

November 2020



EXPANSION OF ANFIELD ROAD STAND, ANFIELD

L1/1 - Lighting Impact Assessment

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Pre-amble

This Lighting Impact Assessment is one of a suite of core documents prepared in support of the application submitted on behalf of Liverpool Football Club and Athletic Grounds Limited (“Liverpool FC” or “the Club”) for full planning permission to expand the Anfield Road Stand to accommodate an additional c.7,000 spectators with associated hospitality and spectator facilities, new public realm, and the realignment of Anfield Road.

This development forms part of the phased regeneration of the Anfield stadium and follows successful delivery of the Main Stand redevelopment and associated public realm (96 Avenue and Paisley Square) and a new free-standing LFC retail store and cafe.

It also reflects the wider regeneration of the Anfield area (The Anfield Project) that includes new and improved homes and regeneration of the Walton Breck Road high street, fuelled by the Club’s significant investment in the redevelopment of Anfield Stadium.

The following documents comprise the application:

- A1/1 Summary Guide to the Planning Application
- B1/3 Planning Statement
- B2/3 Appendices to Planning Statement
- B3/3 Draft S106 Agreement
- C1/2 Application Drawings
- C2/2 Design and Access Statement
- D1/3 Environmental Statement, Volume 1: ES Chapters and Figures
- D2/3 Environmental Statement, Volume 2: Technical Appendices
- D3/3 Environmental Statement, Volume 3: Non-Technical Summary
- E1/3 Transport Assessment
- E2/3 Transport Strategy
- E3/3 Staff Travel Plan
- F1/1 Air Quality Assessment
- G1/1 Phase I Geo-Environmental Desk Study
- H1/1 Flood Risk Assessment
- I1/1 Heritage Assessment
- J1/1 Socio-Economic Statement

K1/1 Health and Wellbeing Statement

L1/1 Lighting Impact Assessment

M1/1 Statement of Community Engagement

N1/1 Sustainability Statement

This statement has been prepared by Mott MacDonald (Consultant Engineers, Environmental Consultants and Transport Planners) with additional work, research and information provided, with thanks, by:

- Turley (Planning and Development Consultants)
- Planit ie (Urban Design, Landscape and Master planners)
- KSS Design Group (Architects)
- Liverpool Football Club
- Liverpool City Council

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Lighting Impact Assessment

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1 Introduction

1.1 Overview

Mott MacDonald Limited was commissioned by Legends on behalf of Liverpool Football Club (LFC), to undertake a Lighting Impact Assessment in support of a planning application comprising of two elements:

Further expansion of Anfield stadium to increase seating capacity through construction of a new Anfield Road stand. This will also involve the realignment of Anfield Road and some minor landscaping north of the stadium on the edge of Stanley Park; and

Amendment to the existing temporary permission (expires 2021) to allow for the permanent permission to hold 12 No. concert events and sporting events with the majority during the football off-season between mid-May to June-end.

1.2 Site Location and Setting

The site covers the Anfield Road Stand, Anfield Road and areas of hard standing at Anfield stadium in Liverpool. The total area of the site is approximately 2.6ha. The wider Anfield Stadium (the other stands and pitch) is located directly south/southwest of the site. Skerries Road is located to the southeast and Alroy Road to the southwest. Stanley Park bounds the site to the north. The wider area surrounding the site is predominately residential with Walton Breck high street containing a mix of commercial and residential properties lying immediately to the south of Anfield Stadium.

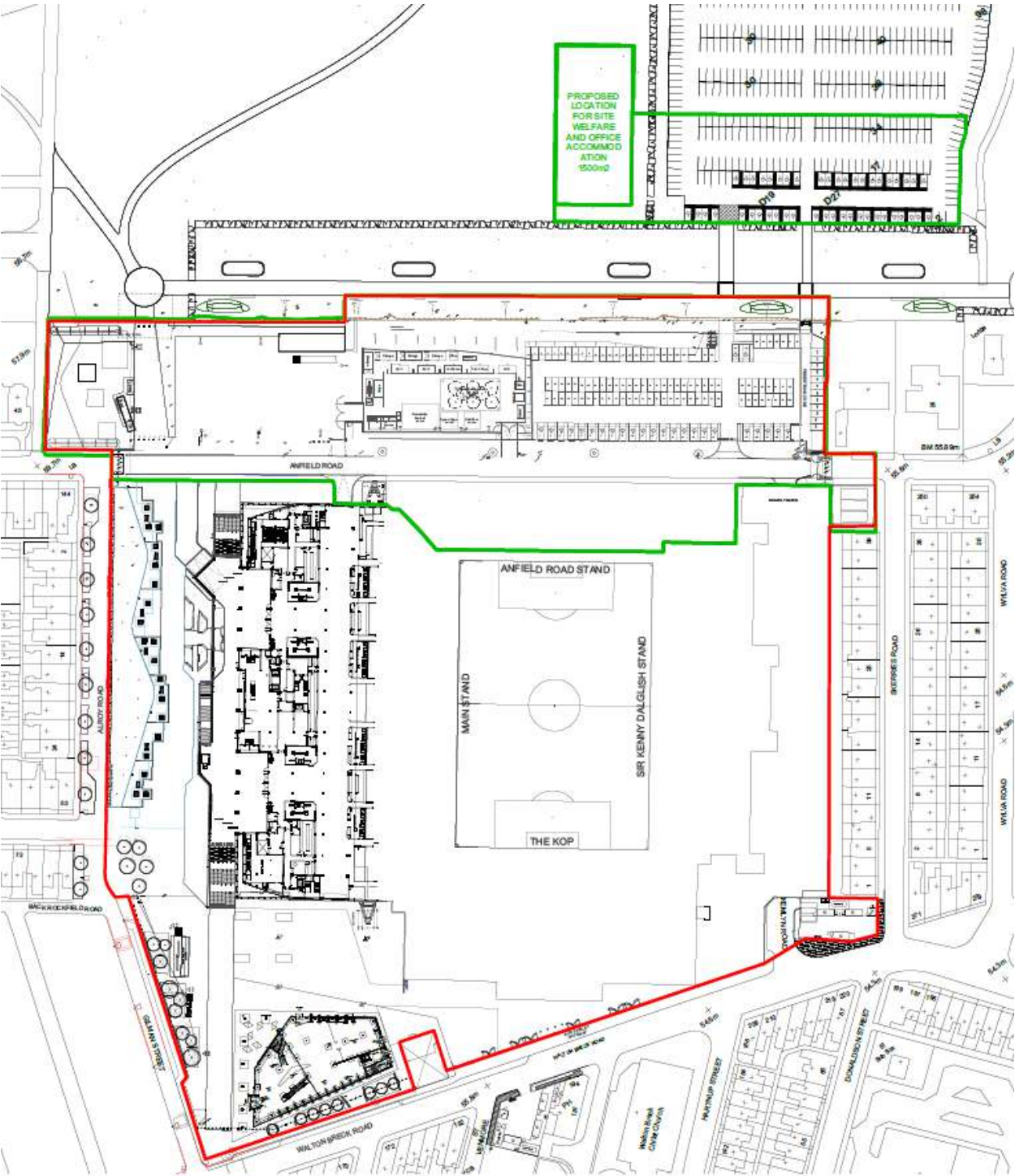
1.3 Scheme Background

The Anfield Stadium was subject to two previous planning permissions to expand capacity and associated improvements. Those applications were approved by Liverpool City Council (LCC) in 2014 and 2016. The application was granted full planning permission for expansion of the Main Stand and outline (in principle) consent for the Anfield Road Stand, although only the siting was agreed, all other matters were reserved. Due to the development of the Main Stand, which was completed in 2016, several residential dwellings were demolished. This has reduced the number of potential residential receptors to be considered as part of the LIA to Alroy Road, Skerries Road, with the majority located on Anfield Road.

1.4 Proposed Scheme

The Proposed Scheme is Phase 2 of the development of the Anfield Stadium. This phase concerns the development of the Anfield Road Stand, Anfield Road and the temporary fan zone area. The proposal includes a new extension to the Anfield Road Stand which will be constructed behind the existing stand to its full height. As part of the Proposed Scheme, Anfield Road (insofar as it is present within the site) will be realigned around the new Anfield Road Stand. The fan zone will be relocated into the completed scheme with options being explored for the relocation both internally and externally. There are existing trees located on the boundary with Stanley Park. The majority are within Stanley Park and are protected under the Park's listed status. The proposal will aim to minimise losses of those that fall under LFC ownership during the construction process. The park railings and counter terrorism bollards will be retained. The Outside Broadcast (OB) area may increase in size and the LFC TV studio will remain in situ.

Figure 1: Proposed Scheme



Source: Planit I.E. Limited (2020)

2 Legislation and Policies

The following section identifies national and local planning policies along with guidance relevant to lighting for the Proposed Development.

2.1 Legislation

The Clean Neighbourhoods and Environmental Act (CNEA) 2005 amended Section 79 of the Environmental Protection Act 1990 to include “artificial light emitted from premises so as to be prejudicial to health or a nuisance”.

The CNEA states that this does not apply to defence infrastructure, airports, harbour premises, railway premises, tramway premises, bus stations and any associated facilities, public service vehicle operating centres, lighthouses and prisons. Additional guidance is provided by the government website GOV.UK, “Guidance on Artificial light nuisances: how councils deal with complaints”, and states that street lighting is also excluded.

Local Authorities are provided with powers to serve abatement notices to premises with artificial lighting installations deemed to be causing a nuisance. There is however no definition provided on the levels of artificial lighting which could be considered as a statutory nuisance.

Section 103 of CNEA allows the defence of best practicable means where artificial lighting is emitted from industrial, trade or business premises or where lighting is used for an outdoor relevant sports facility.

2.2 National Policies

The Department for Communities and Local Government, Revised National Planning Policy Framework (NPPF), February 2019 provides guidance on the Government’s planning policies.

“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 limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation”. (NPPF Section 15, Paragraph 180, 2019)

The Department for Communities and Local Government Planning Practice Guidance (2019) sets out planning policies and the governments expectations of how these should be applied. The guidance provides a section on Light Pollution (2019) and provides guidance on the following:

- What light pollution considerations does planning need to address?
- What factors can be considered when assessing whether a development proposal might have implications for light pollution?
- What factors are relevant when considering where light shines?
- What factors are relevant when considering when light shines?
- What factors are relevant when considering how much light shines?
- What factors are relevant when considering possible ecological impacts of lighting?

- What other information is available that could inform approaches to lighting and help reduce light pollution?

2.3 Guidance

- BS 5489-1:2013, Code of practice for the design of road lighting Part 1: Lighting of roads and public amenity areas (2013)
- BS EN 13201-2:2015, Road lighting – Part 2: Performance requirements (2015)
- BS EN 12464-1:2011, Light and Lighting – Lighting of work places Part 1: Indoor work places (2011)
- BS EN 12464-2:2014, Light and Lighting – Lighting of work places Part 2: Outdoor work places (2014)
- BS 8300-1:2018, Design of an accessible and inclusive built environment – Part 1: External environment – Code of practice (2018)
- CIE 150:2017 International Commission on Illumination, Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations, 2nd Edition (2017)
- BS EN 12193:2018 Light and lighting. Sports lighting (2018)
- UEFA Stadium Lighting Guide (2016)
- Institution of Lighting Professional (ILP) GN2/18 Guidance for lighting of televised sporting events (2018)
- ILP PLG05 Professional Lighting Guide 05, The Brightness of Illuminated Advertisements (2015)
- Chartered Institution of Building Services Engineers (CIBSE), LG06 Lighting Guide 6: The exterior environment (2016)
- CIBSE LG04 Lighting Guide 04: Sports Lighting (2006)
- The Society of Light and Lighting (SLL) Code for Lighting (2012)
- ILP and Bat Conservation Trust Guidance Note 08/18 Bats and Artificial Lighting in the UK, Bats and the Built Environment series (2018)
- Bats and Lighting – Overview of Current Evidence and Mitigation. Stone, Emma (2014).
- BREEAM UK New Construction – Non-domestic buildings – England (2018)
- ILP PLG04 Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (2013)

The remainder of this report considers that these documents are current. These documents should be verified as current and, if superseded, the standards and lighting levels discussed in this report should be reassessed.

