15 September 2023

Manchester City Football Club – Academy Pitches 5 - 7
Manchester, United Kingdom

Reference: Musco Lighting System and Design

Musco Lighting has completed lighting designs and spill light calculations for the planning application of Pitches 5, 6, and 7 at the Manchester City Football Club Academy in Manchester (M11 4TQ) Based on consultation with the club and their design team, Musco has designed the pitch lighting to levels that are suitable for high level training and professional matches in accordance with CIBSE LG4: Sports Lighting and BS EN 12193 – Sports Lighting Class 1 requirements for football.

The club have asked that Musco's lighting design would minimize the spill light and glare on the surrounding areas with particular consideration for the residences and rail line which are in the vicinity. The submitted Musco design is fully compliant with the recommendations of the ILP report – Guidance Notes for the Reduction of Obtrusive Light, while not compromising the criteria set out in the lighting guidelines of the sports' governing bodies. Musco has proposed an appropriate number of columns at the necessary height to provide adequate downward aiming angles of the floodlights onto the pitch surface, thus minimizing glare and spill light. In addition, the Musco system is custom designed with full cut-off visors and reflectors to control the light output from the floodlights. This technology directs as much light as possible onto the pitch surface and away from surrounding areas. The following report details the proposed Musco system and design and how it has been designed to control light, maintains performance, and comply with the requirements of the relevant ILP report and tables.

Experience

Musco Lighting has nearly 50 years of experience in the sports floodlighting industry worldwide. Musco has had a presence in the United Kingdom for over 25 years and has provided floodlighting solutions on hundreds of projects all over the country. This experience extends from grassroots clubs to professional training grounds and major stadiums. Some notable projects similar to the proposed development at the Manchester City FC including all existing floodlit pitches at the Academy. In addition Musco systems are installed at training grounds for, Arsenal FC, Liverpool FC, Leicester City FC, Burnley FC, Fulham FC, Brighton and Hove Albion FC, Manchester United FC, Tottenham Hotspur FC and many others.

Each project involves unique locations that require very specific designs to accommodate the facility users as well as the surrounding residents, railway, and road networks. Musco has an extensive team of project engineers who design in accordance with specific codes and guidelines of each individual project location to provide the best possible floodlighting solution.

In addition to project experience, Musco is consistently on the cutting edge of floodlighting technology in product design and performance. The Musco Total Light Control (TLC) LED system cuts operating costs by around 50%, significantly reduces off-site spill and glare, eliminates all maintenance for 10 years, and guarantees the actual performance of the system for 10 years – all covered by a comprehensive 10 Year Warranty.

Our uniquely designed luminaire uses a system of optics and visors to control and re-direct light onto the pitch, thus significantly reducing the negative impact of the floodlights on nearby

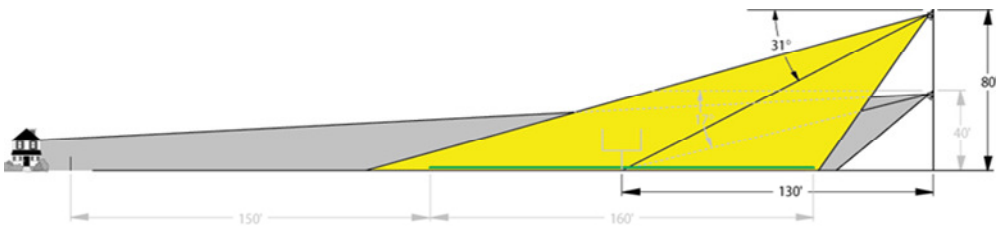
roadways and residences. Each luminaire is custom designed and built according to its specific purpose for the pitch lighting.

Another critical aspect when designing an environmentally friendly lighting system is the reduction of Sky Glow or Upward Light. Sky glow is the illumination of the night sky by an artificial light source. Musco's luminaire is designed to redirect upward light back down to the pitch, using the custom design visor and reflectors, in accordance with ILP recommendation for luminaire design.

