1.4 *d*	3.1 *d*	6.3 *d*	13 *d*	26 *d*	25,000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
Aid to gauging A_p		2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m^2)		0.0008	0.004	0.016	0.063	0.251	>0.5

Notes:

1. d is the distance between the observer and the glare source in metres;
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions;
3. A_p is the apparent surface of the light source seen from the observer position
4. For further information refer to Annex C of CIE 150
5. Upper limits for each zone shall be taken as those with column $A_p>0.5$

The guidance notes also recommend the maximum beam elevations for floodlights and the most effective reflector design required to minimise spill light and glare. By following this advice effective light control can be assured.

Midstream Lighting Design Outline

Midstream Lighting were asked to design a suitable lighting upgrade for the existing floodlit hockey pitch at Eastcote Hockey Club. In proposing a suitable solution, specific issues had to be considered. These included the illuminance level required, the environmental zone category for the site, the minimum mast height as well as the number and type of luminaire.

Details of how these issues were resolved are as follows: -

1. To ascertain the illuminance level required, we referred to the existing lighting and FIH guidelines. This stipulates the following lighting requirements for the club (class II) as follows:

Sport	**Horizontal Illuminance E_{av} (lx)**	**Uniformity E_{min} / E_{av}**	**Uniformity E_{min} / E_{max}**
Hockey	350	> 0.7	> 0.5

Please note:

- *the existing lighting is also designed to achieve the same lighting specification i.e., we are not increasing the light levels that are already there.*
- *Eav refers to a maintained average illuminance, which is the minimum average value required across the whole playing surface during its lifetime and incorporates a maintenance factor to allow for depreciation due to ageing, buildup of dirt etc.*

2. For the relevant environmental zone, reference was made to The Institution *of Lighting Professional (ILP): Guidance Notes for The Reduction of Light Pollution, 2020*. This document categorises the environment into four zones ranging from National Parks to City Centres. The site at Eastcote Hockey Club would fall under Environmental Zone E3 for a suburban location.

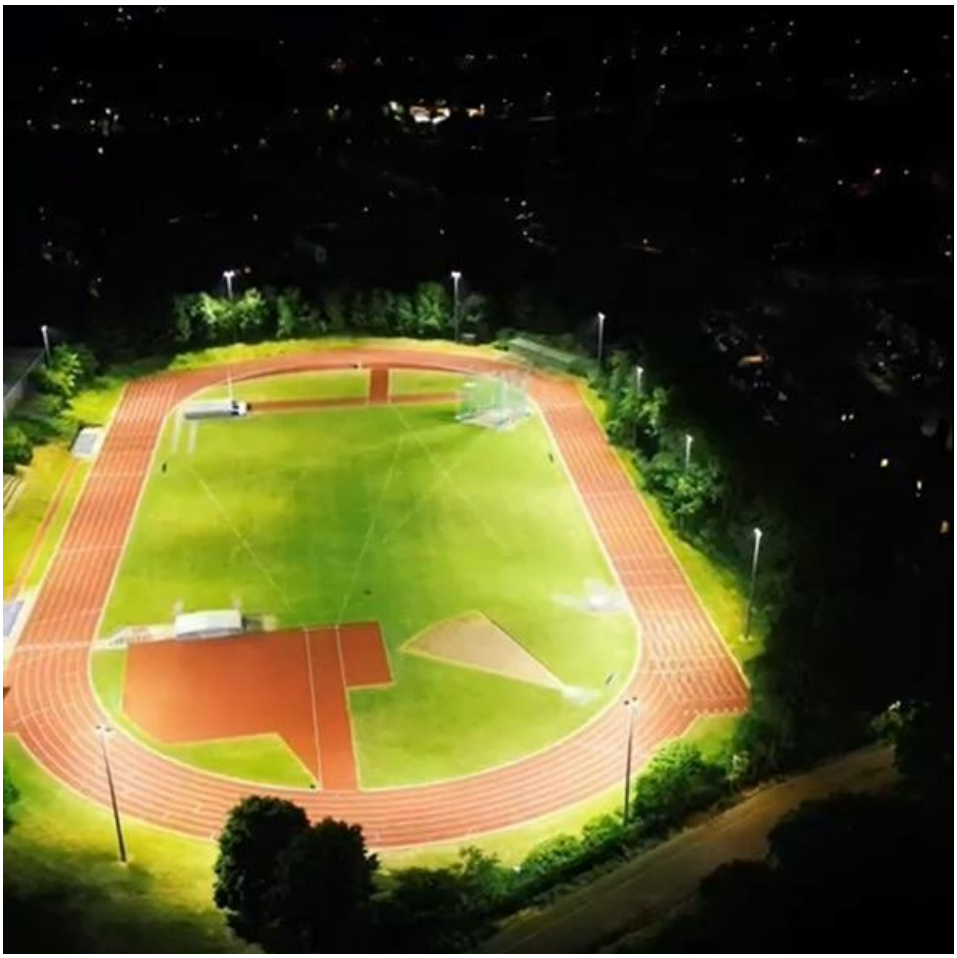
3. The mast height was calculated using the method detailed in the CIBSE guide LG4 "Sports Lighting". This uses angles projected from the centre of the track & the edge of the track to produce a head frame location zone. When applied to this project the optimum mast height was calculated at 15m. This will result in low vertical overspill and good uniformity on the playing surface, without compromising cost. If the mounting height was reduced the floodlights would be elevated above the horizontal consequently increasing overspill. The 15m mounting height also mirrors the height of existing masts that are already on site.