3 Method of Assessment

This section will outline the methodology to be adopted in undertaking the Lighting Assessment.

3.1 Scope of Assessment

The Proposed Scheme will incorporate various elements of electric lighting. The Lighting Assessment will evaluate the impacts of the proposed lighting installation and will:

- Identify and describe the artificial light currently affecting the Site and surrounding identified receptors;
- Provide a description of the proposed lighting standards and associated lighting design information that will be utilised to inform the assessment of obtrusive light (sometimes referred to as light pollution);
- Provide the limitations of obtrusive light for the environmental zone in accordance with the guidance provided in ILP GN01 (included in Appendix B) with the amended pre-curfew level for light intrusion into windows of 6 Lux as requested by Dr Ian Rushforth via e-mail (included in Appendix E);
- Identify design interventions and provide guidance on mitigation measures, with a view to reducing potential impacts to a negligible magnitude;
- Identify predicted impacts of obtrusive light using a combination of qualitative and quantitative assessment techniques;
- The guidance provided in the ILP PLG04:2013 will be used to undertake the lighting assessment in conjunction with ILP GN01 Guidance Notes for the Reduction of Obtrusive Light:2011; and.
- An additional desktop-based study had been undertaken to assess the likely impacts of additional concerts and sporting events, please refer to Appendix I for further details.

3.2 Baseline Assessment Methodology

Receptors in the vicinity of the Proposed Scheme were identified through an initial desk-based study of the area.

The location of each receptor has been agreed with LCC Environmental Enforcement Officer Dr Paul Rushforth on 13th January 2020. Receptor sites were chosen to allow the identification of baseline conditions, and an assessment of potential impacts on people and the environment in which they live, and on the location of potential ecological receptors.

An assessment of each receptor location was undertaken during the day, at night under matchday conditions and non-matchday conditions. These were evaluated in terms of their direct and intermittent views towards the Proposed Scheme, and whether existing screening is likely to prevent spill light, views of luminaire intensity or sky glow. Day and Night time (matchday and non-matchday) photographs were taken from each location at a height of 1.7m (representative of adult eye height).

At each receptor location, four vertical readings of illuminance were taken with the sensor of the light meter pointed north, south, east and west at a height of 1.5m. One horizontal reading was taken at ground level. This provides information on the levels of ambient light at each receptor location.

3.3 Baseline Survey Conditions

The baseline survey was undertaken over a period of two days and nights during the 13th and 15th January 2020. These were undertaken between 11.00 and 16.00 hrs for the daytime assessment and 19.20 and 01.00 hrs for the matchday and non-matchday assessments.

Overcast conditions with cloud breaks were recorded during the daytime survey with temperatures ranging from 5°C to 10°C. The weather conditions during the night time survey on 13th January were cloudy, very windy with some rain. On 14th and 15th January the weather conditions improved, the wind speed lowered, and the cloud became patchy. Whilst it had rained heavily for prolonged periods during the day, it remained dry for the majority of the night.

The surveys were undertaken during the waning gibbous moon phase. While a few stars were visible, the moon itself was not visible on the 13th January due to cloud cover. Due to an improvement in weather conditions on 14th January, the moon was visible through the breaks in the cloud.

3.4 Equipment utilised

A Konica Minolta T-10A illuminance meter (Serial Number 20016343) was used for all on site light readings in lux (lumen/m²). The hand-held meter is maintained and calibrated in accordance with the manufacturers' instructions (the Certificate of Calibration can be found in Appendix C).

The camera utilised for the on-site photography was a Nikon D3200 SLR with a tripod.

3.5 Summary of Receptor Locations

A summary of the locations and a description of each receptor are shown in Table 1.

Table 1: Summary of Receptor locations

| Viewpoint Location No | Drawing Reference Number | Description of Location |
|-----------------------|-----------------------------|---|
| 01 | 405016-MMD-XX-XX-DR-EN-0004 | 45 Anfield Road |
| 02 | 405016-MMD-XX-XX-DR-EN-0004 | 144 Anfield Road |
| 03 | 405016-MMD-XX-XX-DR-EN-0004 | 2 Alroy Road |
| 04 | 405016-MMD-XX-XX-DR-EN-0004 | Stanley Park – Middle of Dahlia Walk behind stadium |
| 05 | 405016-MMD-XX-XX-DR-EN-0004 | Stanley Park – Behind LFCTV cabins on Dahlia Walk |
| 06 | 405016-MMD-XX-XX-DR-EN-0004 | Stanley Park – Curved Footpath |
| 07 | 405016-MMD-XX-XX-DR-EN-0004 | Stanley Park – Car Park |
| 08 | 405016-MMD-XX-XX-DR-EN-0004 | Dahlia Walk at rear of Chairman's Villa/73 Anfield Road |
| 09 | 405016-MMD-XX-XX-DR-EN-0004 | 73 Anfield Road/Chairman's Villa - Front |
| 10 | 405016-MMD-XX-XX-DR-EN-0004 | Sir Kenny Dalglish Car Park/39 Skerries Road (Rear of) |
| 11 | 405016-MMD-XX-XX-DR-EN-0004 | 250 Anfield Road |
| 12 | 405016-MMD-XX-XX-DR-EN-0004 | 36 Skerries Road |
| 13 | 405016-MMD-XX-XX-DR-EN-0004 | Stanley Park – Straight Footpath |

Source: Mott MacDonald Ltd. (2020)

3.6 Environmental Zone

To define the maximum permissible levels of obtrusive light an appraisal has been carried out to classify the Site in terms of its 'environmental zone', which equates to the district brightness of the surroundings (see Table 2 for environment zone information).

In the case of a site being between two possible environmental zones, ILP guidance recommends that the most difficult environmental zone of the two options to achieve is assigned for assessment purposes.

In this case it could be argued that the site lies between an E3 and E4 zone. Therefore in line with ILP guidance, we have applied E3.

Table 2: 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 |

Source: ILP GN01:2011

3.7 Obtrusive Light Limitations

It can be seen from Table 2 that a lighting installation located in an area deemed to be more sensitive will understandably equate to greater constraints with regards to obtrusive light. Table 3 details maximum permissible levels of obtrusive light associated with an E3 Zone.

Table 3: Obtrusive Light Limitations (ILP Guidance Notes for the Reduction of Obtrusive Light 2011)

| Environmental Zone | Sky Glow ULR (Max %) | Light Intrusion (Into Windows) Ev (Lux) | | Luminaire Intensity I (Candelas) | | Building Luminance Pre-curfew |
|--------------------|----------------------|---|---------------|----------------------------------|---------------|---------------------------------|
| | | 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 | 6* | 2 | 10,000 | 1,000 | 10 |
| E4 | 15 | 25 | 5 | 25,000 | 2,500 | 25 |

Source: ILP GN01:2011

*As amended by LCC

**Curfew: The time after which more stringent requirements (for control of obtrusive light) will apply; often a condition of use of lighting by the local planning authority. If not otherwise stated 23:00 hours, is suggested by the ILP.

***Permitted only from Public road lighting installations.

3.8 Lighting Restrictions

As part of the consultation carried out for the Main Stand and Anfield Road EIA LCC Environmental Enforcement Officer, Dr Ian Rushforth confirmed* that the E3 zone highlighted in Table 2 and the light restrictions highlighted in Table 3 are correct and can be applied for this development. Dr Rushforth has also confirmed that 23:00hrs is the curfew time, after which the more stringent requirements for control of obtrusive light, highlighted in Table 3, will apply. In addition, Dr Rushforth requested that the pre-curfew limit for light intrusion (into windows) should be lowered to 6 Lux as opposed to the limit of 10 Lux set by the ILP increasing the stringency of requirements. This has been reconfirmed by Dr Rushforth via e-mail correspondence on 11th December 2019*.

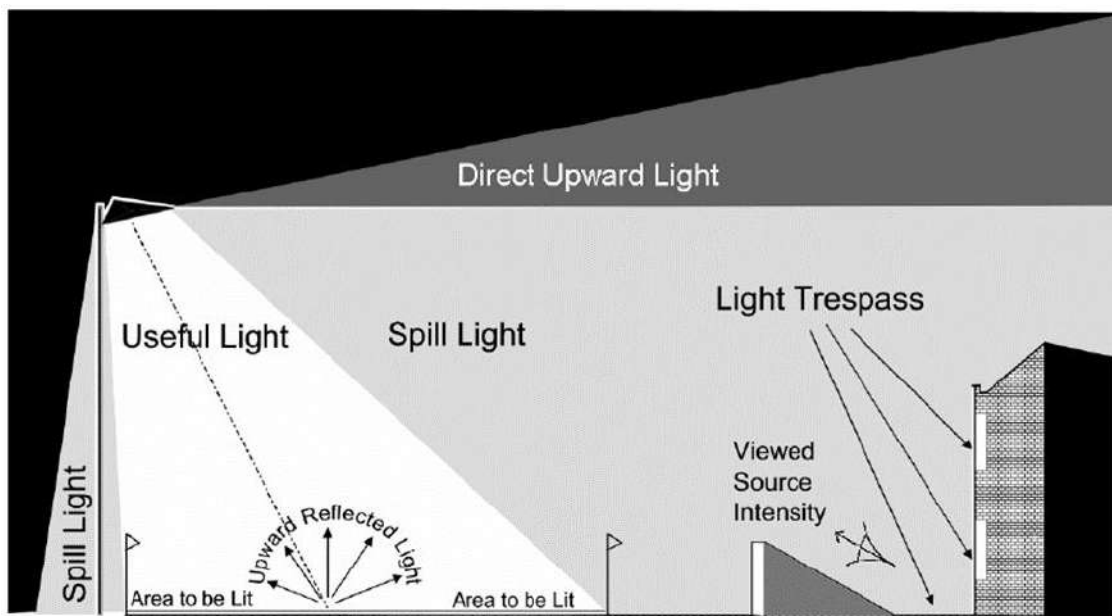
* Confirmation of Dr Rushforth's requests can be found in Appendix E.

3.9 Assessment

The lighting assessment will consider each identified receptor and the potential impacts from the lighting associated with the Proposed Scheme and will evaluate whether the limitations detailed in Table 3 and visualised in Figure 2 will be exceeded in terms of the following:

- Sky Glow – The illumination of the sky at night by artificial light sources including light emitted directly upward from the light source and reflected from the ground or surface;
- Light Intrusion – Light that falls beyond the boundary of the area being lit; and
- Luminaire Intensity – The measure of the amount of light that a source radiates in a given direction.

Figure 2: Types of Obtrusive Light



Source: ILP GN01:2011

The majority of public realm and the football pitch floodlighting designs for the Proposed Scheme have been advanced to a sufficient level to allow a quantitative assessment to be undertaken, this assessment has been undertaken via the construction of a 3 dimensional (3D) lighting model that incorporates the existing stadium, proposed Anfield Road Stand, the majority of proposed public realm lighting and the proposed stadium pitch floodlighting. For elements of

the proposal that do not have a developed lighting design for the Proposed Development, a qualitative assessment will be undertaken. Refer to Section 3.10 'Calculation Methodology' and 3.11 Limitations and Assumptions for further details of the elements of the design proposals that are included within either the quantitative or qualitative assessment.