Musco TLC 1500 Floodlight

In addition to the design of the luminaire, choosing appropriate number of columns and column heights is also key in the overall quality of the lighting design. Based on the size of the pitch, the sport being played, the competition level, and the use of the floodlighting system (televised or non-televised); column number and height requirements must be accurately assessed to ensure the aiming angle of the floodlight onto the pitch is at an appropriate degree to maintain good playability, control glare, and reduce spill light on adjoining properties. See the diagram below:

- Choosing the correct number of columns will improve the quality of light on the pitch, and the control of light off the pitch
- Choosing columns that are too short will increase glare for players and increase undesirable offsite spill light

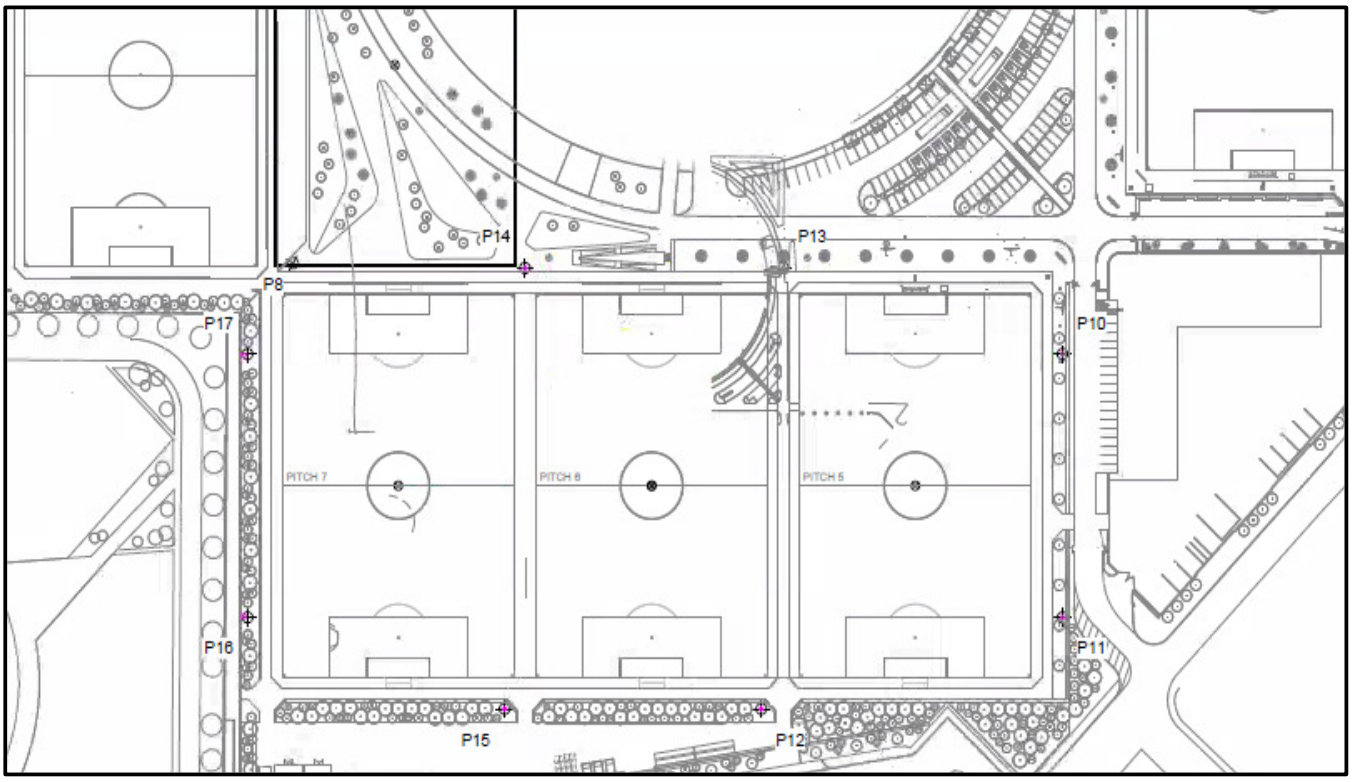


Evaluation of Proposed Development Site and Floodlit Pitches Location

In order to get an understanding of the location of the floodlit pitch in relation to the surrounding area, note the below images and drawings.