4. To meet the requirements of The Institution of Lighting Professionals: Guidance *Notes for The Reduction of Light Pollution, 2020,* the Modus S floodlight was chosen. The Modus S is a Low glare, broadcast-ready, flicker-free LED floodlight designed specifically for sport field and large area lighting. Details of the main features of this product including dimensions are highlighted in the technical specification submitted as part of the planning application.

5. A dimming option is included to reduce the levels to 175-lux, further minimising the impact to the surrounding area. The 175-lux option is intended to be used after 8pm until curfew, with the 350-lux requirement only used for hockey matches and higher team training sessions up to, but not beyond, 8pm.

6. We can meet the lighting requirement by reducing both the quantity and size of the existing fittings to significantly reducing the visual impact of the existing setup during the day.

Please see photo below of a recent installation using the Modus S floodlight



Midstream Lighting Design

The Midstream lighting proposal is detailed in the design reference "ML2115 – Eastcote Hockey Club". This shows the mast locations, floodlight orientations, illuminance levels on the pitch and projected overspill values.

The design achieves the required maintained illuminance value of 350 lux with a uniformity of >0.7 (Emin/Eave) and >0.5 (Emin/Emax).

The maintained illuminance value on the pitch is calculated using a maintenance factor of 0.90. This considers reduction in light output due to dirt accumulation on the front glass of the floodlight and lumen depreciation, ensuring that the minimum requirements are achieved. Note, spill calculations have been calculated using a maintenance factor of 1.

The use of the Modus S ensures that horizontal and vertical overspill containment is excellent, and that light spill falls well within the recommended ILP Guidance Note for obtrusive light onto the surrounding residential properties. Also, upward waste light will be diminished with the floodlight elevations used, thereby reducing sky glow and minimising visual intrusion.

Further mitigation was used to reduce the impact of light spill towards the houses to the south, along Kings College Road and Evelyn Avenue, by reducing the tilt angles of the fittings along the north side.

For comparison, please see below typical examples of different lighting levels for various application.

Light Source	**Horizontal Lux**
Full Moon	0.3 to 0.5
Street Lights – Footpath	3 to 10
Street Lights – Residential Area	5 to 15
Typical City Centre Car Park(non retail)	20 to 30
Office/Classroom	250 to 750
Professional Stadium	800 to 2500
Sunny Day	80,000 to 120,000

Conclusion

The site already has a floodlit pitch lit to the same specification as the proposed new LED lighting system on the pitch. It will also use the same number and height of columns as the existing. However, the use of LED fittings will mean a tighter control of light spill into the surrounding area and a reduction in energy consumption and CO2 emissions (>50%) as well as fewer, smaller fittings to reduce visual impact during the day.

The proposed system would be suitable for installing in the required environmental zone E3 (suburban area), comfortably meeting the most stringent of light control parameters set out by the ILP Guidance Notes whilst at the same time maintaining the specified illuminance levels for the sport's governing body.

Once installed, the Modus series light control system will provide the optimum sports lighting solution, ensuring that light reaches the sports surface and not into the sky or polluting the environment.

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