The assessment will consider the baseline lighting conditions at each identified receptor and review these against the potential lighting impacts from the Proposed Scheme as a whole. A combination of the 3D lighting model outputs and the predicted lighting impacts will be based on the lighting installations for each area as identified on the Receptor Location Plan (drawing number 405016-MMD-XX-XX-DR-EN-0004), included in Appendix A of this report, which establishes the location of the Proposed Development. The lighting requirements for the Proposed Scheme are detailed further in Section 5, and the assessment will consider the likely impacts from these areas.

It should be noted that ILP GN01:2011 (included in Appendix B), states that building luminance is applicable only to buildings which are directly illuminated as a decorative night time feature and not buildings which are illuminated as a result of spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area. It has been confirmed that no buildings are being directly illuminated as a night time feature, as such building luminance has been de-scoped from this assessment.

The impacts of artificial lighting for the Site will have varying levels of significance and have been assessed based on the magnitude experienced by each identified receptor. The level of change is presented on a scale of minor, moderate, major or none/negligible. The resulting overall impacts can be described as positive, neutral or negative.

The magnitude of the impact evaluated from the criteria above is assessed using the matrix outlined in Table 4.

Table 4: Evaluation Table

| Nature | Ref | Level | Description | Remedial Needs |
|----------|-----|--|---|---|
| Positive | 1 | Major / substantial beneficial impacts | Significant improvements in night environment and/or reductions in glare, spill light and sky glow etc. | No remedial/mitigation measures required. |
| | 2 | Moderate beneficial impacts | Noticeable improvements in night environment and/or reductions in glare, spill light and sky glow etc. | |
| | 3 | Minor beneficial impacts | Slight improvements in night environment and/or reductions in glare, spill light and sky glow etc. | |
| Neutral | 4 | None / negligible | No significant impacts or overall impacts balancing out. | |
| Negative | 5 | Minor adverse impacts | Slight increase in visibility of site, | Develop appropriate levels |

| | | | | glare, and sky glow etc. | and type of mitigation |
|--|---|--------------------------|--|--|------------------------|
| | | | | | |
| | | | | | |
| | 6 | Moderate adverse impacts | | Noticeable increase in visibility of site, glare and sky glow etc. | |
| | 7 | Major adverse impacts | | Significant problems with increase in visibility of site, glare, and sky glow etc. | |

Source: ILP PLG04:2013

3.10 Calculation Methodology

Numerical modelling and calculations have been carried out using the Lighting Analysis – AGi32 software package version 19.4 which was checked by Ian Hearsum of Mott MacDonald Ltd.

For the purpose of this assessment, a Radiosity Stopping Criterion of 99% has been used to ensure that results are accurate.

The AGi32 model consists of the following elements:

- An existing ground surface model taken from the elevations on the Ordnance Survey (OS) map;
- A detailed ground surface surrounding the new Anfield Road Stand taken from the 3D Topographical Survey;
- A 3D representation model of the Existing Stadium with the addition of the proposed Anfield Road Stand;
- A 3D representation model of each residential dwelling in proximity to the identified receptors
- The pitch floodlights inside the stadium, including the revised Anfield Road Stand floodlighting design;
- The revised public realm lighting designs provided for Anfield Road, OB Compound, OB footpath Area and Dahlia Walk;
- One Illuminance calculation point at each viewpoint location with an elevation height equal to ground level (GL) within the model;
- An illuminance calculation point at each viewpoint location at GL+1.5m for directions north, east, south and west;
- Luminous intensity calculation point at each viewpoint location at GL+1.5m for directions north, east, south, and west; and
- Illuminance calculations at window locations of residential dwellings in proximity to the identified receptors.

3D Representation model of the Stadium methodology

To create the existing ground surface model, elevations shown on the OS map and AutoDesk Civil 3D 2019 were used to generate the surface. There are no elevation heights available in Stanley Park therefore triangulation was generated using the points along the adjacent highway. The same process was used for the detailed surface, using the points from the 3D topographical survey to create the surface.

3D Representation model of the Stadium methodology

Using AutoDesk Revit 2020, all models received on 31/01/2020 were exported to AutoDesk Civil 3D 2019 using the shared coordinates provided in Revit. This located them correctly in relation to the OS map.

Original Revit files were used to create a model using AutoDesk 3D Studio Max 2019. This model is a low polygon version of the original Revit file and is utilised to reduce the file to a manageable size for import into the lighting model. This modification reduces the calculation time of obtrusive light to a minimum, whilst maintaining accuracy of the modelling outputs. The reduced model is hereafter referred to as the NC low poly model.

Each Revit export from 31/01/2020 was loaded into Navisworks Manage 2019 and the NC low poly model was overlaid to ensure the blocking effect is an accurate representation of the original revit files received.

3D Representation model of the residential dwellings

3-dimensional (3D) geometric models of residential properties in close proximity to the identified receptors have been developed based on OS map data, site photographs and Mott MacDonald's baseline surveys.

Each building footprint has been taken from the OS map and extruded to the approximate height of the building. The location of windows which are representative of the baseline survey locations were included within the 3D model using the site survey photographs and online mapping data to guide where the windows should be placed. Once completed, the building was appended to the surface model.

Proposed luminaire location methodology

The following luminaires have been included within the 3D model:

- Pitch floodlighting
- Anfield Road Proposed Public Realm lighting
- OB compound lighting columns
- OB footpath lighting columns
- Dahlia Walk lighting columns

Each luminaire type, output, location, tilt and orientation has been added manually to the AGi32 file. This information has been gathered from the lighting designs produced by Mott MacDonald Ltd. The luminaire mounting heights have been determined by taking the height of the ground surface model at the approximate location of the lantern and adding the mounting height from the design calculations.

3.11 Limitations and Assumptions

The lighting assessment has been performed with the configurations detailed within Table 5 below:

Table 5: Lighting Configurations

| Type/Area of lighting | Matchday | | Non-matchday | |
|----------------------------|------------|-----------------------------------|--------------|-------------|
| | Pre-curfew | Post-curfew | Pre-curfew | Post-curfew |
| Stadium Floodlighting | ON | ON until between 23:00 & 00:00hrs | OFF | OFF |
| Anfield Road | ON | 40% output | 40% output | 40% output |
| Dahlia Walk | ON | 50% output | ON | 50% output |
| OB compound | ON** | OFF | OFF | OFF |
| OB Footpath | ON | OFF | ON | OFF |
| External Building Lighting | ON | OFF | ON | OFF |

| Type/Area of lighting | Matchday | | Non-matchday | |
|----------------------------------|----------|-----|--|--|
| LFC Crests (Illuminated Signage) | ON | OFF | ON | OFF |
| Interior lighting | ON | ON | * Local occupancy control (Assumed ON) | * Local occupancy control (Assumed ON) |
| Projector | ON | OFF | ON | OFF |

Source: Mott MacDonald (2020).

* The interior lighting operational hours are detailed within the Lighting Philosophy Technical Note 405016-MMD-XX-00-TN-LG-1301 (provided in Appendix F). As a precautionary principle it has been assumed that the interior lighting is ON.

** The lighting within the OB Compound will be switched on the day before a match, on matchday and the day after.

Trees and all other vegetation have been ignored for the purpose of this analysis to provide a 'worst case' assessment, i.e. in winter when vegetation is minimal, or to allow for vegetation to be removed in the future.

Obtrusive light levels are calculated for the baseline survey locations indicated on drawing number 405016-MMD-XX-XX-DR-EN-0004 (included in Appendix A) and the residential property windows which are representative of the baseline survey locations. In relation to Viewpoint 9 Chairman's Villa/73 Anfield Road, the rear windows have not been included due to the inability to view the location of any windows at the rear of this property. The residence has evergreen screening which is approximately 4m in height, a wooden fence, railings and barbed wire along the rear boundary as shown in Appendix D Section D.8 in both south and west day time views.

Obtrusive light limitations are based on the level of light experienced at the windows of each receptor. The locations of the receptor windows have not been surveyed therefore the calculation results provided in Table 13 represent the level of light experienced at the assumed window locations.

A maintenance factor is a luminaire and lamp specific de-rating factor applied to lighting calculations to allow for lumen depreciation of a light source over time and a predicted amount of dirt build up on the glazing of the lantern given its height and the pollution category of the area. Maintenance factors are utilised within the design calculations to prove that an installation will have compliant lighting levels on a worst-case basis. In these situations, worst case would be at the end of the maintenance cycle when the light source has depreciated the most and the glazing of the lantern is the dirtiest.

For the purpose of obtrusive light assessment, a maintenance factor of 1 (no de-rating) has been utilised as this accounts for the worst-case scenario for obtrusive light, this would show the impacts of the installation on the first day of its use or immediately after it has been maintained.

Obtrusive lighting calculations are via direct calculation only and take no account of the reflective properties of the various surfaces.

Due to the lack of accurate inventory details available, the existing lighting information has not been included within the lighting model.

Building luminance calculations are excluded from the calculation model as the Proposed Scheme will not be illuminated as a decorative night time feature. This has been confirmed within the Lighting Philosophy Technical Note 405016-MMD-XX-XX-TN-LG-1301 provided within Appendix F.

If any changes are implemented during design development or as a consequence of value engineering that have potential to increase the levels of obtrusive light, it is recommended that the lighting assessment is re-performed.

The light spill contours detailed in drawing number 405016-MMD-AR-ZZ-DR-E-6301 (provided within Appendix G) have been produced using the industry standard 2D calculation package, Lighting Reality, and therefore does not consider blocking effects from 3D objects such as walls and fences. In conjunction with this the contours generated do not take account of changes in topology levels.

Following interrogation of the NC low poly model and the baseline site visit photographs, it is clear that it would not be possible to view the stadium floodlighting luminaires from the receptor locations. This is due to the blocking effect caused by the existing Stadium and the proposed development; therefore the stadium floodlights have been omitted from the luminous intensity calculations.

It should be noted that the calculation points used within the 3D model may differ slightly from the actual locations of the receptor viewpoints. This is due to the inaccuracy of measuring the exact location during the site survey in comparison to the accuracy of the 3D lighting model locations.

Projects in the earlier stages of design often do not have fixed lighting designs for all elements of the proposal; this is the case with elements of the Proposed Scheme with no detail of locations, lamp types, orientations, mounting angles, photometry etc. available for illuminated signage, external building lighting, internal building lighting and projectors. For further details of additional lighting refer to the Lighting Philosophy Technical Note 405016-MMD-XX-00-TN-LG-1301 (provided in Appendix F). When a detailed lighting design is not available it is not possible for the proposed lighting to be modelled within lighting simulation/calculation software, therefore simulated results of calculations cannot be provided or reported. Instead, a qualitative assessment of the likely impacts has been provided for this element of the lighting design proposals along with a framework of limitations and mitigation measures to set the basis for all future lighting design for these areas within the Proposed Development.

When lighting design calculations are carried out site constraints often limit the most efficient position of light fittings. Often in these situations slight over lighting of areas is a result of a designer's need to compromise ideal positions or spacing between columns. As such, the qualitative assessment of lighting impacts assumes that the achieved levels of lighting for each application would be slightly beyond the minimum required levels discussed in Section 5 of this report.

Due to adverse weather conditions including high wind and associated long exposure times required for night time photography, some photographs may appear to suffer from motion blur however are representative of the night time scene.

Baseline survey lighting measurement results are ground based or at 1.5m above ground and are not taken at the windows of the identified receptors.

The assessment of the overall effects on bats and other species do not form part of this report.