Google Image below, which indicates in the red box the location of the pitches to be floodlit relative to the current site and surrounding area:

Proposed Site Plan Drawing of the proposed floodlit pitches:



Musco Proposed Design

With the proximity of residential housing and roads, it was important the pitch floodlighting take into consideration the potential impact to the surrounding area. The accepted guidance for this is the Institution of Lighting Professionals: Guidance Notes for the Reduction of Obtrusive Light. This document outlines acceptable parameters for evaluating the impact of outdoor lighting on an environment or building, with consideration for the type of area, see table below:

ENVIRONMENTAL ZONES

It is recommended that Local Planning Authorities specify the following environmental zones for exterior lighting control within their Development Plans.

Table 1 – Environmental Zones

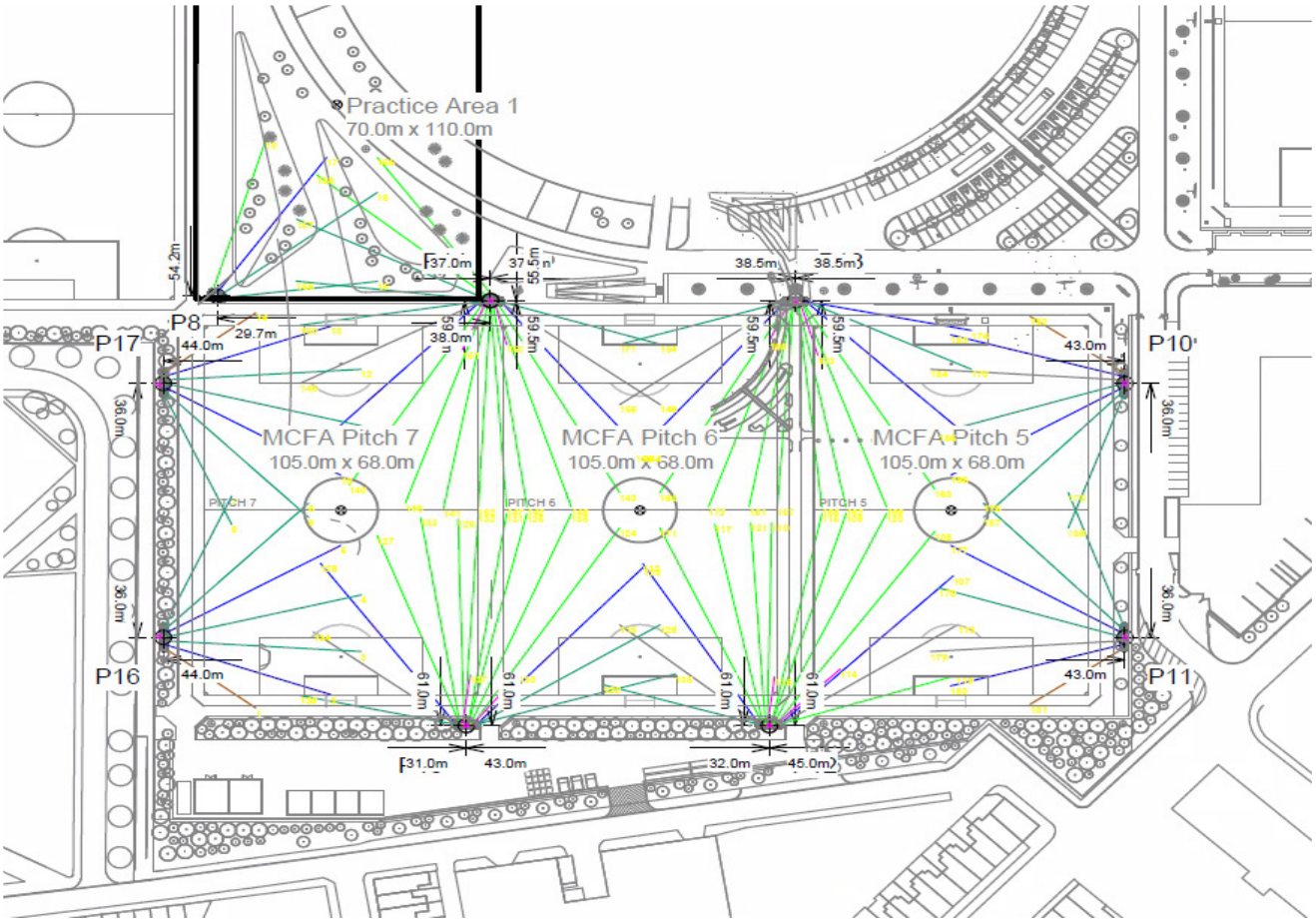
Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Based on similar applications in the area, it is most likely that the area of the proposed development would be classified into E3 – Suburban. This classification dictates specific criteria that should be taken into consideration and achieved with any external lighting to be designed or installed in the area. This criterion is detailed in the below table and outlined in red:

Table 2 – Obtrusive Light Limitations for Exterior Lighting Installations – General Observers						
Environmental Zone	Sky Glow ULR [Max %](1)	Light Intrusion (into Windows) E_v [lux] (2)		Luminaire Intensity I [candelas] (3)		Building Luminance Pre-curfew (4)
		Pre-curfew	Post-curfew	Pre-curfew	Post-curfew	Average, L [cd/m^2]
E0	0	0	0	0	0	0
E1	0	2	0 (1*)	2,500	0	0
E2	2.5	5	1	7,500	500	5
E3	5.0	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

As indicated, the allowable light intrusion at the façade/windows of an adjacent residence, measured vertically, is 10 lux (pre-curfew). Sky glow must be less than 5.0%, and luminaire intensity/candela less than 10,000 candelas.

Taking the ILP requirements into consideration along with the level of lighting performance that must be achieved on the pitch for the club to be able to comply with the relevant lighting requirements, Musco developed the below layout, with the columns being located in the corners of the pitches and along the ends, sharing columns between pitches. The columns range from a height of 21-24m above the pitch level which is necessitated by the size of the pitches and aiming distance based on the column locations. See below layout of the proposed floodlighting:



Design Evaluation - Spill Light Levels

The design submitted by Musco includes spill calculations both vertical and horizontal for evaluation. The spill calculations are presented on a blanket grid to a 200m radius around the pitch with contours at 10, 5, and 2 lux. In addition, vertical light to windows calculations are given along all nearby residences and the train line. These are shown to confirm compliance with the ILP Guidance Table 2 requirements.

Image below of the Horizontal Light Spill Contours:

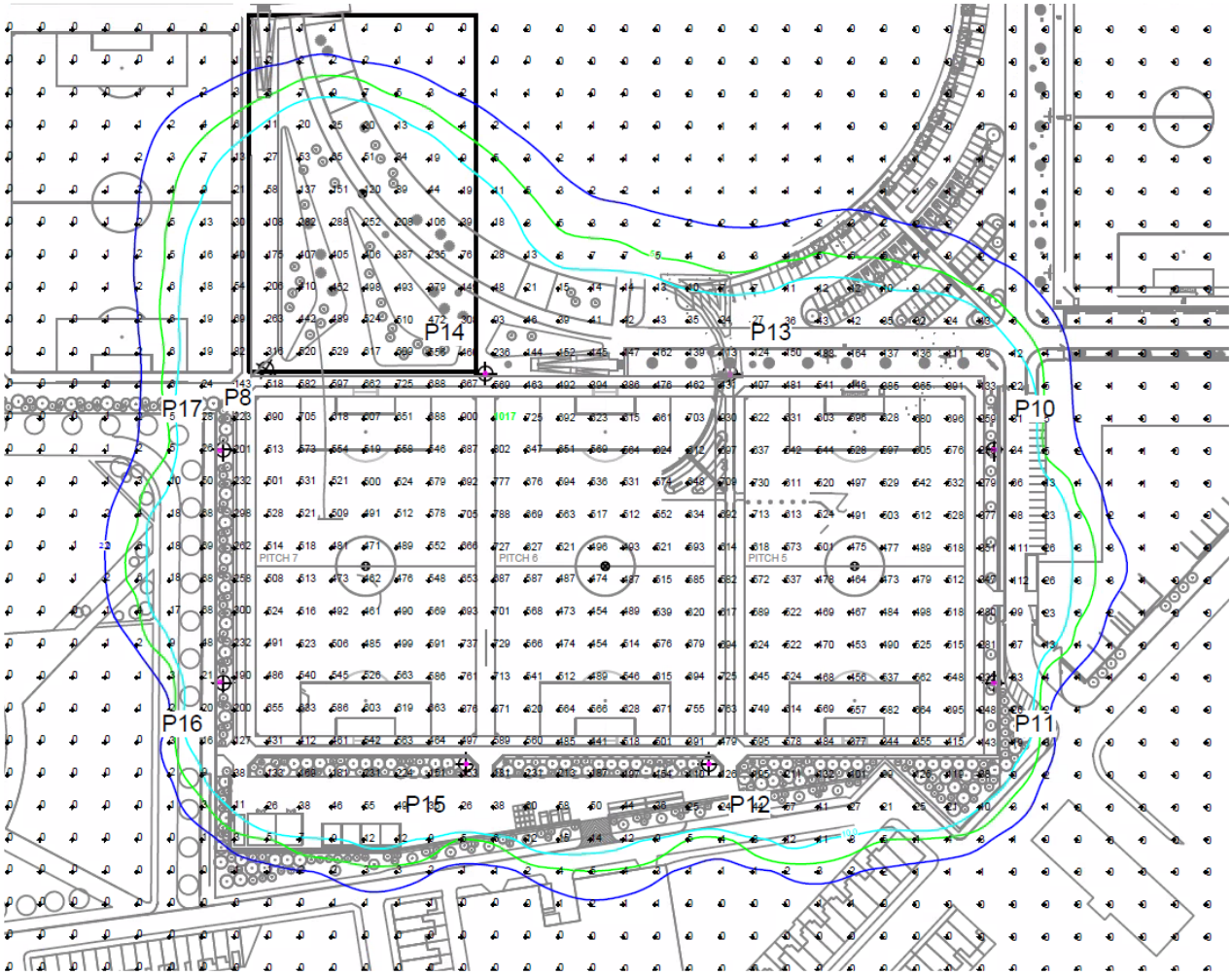


Image below of the horizontal light spill along the residences South of the pitches:
Note the values are all below 10 lux