4 Baseline Description

The baseline conditions presented in this section are those surveyed and documented during the day and night time surveys. For a comprehensive overview, it is recommended that this section of the report should be read with reference to the following:

- Appendix A - 405016-MMD-XX-XX-DR-EN-0004 - Receptor Location Plan; and
- Appendix D – Baseline Survey Photograph Sheets.

The wider area surrounding the site is predominately residential with Skerries Road located to the southeast and Alroy Road to the southwest, Walton Breck high street contains a mix of commercial and residential properties lying immediately to the south of Anfield stadium. Stanley Park bounds the site to the north.

The immediate areas surrounding the Site are:

- Anfield Road;
- Dahlia Walk;
- Stanley Park;
- Alroy Road; and
- Skerries Road.

4.1 Baseline Survey Descriptions and Results

Table 6: Baseline Survey Descriptions and Results

| Viewpoint number and location | Description of existing day-time view | Description of existing night-time view - Matchday | Summary of prevalent lighting - Matchday | | | | | | | | |
|--|---|--|--|--|--|---------------------|----------------------|--------|-----|-----------------|------|
| 01 – 45 Anfield Road | Viewpoint location 01 is located on a footpath leading to Stanley Park which runs down the side of 45 Anfield Road. This location represents the views from the windows of residential properties 41 to 45 Anfield Road. Directly at the viewpoint location is a brick wall which borders number 45 Anfield Road. This provides little shielding for the lower floor windows due to the change in elevation between footpath and property. Towards the east there is a flat grassed area and the LFC TV studio beyond which is an access footpath to Stanley Park, the OB compound and Stanley Park. There is a line of mature deciduous trees located between Stanley Park and the OB compound/Fan zone/Anfield Road car park areas. In addition areas of mixed vegetation can be viewed in all the areas referenced above. To the Southeast lies Anfield Road which runs along the stadium/Anfield Road stand and to the east is the view of Main Stand in front of which is a line of deciduous trees with heights up to 10m and a shorter | At this location the lighting levels are relatively high as indicated by the match lighting measurements. Only one of the street lights located on the adjacent footpath was working at the time of the survey which emitted yellow light towards the viewpoint location. Viewing further down the path the footpath gets darker due to the second not operating, although at the end the footpath leading into Stanley Park and where Dahlia walk commences white lighting can be seen. To the east the LED style lighting columns at the OB compound and on the footpath are clearly visible as bright white light which appear intense, spilling light onto the vegetation and trees located in the vicinity as well as the nearby footpath. Beyond the OB compound and footpath many white light sources can be viewed through the vegetation. When viewing along Anfield Road, the older style street lighting is a yellow light, the LED style lighting columns located in the fan zone and Anfield Road car park are white light appearing brighter and more intense than the yellow lights. The main | <p>Light sources: Street lighting, residential lighting, Main Stand internal and external lighting including the concourse area, vehicle headlights, car park lighting, fan zone and OB compound area lighting</p> <p>Principal sources of glare: Main stand steps and footpath/OB compound light columns</p> <p>Principal sources of spill light: OB compound and footpath, Street lighting, Main Stand external lighting including the concourse area and vehicle headlights.</p> <p>Sources of sky glow: Stadium floodlighting</p> <table><tr><th colspan="2">Lighting measurements Matchday (13/01/2020 21:50)</th></tr><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>2.7</td></tr><tr><td>North (at 1.5m)</td><td>4.15</td></tr></table> | Lighting measurements Matchday (13/01/2020 21:50) | | Direction of sensor | Light reading in lux | Ground | 2.7 | North (at 1.5m) | 4.15 |
| Lighting measurements Matchday (13/01/2020 21:50) | | | | | | | | | | | |
| Direction of sensor | Light reading in lux | | | | | | | | | | |
| Ground | 2.7 | | | | | | | | | | |
| North (at 1.5m) | 4.15 | | | | | | | | | | |

| | | |
|--|--|--|
| <p>evergreen hedge providing screening at low level.</p> <p>Two existing street lights are located on the footpath to the northeast mounted on hockey stick style lighting columns at an assumed height of approximately 6/8m, both street lights have back shields fitted. Looking east, there are several 10/12m mounting height columns on the footpath and OB compound located behind LFCTV cabin. All are fitted with LED style luminaires. To the southeast, older style street lights approximately 8/10m mounting height are located along Anfield Road, with LED style luminaires mounted on 10/12m columns in the fan zone and Anfield Road carpark areas. Viewing towards the south and the stadium, exterior light fittings can be seen fitted to the exterior of the Anfield Road stand with 12m mounting height columns located on the Main Stand concourse.</p> | <p>stand has exterior lighting in the form of downlights creating strips of white light running down the façade. The access steps to the upper level have light fittings installed just above each step which creates an intense white light running up both flights of stairs, these light fittings emit an intense glare. The players entrance and the lighting of the Hillsborough memorial can be viewed through the screening provided by the hedge, the former is a white light source with the more yellow lighting viewed at the latter. Internal office and stairwell lighting are visible when looking at the Main stand and higher-level white LED lighting for the concourse area. Internal lighting is emanating from the residential properties located opposite the viewpoint. In addition, vehicle headlights were apparent from passing traffic. Local Skyglow is apparent above the stadium white in nature.</p> | |
| | <p>East (at 1.5m)</p> | <p>3.8</p> |
| | <p>South (at 1.5m)</p> | <p>2.2</p> |
| | <p>West (at 1.5m)</p> | <p>1.5</p> |
| <p>Description of existing night-time view - Non Matchday</p> | | <p>Summary of prevalent lighting – Non-Matchday</p> |
| <p>In contrast, on a non-matchday the viewpoint feels darker and more residential, as indicated by the non-matchday lighting measurements. The LFC TV studio and OB compound are in darkness, with white and yellow light sources visible in the distance to the east</p> | | <p>Light sources: Street lighting, residential lighting, Main Stand internal lighting, vehicle headlights</p> <p>Principal sources of glare: Glare from yellow street light on located on the adjacent footpath.</p> |

through the deciduous screening provided by the vegetation and trees. The older style lighting columns on Anfield Road are yellow in appearance. When viewing towards the stadium, external light fittings are visible fixed to the exterior of the Anfield Road Stand, with interior office lighting apparent in the Main Stand. The players entrance is still illuminated but does not appear as intense. The Hillsborough memorial is lit to the same level. Other sources of artificial light apparent at this location are the vehicle headlights and internal residential lighting.

Principal sources of spill light:

Street light located at viewpoint

Sources of sky glow: Low levels of skyglow can be seen in the distant to the East, white in appearance.

Lighting measurements

Non-Matchday (14/01/2020 23:25)

| Direction of sensor | Light reading in lux |
|---------------------|----------------------|
| Ground | 0.95 |
| North (at 1.5m) | 4.11 |
| East (at 1.5m) | 2.63 |
| South (at 1.5m) | 1.3 |
| West (at 1.5m) | 1.0 |

02 – 144 Anfield Road

Viewpoint 02 is located on the corner of Anfield Road and Alroy Road. This location represents the views from the windows of 144-142 Anfield Road. Viewing northwards, 145 Anfield Road is directly in view with the adjacent footpath leading to Stanley Park. Viewing towards the east, the OB compound, footpath to Stanley Park, Fan zone, Anfield Road car park and deciduous trees and vegetation in Stanley Park can be seen. At the far end of Anfield Road 73

Description of existing night-time view - Matchday

At this location the lighting levels are relatively high as indicated by the match lighting measurements. To the north 145 Anfield is directly in view with the single working streetlight emitting yellow light. To the east LED style lighting is visible and is a bright white light emanating from the lighting located within the OB compound, Fan zone and the Anfield Road carpark. Bulkhead style lights that

Summary of prevalent lighting - Matchday

Light sources: Street lighting, residential lighting, Main Stand floodlighting, internal and external lighting including the concourse area, vehicle headlights, car park lighting, fan zone, OB compound area and building mounted lighting.

Principal sources of glare: OB compound building lighting

Anfield Road (also known as Chairman's Villa) is visible in the distance. Opposite the entrance to Alroy Road a single old-style street light is located on Anfield Road, further lights of the same type are visible on Anfield Road heading towards 73 Anfield Road and are approximately 8m in height. The Main Stand is located south of the viewpoint with Alroy Road located in front on the concourse and separated from this area by a small hedge which provides a level of screening at low level. Deciduous and non-deciduous trees provide some screening at this location with deciduous screening that that is less effective in the winter months.

Artificial light sources viewed from this location consist of older style street lights on footpath adjacent to 145 Anfield Road to the north, LED type 12m mounting height lighting columns in the OB compound/adjacent footpath, Main Stand Concourse 12m mounting height lighting columns to the south. In addition, several bulkhead style light fittings are fixed to the brick building within the OB compound. Along Alroy Road (which runs along the western side of the Main Stand) there are several 6m lighting columns with LED type luminaires

are fixed to the front of the OB compound building provide high levels of intense white light which causes uncomfortable glare. Opposite the entrance to Alroy Road a single old-style street light is located on Anfield Road, further lights of the same type are visible on Anfield Road heading towards 73 Anfield Road, they produce a light that is yellow in appearance and are approximately 8m in height. Spill light can be seen on the tree line screening between Stanley Park and these areas with the tops of the tallest trees being visible due to the extent of spill light. To the south the Main Stand concourse lighting columns, internal office lighting and external downlighters are visible through the treeline between the stand and Alroy Road. The low-level hedge provides some screening but the exterior lighting at the Hillsborough memorial can be viewed as a yellow glow. At the far end there are two more lights viewed just above the hedge located at the corner of the Main Stand, these are intense and bright. Alroy Road is illuminated by LED street lighting approximately 6m in height with a light that is white in appearance. Skyglow is apparent and white above the Main stand.

Principal sources of spill light:

Street Lighting, Main Stand external lighting including the concourse area and vehicle headlights.

Sources of sky glow: Stadium floodlighting

Lighting measurements Matchday (13/01/2020 21:25)

| Direction of sensor | Light reading in lux |
|---------------------|----------------------|
| Ground | 7.2 |
| North (at 1.5m) | 3.7 |
| East (at 1.5m) | 10.5 |
| South (at 1.5m) | 3.6 |
| West (at 1.5m) | 2.1 |

Description of existing night-time view - Non Matchday

Summary of prevalent lighting – Non-Matchday

mounted post-top. These run the length of Alroy Road.

In contrast, on a non-matchday the viewpoint feels darker and more residential, as indicated by the non-matchday lighting measurements. To the north the visible lighting comes from the yellow street light with 145 Anfield Road appearing noticeably darker except for the yellow glow of the street light. To the east lighting is visible in the OB compound mounted bulkhead lights which appear more intense and emitting a high level of glare from this location which is in contrast to the relative darkness of the surrounding area. The lighting within Stanley Park is visible in the distance and is a mix of light that is yellow and white in appearance. The yellow street lighting is visible running the length of Anfield Road with a yellow hue visible on the tarmac. To the south, the main stand is lit internally although the Hillsborough memorial is lit with a yellow glow and visible through the screening. The two intensely bright and white lights and a third more distant less intense white light is visible

Light sources: OB compound building bulkhead light fittings, Anfield Road and Alroy Road Street lighting, vehicle headlights on Anfield Road and Alroy Road, residential interior lighting

Principal sources of glare: OB compound building lights

Principal sources of spill light: Street lightings, OB concourse building lights, vehicle headlights.

Sources of sky glow: Apparent above the stadium at a low level.

| Lighting measurements | |
|---------------------------------|----------------------|
| Non-Matchday (14/01/2020 22:00) | |
| Direction of sensor | Light reading in lux |
| Ground | 5.3 |
| North (at 1.5m) | 3.4 |
| East (at 1.5m) | 6 |
| South (at 1.5m) | 1.2 |
| West (at 1.5m) | 1.75 |

| 03 – 2 Alroy Road | <p>This viewpoint represents 2 and 4 Alroy Road and the immediate neighbours. Viewing East, the view consists of the hedgerow located on the opposite side on Alroy Road and separating the Main Stand concourse area from the highway. A treeline (consisting of both deciduous and non-deciduous trees) located on the concourse is visible behind the low-level hedge. Both provide a certain level of screening. Further in the distance, the trees located in Stanley Park are visible. Looking to the south is the Main Stand, with the treeline and low-level hedge visible in the foreground.</p> <p>The main sources of artificial light are the LED type street lights located on Alroy Road, the Main Stand concourse lighting and Main Stand exterior lighting.</p> | <p>Description of existing night-time view - Matchday</p> <p>At this location the lighting levels are relatively high as indicated by the matchday lighting measurements. To the east the old-style street lighting is yellow in appearance. White light from the OB compound lighting and Anfield Road carpark is visible. The bulkhead style lighting fixed to the OB compound building can be seen through the screening provided by the hedge this lighting appeared less intense with less glare. The tree line screening along Stanley Park has spill light white in appearance from the OB compound lighting and Anfield Road carpark with the top of the trees visible due to additional spill light assumed to be from the football pitch floodlighting. Looking towards the stadium and southwards, the steps leading to the higher levels of the Main Stand are illuminated with a white light as is the Players entrance. The lighting to the south on the Main Stand concourse (12m height LED columns white in appearance with high intensity), 6m LED columns with light white in appearance located on Alroy Road, Main Stand external downlighters white in appearance. Sky glow is apparent and white above the stadium.</p> | <p>Summary of prevalent lighting - Matchday</p> <p>Light sources: OB compound building bulkhead light fittings, OB compound and Anfield Road car park lighting, Anfield Road and Alroy Road Street lighting, Main Stand concourse LED floodlighting, vehicle headlights on Anfield Road and Alroy Road, residential interior lighting, exterior stair and stadium downlights.</p> <p>Principal sources of glare: Main Stand concourse LED floodlighting.</p> <p>Principal sources of spill light: OB compound and Anfield Road car park lighting, street lighting, Main Stand concourse LED floodlighting and stadium floodlighting lighting</p> <p>Sources of sky glow: Stadium floodlights</p> <table><tr><th colspan="2">Lighting measurements Matchday (13/01/2020 22:10)</th></tr><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>3.4</td></tr><tr><td>North (at 1.5m)</td><td>2.5</td></tr></table> | Lighting measurements Matchday (13/01/2020 22:10) | | Direction of sensor | Light reading in lux | Ground | 3.4 | North (at 1.5m) | 2.5 |
|--|---|---|---|--|--|---------------------|----------------------|--------|-----|-----------------|-----|
| Lighting measurements Matchday (13/01/2020 22:10) | | | | | | | | | | | |
| Direction of sensor | Light reading in lux | | | | | | | | | | |
| Ground | 3.4 | | | | | | | | | | |
| North (at 1.5m) | 2.5 | | | | | | | | | | |

| | | | |
|--|--|------------------------|-----|
| | | East (at 1.5m) | 2.5 |
| | | South (at 1.5m) | 4 |
| | | West (at 1.5m) | 1.5 |

| Description of existing night-time view - Non-Matchday | Summary of prevalent lighting – Non-Matchday | | | | | | | | | | |
|---|---|----------------------------|-----------------------------|---------------|------------|------------------------|------------|-----------------------|-------------|------------------------|------------|
| <p>In contrast, on a non-matchday the viewpoint feels darker and more residential, as indicated by the non-matchday lighting measurements. The electric lighting apparent in the east is the yellow old-style street lighting with white light sources in the distance within Stanley Park. To the south lighting is visible in the distance with a mix of light that is white and yellow in appearance. The external stairway to the south is illuminated by local lighting and is orange in appearance. The LED style street lighting that is white in appearance provides lighting along Alroy Road. Sky glow is not apparent from this location due to the main stand obscuring more distant views.</p> | <p>Light sources: street lighting</p> <p>Principal sources of glare: none</p> <p>Principal sources of spill light: street lighting</p> <p>Sources of sky glow: none apparent from this location</p> | | | | | | | | | | |
| | <p>Lighting measurements Non-Matchday (14/01/2020 23:30)</p> <table><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>1.9</td></tr><tr><td>North (at 1.5m)</td><td>2.0</td></tr><tr><td>East (at 1.5m)</td><td>1.95</td></tr><tr><td>South (at 1.5m)</td><td>2.8</td></tr></table> | Direction of sensor | Light reading in lux | Ground | 1.9 | North (at 1.5m) | 2.0 | East (at 1.5m) | 1.95 | South (at 1.5m) | 2.8 |
| Direction of sensor | Light reading in lux | | | | | | | | | | |
| Ground | 1.9 | | | | | | | | | | |
| North (at 1.5m) | 2.0 | | | | | | | | | | |
| East (at 1.5m) | 1.95 | | | | | | | | | | |
| South (at 1.5m) | 2.8 | | | | | | | | | | |

| | | | |
|---|---|---|--|
| | | West (at 1.5m) | 1.1 |
| 04 – Stanley Park – Middle of Dahlia Walk | <p>This viewpoint is located in Stanley Park towards the centre of Dahlia Walk. To the south there is the deciduous treeline and vegetation which separates Stanley Park from the Fan zone area which is located directly in front on the trees and park railings and is at a lower level than Dahlia Walk. Beyond the Fan zone area is the Anfield Road stand. Dahlia Walk extends southeast to northwest with Stanley Park carpark in the east and the main park area located directly behind the viewpoint. There is a deciduous treeline running between Dahlia Walk and the main park area. At this location the topography is flat then rises slightly towards the treeline and then falls away with the gradient running down to the Stanley Park car parking areas. The LFC TV studio, OB compound and 145 Anfield Road are viewed when looking northwest.</p> <p>Dahlia Walk is lit by heritage style LED lighting mounted on 5m columns. The fan zone area to the south has 10m LED lighting columns with various bulkhead style light fittings fixed to the cabins</p> | Description of existing night-time view - Matchday | Summary of prevalent lighting - Matchday |
| | | At this location the lighting levels are relatively low as indicated by the match lighting measurements. Dahlia Walk has heritage style LED lighting mounted at 5m installed along its length giving off white light with two lights not working to the northwest. The viewpoint has spill light emanating from the fan zone area located directly south, close to eye level due to the change in gradient. The screening provided by the trees and vegetation does not provide effective shielding of the location from the fan zone however is more effective at screening the stadium exterior lighting mounted on the front of the building, the pitch floodlighting, the Road lighting and Anfield Road car park lighting. The lighting within the fan zone is intensely bright white light which creates glare when viewing towards the stadium to the south. Viewing northwest, the spill light is apparent on the grassed area and also on the trees which are located along Dahlia Walk. There are heritage style columns lining Dahlia Walk with only one | <p>Light sources: Street lighting on Anfield Road, in Anfield Road car park, OB compound, Stanley Park Car park, Fan zone area and within Stanley Park</p> <p>Principal sources of glare: Stanley Park Car park lighting, fan zone area</p> <p>Principal sources of spill light: Fan zone area, Anfield Road car park, OB compound, heritage style LED lighting columns in Stanley Park, football pitch floodlighting</p> <p>Sources of sky glow: None visible</p> |
| | | Lighting measurements Matchday (13/01/2020 20:05) | |
| | | Direction of sensor | Light reading in lux |
| | | Ground | 3.5 |
| North (at 1.5m) | 0.3 | | |

| | | | | | | | | | | | |
|--|---|--|--|--|------|----------------|-----|-----------------|------|----------------|-----|
| | <p>which are visible through the park railings and vegetation. To the east the 10m LED style lighting columns located in the Stanley Park carpark beyond the deciduous treeline running between Dahlia Walk and the main park area. To the northwest the LED lighting located in the vicinity of the LFC TV studio and OB compound is visible. Residential properties on Anfield Road are also visible.</p> | <p>operational in this direction giving off a white light with the two non-operational columns leaving the footpath in darkness. Beyond the park railings the sources of light visible are the OB compound lighting, which is white in appearance, the Anfield Road street lighting which is yellow in appearance and the yellow footpath light adjacent to 145 Anfield Road. Residential exterior lighting is also visible in this direction at the rear of properties on Anfield Road. To the east, the orange Road lighting located on Priory Road and Arkles Lane is visible in the distance, vehicle headlights are also visible moving along these routes. When viewing towards the Stanley Park car park in the east, the lighting within the car park is bright and white with some lower levels of glare.</p> | <p>Sky glow masked by the tree lines to the east, south and northwest.</p> | <table><tr><td>East (at 1.5m)</td><td>3.8</td></tr><tr><td>South (at 1.5m)</td><td>12.5</td></tr><tr><td>West (at 1.5m)</td><td>6.3</td></tr></table> | | East (at 1.5m) | 3.8 | South (at 1.5m) | 12.5 | West (at 1.5m) | 6.3 |
| | | | | East (at 1.5m) | 3.8 | | | | | | |
| | | | | South (at 1.5m) | 12.5 | | | | | | |
| | | | | West (at 1.5m) | 6.3 | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | Description of existing night-time view – Non-Matchday | | Summary of prevalent lighting – Non-Matchday | | | | | | | |
| | | <p>In contrast, on a non-matchday the viewpoint feels darker as indicated by the non-matchday lighting measurements. The screening provides a more effective barrier to the street lighting located on Anfield Road and the stadium to the south. The stadium appears to have a</p> | | <p>Light sources: Street lighting, Stanley Park car park lighting and Dahlia Walk lighting</p> <p>Principal sources of glare: Stanley Park car park lighting</p> | | | | | | | |

| | | <p>yellow glow. The heritage style lighting is switched on however the light levels on the path are noticeably lower than match day. Looking towards the Stanley Park car park in the east, the lighting located there is bright and white in appearance with orange road lighting located on Priory Road and Arkles Lane visible further in the distance, vehicle headlights are also visible moving along these routes. Looking northwest, the main sources of light visible are the Anfield Road street lighting yellow or white in appearance, the yellow footpath light adjacent to 145 Anfield Road and the residential lighting at the rear of properties on Anfield Road. Sky glow is masked by the tree lines to the east, south and northwest.</p> | <p>Principal sources of spill light: Dahlia Walk lighting</p> <p>Sources of sky glow: None visible</p> <p>Lighting measurements Non-Matchday (14/01/2020 23:10)</p> <table><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>2.2</td></tr><tr><td>North (at 1.5m)</td><td>0.2</td></tr><tr><td>East (at 1.5m)</td><td>2.18</td></tr><tr><td>South (at 1.5m)</td><td>2.85</td></tr><tr><td>West (at 1.5m)</td><td>0.72</td></tr></table> | Direction of sensor | Light reading in lux | Ground | 2.2 | North (at 1.5m) | 0.2 | East (at 1.5m) | 2.18 | South (at 1.5m) | 2.85 | West (at 1.5m) | 0.72 |
|--|--|--|--|---------------------|----------------------|--------|-----|-----------------|-----|----------------|------|-----------------|------|----------------|------|
| Direction of sensor | Light reading in lux | | | | | | | | | | | | | | |
| Ground | 2.2 | | | | | | | | | | | | | | |
| North (at 1.5m) | 0.2 | | | | | | | | | | | | | | |
| East (at 1.5m) | 2.18 | | | | | | | | | | | | | | |
| South (at 1.5m) | 2.85 | | | | | | | | | | | | | | |
| West (at 1.5m) | 0.72 | | | | | | | | | | | | | | |
| 05 – Stanley Park – Dahlia Walk behind LFC TV Studio | <p>This viewpoint is located at the end of Dahlia Walk behind the LFC TV studio. To the north located behind the viewpoint lies the main area of Stanley Park. To the south lies Anfield Stadium with the main view consisting of the corner of the Main Stand. Anfield Road and the OB compound is located between the viewpoint and the stadium with the OB compound located on the left-hand side of the footpath leading onto Anfield Road. To the west, 145 Anfield Road is located with an old-style</p> | <p>Description of existing night-time view - Matchday</p> <p>At this location the lighting levels are relatively high as indicated by the match lighting measurements. Two heritage style columns at the start of Dahlia Walk were not operating at the time of the survey when viewing to the east. Viewing south the Main Stand concourse LED lighting mounted on 12m high columns emits white bright light, the steps to the Main Stand higher level emit intense, bright, white light and a high level of glare is visible. Between the two flights of steps</p> | <p>Summary of prevalent lighting - Matchday</p> <p>Light sources: Anfield Road street lighting, OB compound lighting and footpath, Main Stand concourse lighting, heritage style lighting columns on Dahlia Walk and within Stanley Park, Stadium exterior lighting, residential interior and exterior lighting, vehicle headlights.</p> <p>Principal sources of glare: OB compound lighting Main Stand stairwell lighting</p> | | | | | | | | | | | | |