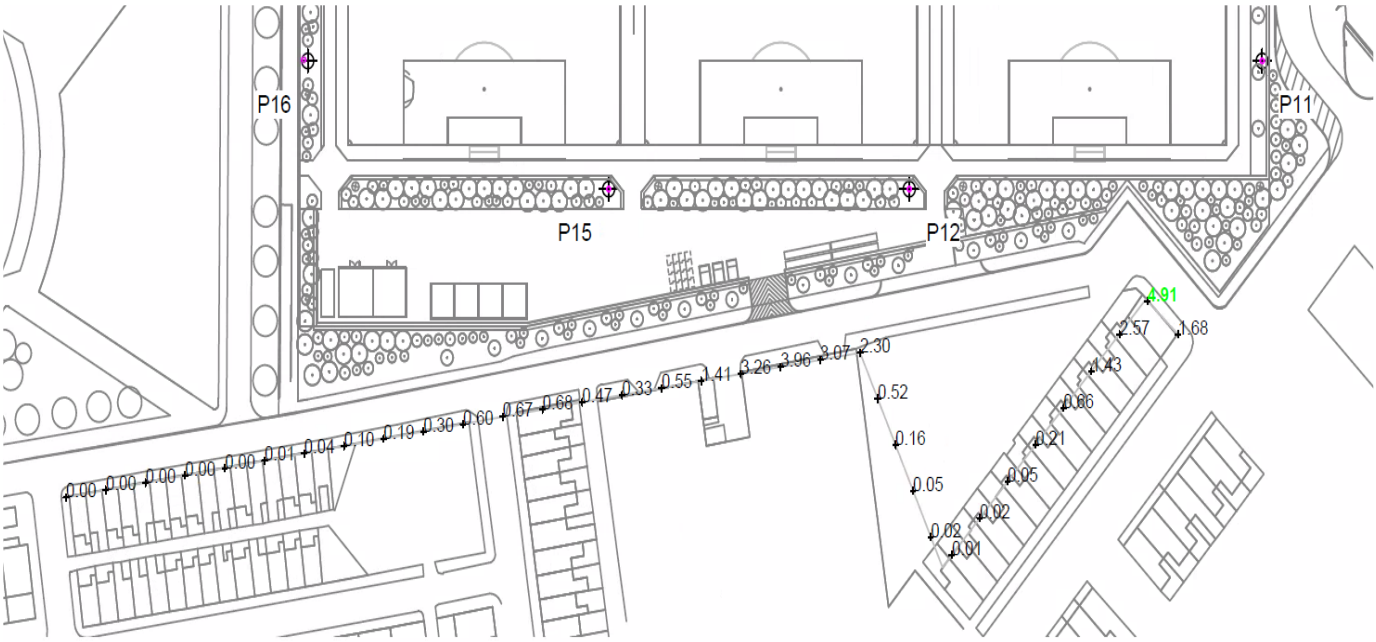


Image below of the vertical light spill along the train line to the SW to NW of the pitch:
Note the values are all below 10 lux

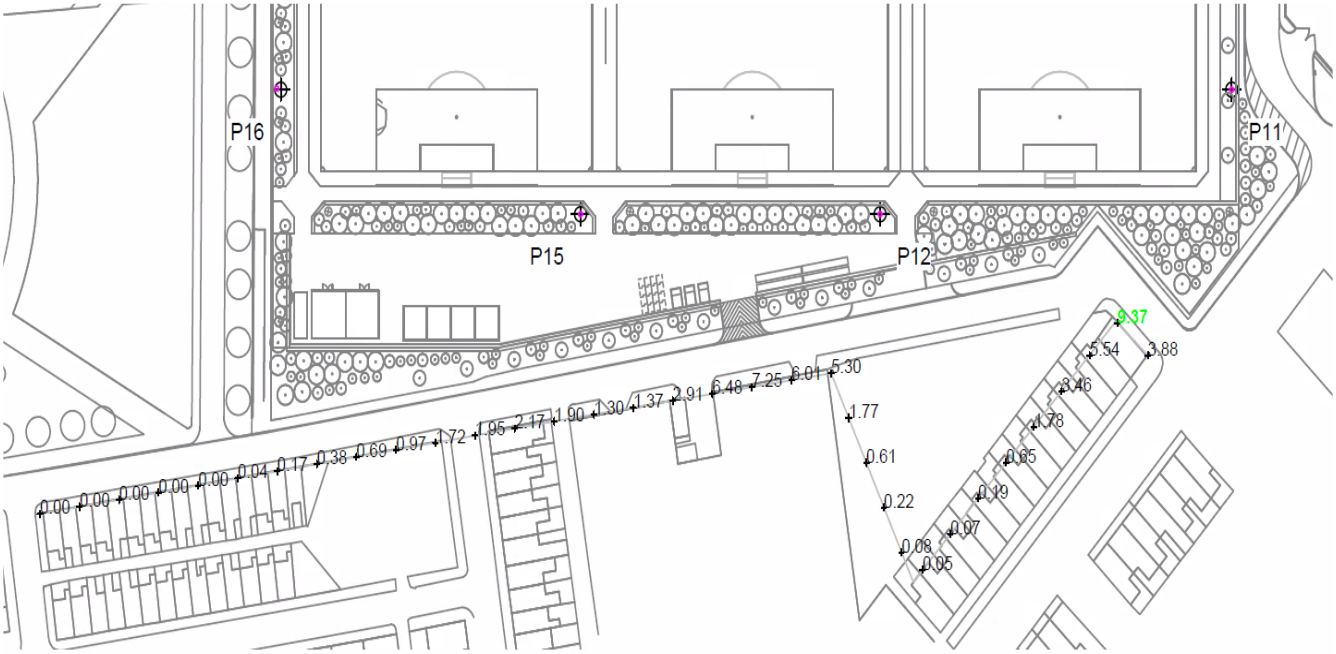
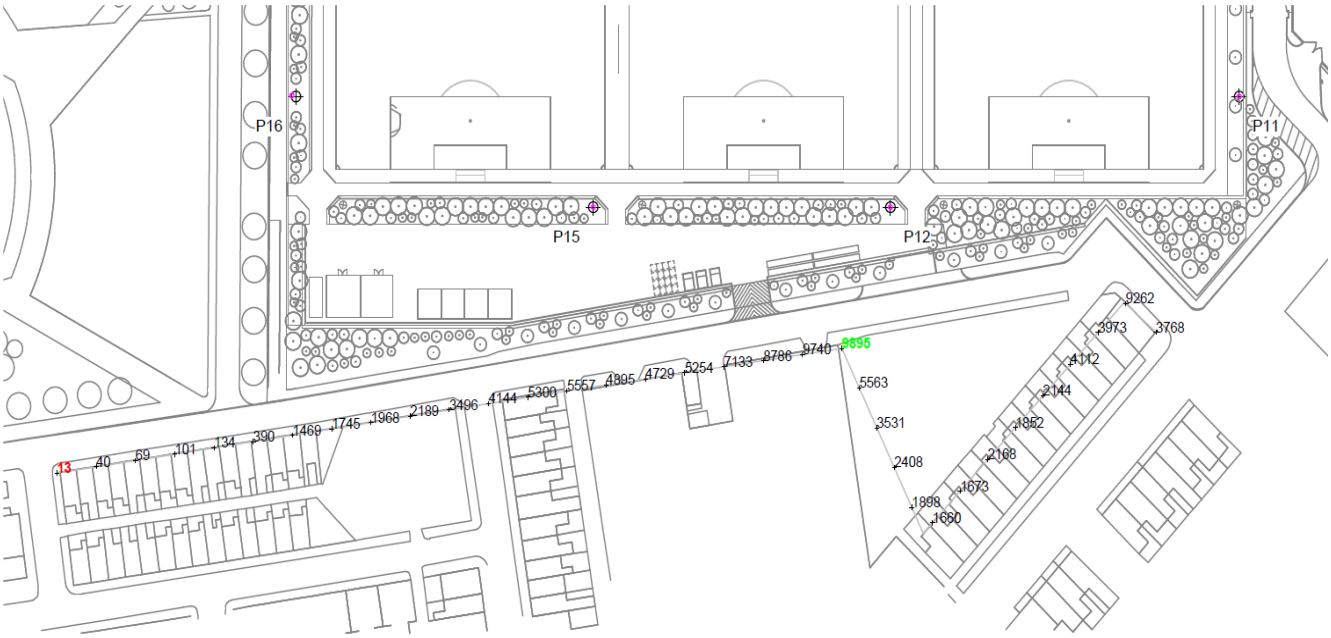
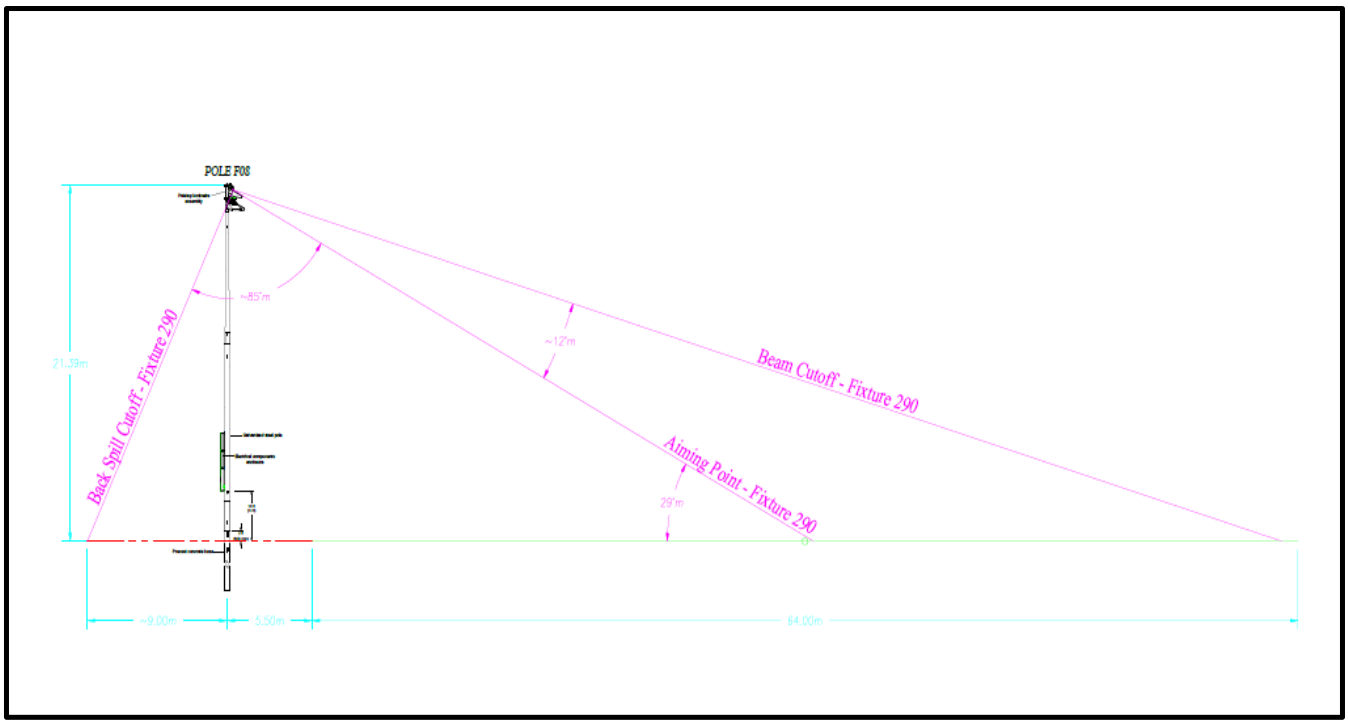