| street light located at the side of the property. | the players entrance is lit by a white light source. The exterior of the Main Stand at high level has several lights shining white light down the exterior wall. Bulkhead type light fittings fixed to the exterior of the Anfield Road side of the stand which appear white and bright. The Main stand interior lighting (office and stairwell) is also visible. In the foreground, the white LED lights located within the OB compound shine white and bright with a yellow street light on Anfield Road visible far left. Vehicle headlights from passing traffic is also visible. To the west residential exterior lighting is visible at the rear of a property on Anfield Road. Spill light is apparent within Stanley Park and on the trees and vegetation in the vicinity of Dahlia Walk. The exterior of 145 Anfield Road is lit by spill light along the side of the property. Skyglow is visible above the stadium and is white in appearance. | Principal sources of spill light: OB compound lighting and footpath, street lighting, heritage style columns on Dahlia Walk | | | | | | | | | | | | |
|---|---|---|----------------------|----------------------|--------|-----|-----------------|------|----------------|-----|-----------------|------|----------------|-----|
| | | Sources of sky glow: Stadium floodlights | | | | | | | | | | | | |
| | | Lighting measurements Matchday (13/01/2020 19:50) | | | | | | | | | | | | |
| | | <table><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>7.5</td></tr><tr><td>North (at 1.5m)</td><td>0.45</td></tr><tr><td>East (at 1.5m)</td><td>1.2</td></tr><tr><td>South (at 1.5m)</td><td>12.2</td></tr><tr><td>West (at 1.5m)</td><td>2.8</td></tr></table> | Direction of sensor | Light reading in lux | Ground | 7.5 | North (at 1.5m) | 0.45 | East (at 1.5m) | 1.2 | South (at 1.5m) | 12.2 | West (at 1.5m) | 2.8 |
| | | Direction of sensor | Light reading in lux | | | | | | | | | | | |
| Ground | 7.5 | | | | | | | | | | | | | |
| North (at 1.5m) | 0.45 | | | | | | | | | | | | | |
| East (at 1.5m) | 1.2 | | | | | | | | | | | | | |
| South (at 1.5m) | 12.2 | | | | | | | | | | | | | |
| West (at 1.5m) | 2.8 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | Description of existing night-time view – Non-Matchday | Summary of prevalent lighting – Non-Matchday | | | | | | | | | | | | |
| | In contrast, on a non-matchday the viewpoint feels darker as indicated by the non-matchday lighting measurements. The main light source along Anfield Road is the street lighting that is yellow in appearance. Viewing south towards the stadium, the players entrance is brightly | Light sources: Street lighting, players entrance lighting, turnstile bulkhead lighting, totem sign lighting, internal stadium lighting, external and internal residential lighting, vehicle headlights. | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

lit with lighting that is white in appearance. White bulkhead light fittings are mounted to the turnstile gates at the end of the Anfield Road Stadium and appear to be intense, white and bright and produce glare when viewed against the darker background. These lights produce spill light onto the surface of Anfield Road in the local vicinity. The internally illuminated totem sign located at near the Main Stand concourse also appears bright with light that is white in appearance. Internal lighting is visible within the Main Stand at a lower level than matchday. To the west, the view is of the rear of properties on Anfield Road where and orange exterior light is visible giving an intense orange glow. Through gaps between the houses the yellow street lighting located on Anfield Road is visible. Sky glow is apparent in the west orange/yellow in appearance.

Principal sources of glare: Stadium bulkhead light fittings

Principal sources of spill light: Street lighting, bulkhead light fittings

Sources of sky glow: Urban areas in the west

Lighting measurements

Non-Matchday (14/01/2020 23:20)

| Direction of sensor | Light reading in lux |
|---------------------|----------------------|
| Ground | 0.23 |
| North (at 1.5m) | 0.56 |
| East (at 1.5m) | 0.49 |
| South (at 1.5m) | 0.3 |
| West (at 1.5m) | 0.17 |

06 – Stanley Park – Curved Footpath

This viewpoint is located within the main area of Stanley Park on a footpath which is illuminated by heritage style LED columns approximately 5m in height. The surrounding area is mainly grass with a few young trees. To the south is Anfield Stadium with Dahlia Walk running along the perimeter of Stanley Park. There is a line of mature trees, mainly deciduous, which provides a level of screening in

Description of existing night-time view - Matchday

At this location the lighting levels are relatively low as indicated by the match lighting measurements. The white light from the heritage style columns approximately 5m in height which lights the footpath is the predominant local light source. There is local spill light onto the grassed area from the heritage style

Summary of prevalent lighting - Matchday

Light sources: footpath lighting, vehicle headlights, stadium lighting including pitch floodlights, street lighting, carpark lighting

Principal sources of glare: Stadium floodlighting and Stanley Road car park light

this direction. These trees run the length of Stanley Park up to the Arkles Lane entrance. The treeline continues along the perimeter along Arkles Lane although the level of screening becomes sparse. To the west are the rear of residential properties located on Anfield Road with deciduous screening and heritage style LED columns approximately 5m in height also visible in this direction.

lighting columns. To the south, the Stadium floodlighting on the Kenny Dalglish Stand is visible and is white, bright and intense. In front of the stadium, the bright white car park lighting and the yellow street lighting on Anfield Road can be seen. In the far left, a single LED light is visible which is located in the Stanley Road car park. This emits white bright light and glare. Viewing west, the view is of the lit footpath with the heritage style columns emitting bright white light and creating spill light on the grassed areas surrounding the footpath. In the distance, the yellow street lighting on Anfield Road is visible. A white light source on the far left is located on Alroy Road and has created spill light on the residential properties behind it. Directly ahead, an exterior light on a residential property has created yellow spill light which has illuminated the side of a building. To the northwest, Dahlia Walk is lit with heritage style LED lighting white in appearance, this lighting extends to the point where the footpaths merge within the park. The park lighting continues behind the Villas located on Anfield Road with the surrounding area in darkness. Sky glow is apparent to the west and is yellow in appearance.

Principal sources of spill light: footpath lighting, stadium floodlighting, car park lighting, Street lighting

Sources of sky glow: Westerly direction and yellow in appearance.

| Lighting measurements Matchday (13/01/2020 19:30) | |
|--|----------------------|
| Direction of sensor | Light reading in lux |
| Ground | 2.5 |
| North (at 1.5m) | 0.5 |
| East (at 1.5m) | 0.8 |
| South (at 1.5m) | 2.0 |
| West (at 1.5m) | 5.0 |

Description of existing night-time view - Non Matchday

Summary of prevalent lighting – Non-Matchday

In terms of spill light this viewpoint on a non-matchday is very similar to that of a matchday due to the distance from the stadium therefore non-matchday light measurements have not been taken. In the west, the footpath lighting is operational and providing spill light onto the grassed area each side of the footpath. In the distance, the yellow street lighting on Anfield Road is visible. A white light source on the far left is located on Alroy Road and has created spill light on the residential properties behind it. Directly ahead, an exterior light on a residential property has created yellow spill light which has illuminated the side of a building. Viewing towards the south, the stadium is yellow at high level and has a yellow tinge from the street lighting. Several white light sources are visible which are located within the Stanley Park car park, Anfield Road car park, and on Dahlia Walk. At the eastern end of the Anfield Road stand, an intense, bright, white floodlight located in the Kenny Dalglish car park is visible creating glare. Sky glow is less apparent above the stadium and predominantly white in appearance to the west skyglow is more orange in appearance.

Light sources: Street lighting, vehicle headlights, internal stadium lighting, Anfield Road, Stanley Park and Kenny Dalglish car park lighting, Dahlia Walk lighting and Stanley Park footpath lighting.

Principal sources of glare: floodlight in Kenny Dalglish car park, Stanley Park Car park

Principal sources of spill light: Stanley Park footpath lighting

Sources of sky glow: White skyglow to the south and more orange skyglow to the west.

Lighting measurements

Non-Matchday (14/01/2020 22:45)

| Direction of sensor | Light reading in lux |
|---------------------|----------------------|
| Ground | NA |
| North (at 1.5m) | NA |
| East (at 1.5m) | NA |
| South (at 1.5m) | NA |
| West (at 1.5m) | NA |

Description of existing night-time view - Matchday

Summary of prevalent lighting - Matchday

07 – Stanley Park – Car Park

This viewpoint is located within the Stanley Park car park. The topology is flat with a gradual decline northward as the gradient lowers towards the northeast where on Priory Road a petrol station and the entrance to the car park is located. To the south is the rear of 73 Anfield Road (Chairman's Villa) and neighbouring properties. Viewing to the south, Dahlia Walk lighting is visible in places when not obscured by the deciduous tree line running along the footpath. To the southwest lighting for the stadium floodlighting, exterior lighting in the Stanley Park and Anfield Road car park, OB compound, street lighting on Anfield Road and fixed to stadium external walls are visible.

At this location the lighting levels are relatively high as indicated by the match lighting measurements, this is largely due to the proximity of the 10m LED lighting columns within the Stanley Park car park. The lighting columns are visible in every direction and are intense, white and bright with closer lighting columns within the car park emitting glare. To the south the view is of fencing running along the back of properties on Anfield Road including Chairman's Villa with some white and yellow light sources visible. Arkles Public House lighting is visible and warm white / yellow in appearance. The southwest provides a direct view of the stadium therefore additional matchday and non-matchday night time photographs have been provided within Appendix D. When viewing southwest several Main Stand floodlights are visible as white and bright light with glare. Other visible light sources are white light LED columns located in Stanley Road and Anfield Road car park, Yellow street lighting on Anfield Road and external lights fixed to stadium exterior walls. In addition Dahlia Walk LED lighting that is white in appearance is visible. Sky glow is apparent above the stadium in the southwest and is white in nature which continues to the south.

Light sources: Stadium floodlighting, car park lighting, stadium external lighting, street lighting, footpath lighting, vehicle headlights

Principal sources of glare: Stanley Park car park lighting, Main Stand floodlighting.