Image below of the vertical light spill along the residential areas North of the pitch:
Note the values are all 0 lux

In addition, Musco has evaluated the maximum Candela values for the proposed lighting system in the same areas as those noted previously for the vertical light to windows evaluation. These are indicated in the image below and provided in the Musco lighting design submitted with the application. The maximum values are circled in blue, and are fully compliant:



Sky Glow / Upward Light Ratio has also been evaluated for compliance, and the following diagram developed specifically for this design demonstrates that the proposed Musco system will achieve 0% ULR:



Conclusion:
Below is a table which indicates the maximum value for the relevant criteria of the ILP Guidance Table 2 requirements and how the proposed design compares:

EVALUATION CRITERIA	MAXIMUM ALLOWABLE VALUE (ILP Table 2)	MAXIMUM MUSCO DESIGN VALUE	COMPLIANT?
Sky Glow / ULR %	5%	0%	YES
Light Intrusion (into Windows) Vertical Lux	10 Lux	9.3 Lux	YES
Luminaire Intensity (Candelas)	10,000 Candelas	9,895 Candelas	YES

- The system proposed has been designed in accordance with the relevant lighting standards, requirements of the sport governance, and in line with similar installations across the country. This will allow safe play for the participants.

- While achieving these performance requirements, specific efforts have been made to minimise the impact of the lighting on the surrounding area by using custom designed LED luminaires with internal optics and external visors, proper column height and locations - all contributing to the directional control of the light to the playing area and limiting unwanted spill, glare, and sky glow.

- The system fully complies with the requirements of the ILP Guidance Notes on the Reduction of Obtrusive Light, which is the accepted standard for evaluating the suitability of external lighting design to specific environmental areas.

- It should be noted that the area surrounding the site boundary does have consistent trees and vegetation which will create additional light blockage to the road and residential buildings. No blockage has been considered as part of the design calculations, so values given are worst case and likely will be less in the field.

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REFERENCE DOCUMENTS:

Musco Design – 203262E
Musco Beam Cut-off Diagram – 203262X1
Musco Column Detail – 203262P1 & 203262E_Elevation Drawings
Musco TLC-LED-1500 & 1200 5700K – 75 CRI Datasheet
Musco TLC-LED-1500 & 1200 Luminaire

ILP Guidance Notes on the Reduction of Obtrusive Light
CIBSE LG4: Sports Lighting
BS EN 12193:2016 Sports Lighting