Principal sources of spill light: Main Stand floodlighting, Stanley Park car park lights

Sources of sky glow: Stadium floodlighting

| Lighting measurements Matchday (13/01/2020 19:20) | |
|--|----------------------|
| Direction of sensor | Light reading in lux |
| Ground | 8.0 |
| North (at 1.5m) | 16.0 |
| East (at 1.5m) | 13.0 |
| South (at 1.5m) | 11.0 |
| West (at 1.5m) | 10.0 |

| | Description of existing night-time view - Non Matchday | Summary of prevalent lighting – Non-Matchday | | | | | | | | | | | | |
|---------------------|---|--|---------------------|----------------------|--------|------|-----------------|------|----------------|-------|-----------------|-------|----------------|------|
| | <p>At this location the lighting levels are relatively high as indicated by the non-match lighting measurements. The viewpoint on a non-matchday is the car park lighting operating to the same level as a matchday. The LED lights are intense, bright and white and glare is emitted from the lighting that is closer to the viewpoint. To the southwest the stadium itself has a yellow hue at high level from the internal lighting and a yellow hue from street lighting at lower level. Dahlia Walk LED lighting that is white in appearance is visible to the southwest as is the yellow street lighting on Anfield Road</p> | <p>Light sources: Stanley Park Car park LED lighting, stadium internal lighting Anfield Road street lighting and Dahlia Walk LED lighting.</p> <p>Principal sources of glare: Stanley Park car park LED lighting</p> <p>Principal sources of spill light: Stanley Park car park LED lighting</p> <p>Sources of sky glow: None apparent</p> <p>Lighting measurements Non-Matchday (15/01/2020 00:10)</p> <table><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>8.47</td></tr><tr><td>North (at 1.5m)</td><td>15.8</td></tr><tr><td>East (at 1.5m)</td><td>12.37</td></tr><tr><td>South (at 1.5m)</td><td>10.15</td></tr><tr><td>West (at 1.5m)</td><td>8.91</td></tr></table> | Direction of sensor | Light reading in lux | Ground | 8.47 | North (at 1.5m) | 15.8 | East (at 1.5m) | 12.37 | South (at 1.5m) | 10.15 | West (at 1.5m) | 8.91 |
| Direction of sensor | Light reading in lux | | | | | | | | | | | | | |
| Ground | 8.47 | | | | | | | | | | | | | |
| North (at 1.5m) | 15.8 | | | | | | | | | | | | | |
| East (at 1.5m) | 12.37 | | | | | | | | | | | | | |
| South (at 1.5m) | 10.15 | | | | | | | | | | | | | |
| West (at 1.5m) | 8.91 | | | | | | | | | | | | | |
| | Description of existing night-time view - Matchday | Summary of prevalent lighting - Matchday | | | | | | | | | | | | |

08 – Dahlia Walk at rear of 73 Anfield Road/Chairman’s Villa

This viewpoint is located on Dahlia Walk behind 73 Anfield Road (Chairman’s Villa). The topography is generally flat with a slope downhill northward towards Priory Road. To the south is the rear of Chairman’s Villa which has a line of non-deciduous trees behind a boundary fence which have grown to an approximate height of 4m. Viewing west the view is predominantly of the stadium with the deciduous treeline & Dahlia Walk running in the foreground. LED lighting columns 5m in height are visible in this location. When looking northwest, the view is directly down Dahlia Walk with heritage style columns on the left-hand side. There are deciduous trees lining each side of the footpath, these treelines provide screening when viewing the stadium from Stanley park.

At this location the lighting levels are relatively high as indicated by the match lighting measurements. This location on Dahlia Walk is in close proximity to a heritage LED style lighting column resulting in higher lighting measurements. The view to the west is of the stadium with bright white floodlighting visible giving high levels of glare through the screening provided by the deciduous trees. The area in front of the stadium is lit by Anfield Road car park lighting white in appearance, Anfield Road streetlights yellow in appearance, and the Fan zone area lighting white in appearance with additional white lighting mounted to the Anfield Road stand. This amount of lighting has created spill light within the Stanley Park area and towards the receptor. The tree line has been lit from top to bottom and the grassed area behind shows an intrusion of spill light into the location which in conjunction with the LED lighting along Dahlia Walk extends beyond the footpath into the second tree line and grassed area separating the footpath from Stanley Park. When viewing towards the northwest the spill light which is white in appearance is apparent along the length of the Dahlia Walk. Viewing to the south, the rear of chairman’s villa is in darkness with the exception of three white light

Light sources: Main Stand floodlighting, Anfield Road Street lighting, Anfield Road car park lighting, OB Compound, fan zone area, heritage style LED lighting, stadium exterior mounted lighting.

Principal sources of glare: Main Stand floodlighting

Principal sources of spill light: Main Stand floodlight, Anfield Road car park, fan zone, OB Compound, heritage style LED lighting located at Dahlia Walk

Sources of sky glow: Stadium floodlighting

| Lighting measurements Matchday (13/01/2020 21:15) | |
|--|----------------------|
| Direction of sensor | Light reading in lux |
| Ground | 3.6 |
| North (at 1.5m) | 1.2 |
| East (at 1.5m) | 1.15 |
| South (at 1.5m) | 0.15 |
| West (at 1.5m) | 2.91 |

| | | | |
|-----------------|--|---|----------------------|
| | sources which are visible through the screening. Sky glow is apparent and white in nature above the stadium to the west. | | |
| | Description of existing night-time view – Non-Matchday | Summary of prevalent lighting – Non-Matchday | |
| | <p>The viewpoint is darker than the matchday conditions as shown by the non-matchday light measurements. Viewing to the south, the rear of chairman’s villa is in darkness with the exception of two white light sources viewed through the screening. Viewing west, the stadium has a yellow hue due to internal lighting, the Anfield Road carpark lighting is white and creates spill light on the trees and vegetation along the perimeter of the park and can be viewed through the gaps in the deciduous screening. The Anfield Road street lighting is yellow in appearance. No exterior lighting on the stadium is visible. No sky glow is apparent as views are masked by tree line to the south and northwest. To the west the skyglow is visible and has an orange hue.</p> | <p>Light sources: Anfield Road car park lighting, Anfield Road street lighting, Stadium internal lighting</p> <p>Principal sources of glare: Anfield Road car park lighting</p> <p>Principal sources of spill light: Anfield Road car park lighting</p> <p>Sources of sky glow: West direction orange in appearance</p> | |
| | | Lighting measurements Non-Matchday (15/01/2020 00:10) | |
| | | Direction of sensor | Light reading in lux |
| Ground | | 0.5 | |
| North (at 1.5m) | 0.7 | | |
| East (at 1.5m) | 0.69 | | |
| South (at 1.5m) | 0.4 | | |
| West (at 1.5m) | 0.7 | | |

| 09 – 73 Anfield Road/Chairman’s Villa - Front | <p>This viewpoint is located on Anfield Road directly outside 73 Anfield Road (Chairman’s Villa). Viewing to the north is the coach house/outbuilding which is adjacent to Anfield Road car park. To the east is the main house and front door which has two decorative lights one fixed to each side. To the southeast is the view along Anfield Road towards Arkles Public House. To the south lies Skerries Road with street lighting concealed from the viewpoint by brick pillars. The view to the west is the Sir Kenny Dalglish stand and Anfield Road stand. To the northwest is the Anfield Road stand, Anfield Road car park, Fan zone area and Anfield Road. Lighting visible from this location consists of street lighting on Anfield Road, floodlighting mounted on the Sir Kenny Dalglish stand, external lighting mounted to the Main Stand, Anfield Road car park lighting and lighting columns located in the Sir Kenny Dalglish car park.</p> | <p>Description of existing night-time view - Matchday</p> <p>At this location the lighting levels are high as indicated by the match lighting measurements. Viewing to the west, the Bill Shankly gates, the Sir Kenny Dalglish Carpark, Stand and the Anfield Road stand are visible. The floodlighting on the exterior of the Sir Kenny Dalglish stand are bright, white and emit glare. The exterior lights fixed to the Anfield Road Stand are also bright and white and emit glare. There are two intensely white uplighters beneath the Bill Shankly gates which emit glare. While not visible within the westerly view an intense white LED floodlight is emitting high levels of spill light in the direction of the Chairman’s Villa. Viewing northwest down Anfield Road, the sources of lighting viewable are the exterior lights on the lower section of the Anfield Road stand and lights fixed at high level under the façade. These run the length of the stand and are white in colour with the streetlights on Anfield Road installed on the opposing side being yellow in appearance. With some white LED based lighting visible from the Anfield Road car park.</p> | <p>Summary of prevalent lighting - Matchday</p> <p>Light sources: Sir Kenny Dalglish stand floodlights, Bill Shankly gates uplighters, Anfield Road stand lighting, street lighting, Anfield Road car parking and vehicle headlights.</p> <p>Principal sources of glare: Sir Kenny Dalglish stand and car park floodlights, Bill Shankly gates uplighters</p> <p>Principal sources of spill light: Sir Kenny Dalglish Stand and car park floodlights, Anfield Road stand lighting, street lighting and Anfield Road car park lighting</p> <p>Sources of sky glow: None apparent from this location.</p> <table><tr><th colspan="2">Lighting measurements Matchday (13/01/2020 20:50)</th></tr><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>6.7</td></tr><tr><td>North (at 1.5m)</td><td>7.1</td></tr></table> | Lighting measurements Matchday (13/01/2020 20:50) | | Direction of sensor | Light reading in lux | Ground | 6.7 | North (at 1.5m) | 7.1 |
|--|--|---|--|--|--|---------------------|----------------------|--------|-----|-----------------|-----|
| Lighting measurements Matchday (13/01/2020 20:50) | | | | | | | | | | | |
| Direction of sensor | Light reading in lux | | | | | | | | | | |
| Ground | 6.7 | | | | | | | | | | |
| North (at 1.5m) | 7.1 | | | | | | | | | | |

| | | | |
|--|--|---|--|
| | Headlights are visible from approaching vehicles. Skyglow not apparent, obscured by floodlighting and the stadium. | East (at 1.5m) | 4.2 |
| | | South (at 1.5m) | 6.2 |
| | | West (at 1.5m) | 16.3 |
| | Description of existing night-time view – Non-Matchday | | Summary of prevalent lighting – Non-Matchday |
| <p>This viewpoint is darker in the direction of the Stadium on a non-matchday as indicated by the light measurements. Viewing to the west, the Bill Shankly gates uplighters are intensely bright against the darker background and emit glare. One floodlight assumed to be in the Sir Kenny Dalglish car park was visible as in operation emitting intensely white and bright light. Viewing northwest down Anfield Road, the streetlights are yellow in appearance giving the surroundings a yellow hue. Headlights are visible from approaching vehicles on Anfield Road. Skyglow not apparent, obscured by the stadium.</p> | | <p>Light sources: Bill Shankly gates uplighters, Sir Kenny Dalglish car park floodlight, street lighting and vehicle headlights.</p> <p>Principal sources of glare: Bill Shankly uplighters</p> <p>Principal sources of spill light: Sir Kenny Dalglish car park light, street lighting</p> <p>Sources of sky glow: None apparent from this location.</p> | |
| | | Lighting measurements Non-Matchday (14/01/2020 23:50) | |
| | | Direction of sensor | Light reading in lux |
| | | Ground | 5.0 |
| | | North (at 1.5m) | 9.8 |
| | | East (at 1.5m) | 4.6 |

| | | | | |
|--|--|--|---|----------------------|
| | | South (at 1.5m) | 2.8 | |
| | | West (at 1.5m) | 8.2 | |
| 10 – Sir Kenny Dalglish Car Park/39 Skerries Road - Rear | This viewpoint is located within the Sir Kenny Dalglish car park and is representative of the rear aspect of residents on north end of Skerries Road. Viewing north through the Bill Shankly gates, the Anfield Road and Anfield Road car park are directly ahead with the deciduous tree line between the car park and Dahlia Walk providing intermittent screening. Viewing west and south-southwest, the Sir Kenny Dalglish Stand is directly in front with properties on the Walton Breck Road viewable in the background. There are several floodlights fixed to the exterior of the stand. Looking south at the rear of the properties on Skerries Road, there are several floodlights mounted on columns running along the perimeter (a concrete fence) with the floodlights orientated towards the car park. | Description of existing night-time view - Matchday | Summary of prevalent lighting - Matchday | |
| | | This viewpoint is very bright as indicated by the matchday light measurements. Viewing north through the gates, the LED lighting within Anfield Road car park is white and bright with the Bill Shankly uplighters visible below the gate. High levels of spill light can be seen on the internal aspect of the boundary. Viewing to the west and south-southwest, the internal lights within the stand are visible as well as the intense white exterior lights within the car park which emit high levels of glare. There is one bright orange street light located on Walton Breck Road viewable in the background to the left of the stand and the floodlighting on columns running along the perimeter of the carpark directly behind the viewpoint. Skyglow not apparent, obscured by floodlighting and stadium. | Light sources: Sir Kenny Dalglish Stand exterior floodlights and internal lighting, Sir Kenny Dalglish car park floodlighting, Bill Shankly gates uplighters, Anfield Road car park lighting, street lighting and Walton Breck Road street light. | |
| | | | Principal sources of glare: Sir Kenny Dalglish stand exterior floodlights and Sir Kenny Dalglish car park floodlights. | |
| | | | Principal sources of spill light: Sir Kenny Dalglish stand exterior floodlights, Sir Kenny Dalglish car park floodlights, Walton Breck Road streetlight and Anfield Road car park lighting | |
| | | | Sources of sky glow: None apparent from this location. | |
| | | | Lighting measurements Matchday (13/01/2020 22:50) | |
| | | | Direction of sensor | Light reading in lux |

| | | |
|---|-----------------|--|
| | | |
| | Ground | 30.7 |
| | North (at 1.5m) | 15 |
| | East (at 1.5m) | 13.8 |
| | South (at 1.5m) | 4.2 |
| | West (at 1.5m) | 18.8 |
| Description of existing night-time view - Non Matchday | | Summary of prevalent lighting – Non-Matchday |
| <p>This viewpoint is darker on a non-matchday as indicated by the light readings. Viewing to the north, the lighting in Anfield Road car park is bright and white with glare present. A heritage style column is visible on Dahlia Walk in the background through the deciduous screening between car park and Dahlia Walk. Anfield Road street lighting is also visible and yellow in appearance. Viewing west and south-southwest, the only lighting visible is the bright orange street light on Walton Breck Road and some green light from emergency lighting. Sky glow not apparent, obscured by Stadium.</p> | | <p>Light sources: Anfield Road car park, Walton Breck Road street light, heritage style light on Dahlia Walk and Anfield Road street lighting.</p> <p>Principal sources of glare: Anfield Road car park</p> <p>Principal sources of spill light: Anfield Road car park, Anfield Road street lighting and Walton Breck Road street light.</p> <p>Sources of sky glow: None apparent from this location.</p> |
| | | Lighting measurements Non-Matchday (15/01/2020 00:30) |
| | | Direction of sensorLight reading in lux |
| | | Ground16.6 |

| | | | |
|--|--|-----------------|------|
| | | North (at 1.5m) | 3.88 |
| | | East (at 1.5m) | 2.05 |
| | | South (at 1.5m) | 0.21 |
| | | West (at 1.5m) | 2.55 |

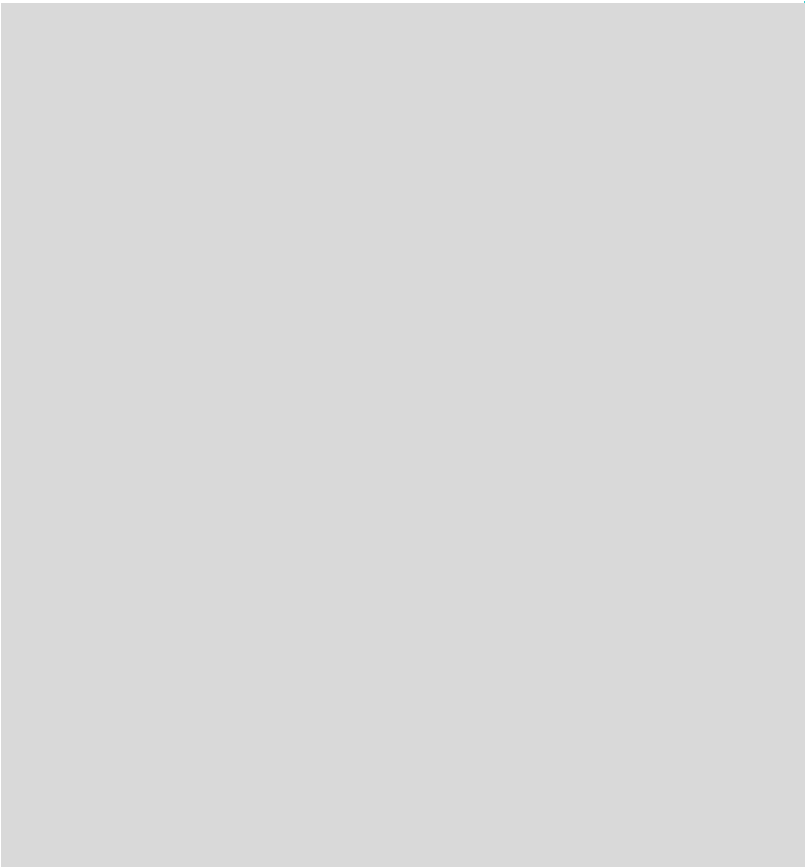
| 11 – 250 Anfield Road | <p>This viewpoint is located on the corner of Skerries Road and Anfield Road and is representative of the residents of 250, 252 and 254 Anfield Road. Viewing north is the Chairman’s Villa which is situated on the other side of Anfield Road to the viewpoint. Anfield Road car park is situated to the left of the Villa on the same side of Anfield Road. To the west the view is across Skerries Road and through the railings that border the Sir Kenny Dalglish car park. Floodlighting on 6/8m height columns are visible within the Sir Kenny Dalglish car park and exterior lights fixed to the stand façade. Viewing northwest, the view is looking down Anfield Road and Anfield Road car park. The lights within the Anfield Road car park are visible from this viewpoint as well as an older style street light mounted post top on an 8m column and orientated towards the highway.</p> | <p>Description of existing night-time view - Matchday</p> <p>This viewpoint is bright as indicated by the matchday light readings. Viewing north, spill light is very apparent on the Chairman’s Villa, wall, gates and coach house and is white in colour, this light is emitted by the Sir Kenny Dalglish car park floodlighting. Lighting located in the Anfield Road car park can be seen in the background behind the coach house and is white in appearance. Some yellow spill light is also apparent on these buildings from the Anfield Road street lighting. Viewing west, the floodlighting within the Sir Kenny Dalglish car park is visible through the railing and is bright, white and emits glare. Yellow spill light is apparent on the railings from the Anfield Road streetlight located behind viewpoint on opposite side of Anfield Road. The exterior lighting mounted on the stand is also visible as white, bright and emits glare. Viewing northwest, the lighting within the Anfield Road car park is bright and white with the street light on the</p> | <p>Summary of prevalent lighting - Matchday</p> <p>Light sources: Sir Kenny Dalglish stand and car park floodlighting, Anfield Road car park, Anfield Road street lighting and stand mounted lighting.</p> <p>Principal sources of glare: Sir Kenny Dalglish stand and car park floodlights</p> <p>Principal sources of spill light: Sir Kenny Dalglish stand and car park floodlights, Anfield Road street lighting.</p> <p>Sources of sky glow: None apparent from this location.</p> <table><tr><th colspan="2">Lighting measurements Matchday (13/01/2020 21:00)</th></tr><tr><th>Direction of sensor</th><th>Light reading in lux</th></tr><tr><td>Ground</td><td>7.7</td></tr></table> | Lighting measurements Matchday (13/01/2020 21:00) | | Direction of sensor | Light reading in lux | Ground | 7.7 |
|--|--|---|---|--|--|---------------------|----------------------|--------|-----|
| Lighting measurements Matchday (13/01/2020 21:00) | | | | | | | | | |
| Direction of sensor | Light reading in lux | | | | | | | | |
| Ground | 7.7 | | | | | | | | |

| | | | |
|---|--|---|-----------------------------|
| | highway visible as bright yellow. The street light spills yellow light on the highway and surrounding area. There is also one exterior light on the Anfield Road stand visible and is viewed as bright and white in appearance. Fan zone lighting is in the background as is white in appearance. Skyglow not apparent to the north, west or northwest as it is obscured by the stadium and car park lighting. | | |
| | | North (at 1.5m) | 9.2 |
| | | East (at 1.5m) | 8.75 |
| | | South (at 1.5m) | 3.7 |
| | | West (at 1.5m) | 6.1 |
| Description of existing night-time view – Non-Matchday | | Summary of prevalent lighting – Non-Matchday | |
| This viewpoint is darker than the matchday conditions as indicated by the non-matchday light readings. Viewing north, the Chairman's Villa has spill light yellow in appearance from the Anfield Road street lighting. Behind the coach house the Anfield Road car park lights can be seen and are white and bright, emitting glare. Viewing to the west, yellow spill light is visible on the railings of the Sir Kenny Dalglish car park. There is one internal light visible in the Sir Kenny Dalglish stand through the railings. Viewing northwest, The Anfield Road car park lights are white and bright with the Anfield Road street light visible as bright yellow and emitting glare. There is an overall yellow hue to this viewpoint and immediate surrounding area. Skyglow is not apparent, obscured by stadium and car park lighting. | | Light sources: Anfield Road car park and street lights Principal sources of glare: Anfield Road car park and street lights Principal sources of spill light: Anfield Road street lights Sources of sky glow: None apparent from this location. | |
| | | Lighting measurements Non-Matchday (14/01/2020 23:50) | |
| | | Direction of sensor | Light reading in lux |
| | | Ground | 7.0 |
| | | North (at 1.5m) | 5.5 |

| | | | | |
|----------------------|---|--|----------------------|--|
| | | East (at 1.5m) | 7.6 | |
| | | South (at 1.5m) | 3.5 | |
| | | West (at 1.5m) | 2.7 | |
| 12 –36 Skerries Road | <p>This viewpoint is located on Skerries Road and is representative of the front aspect of the residential properties at 36 and 34 Skerries Road. Viewing north towards Anfield Road there is a direct view of Chairman’s Villa with the railings of Sir Kenny Dalglish car park visible. There are no floodlights visible in the car park from this location. There is a street light visible on Anfield Road located close to the Anfield Road car park and Chairman’s Villa coach house.</p> | Description of existing night-time view - Matchday | | |
| | | This viewpoint is bright in the direction of Anfield Road as indicated by the matchday light readings. Viewing north, the street light on Anfield Road is bright yellow in appearance and emitting glare. White spill light can be seen on the coach house and wall at the Chairman’s Villa with yellow spill light visible on the coach house window. White spill light is also visible on the Villa. | | |
| | | Sky glow is apparent above properties backing onto the stadium to the west and is white in appearance. | | |
| | | Light sources: Anfield Road street light and Sir Kenny Dalglish car park floodlighting | | |
| | | Principal sources of glare: Anfield Road street light | | |
| | Principal sources of spill light: Anfield Road Street light and Sir Kenny Dalglish car park floodlighting | | | |
| | Sources of sky glow: Stadium floodlighting and Sir Kenny Dalglish car park floodlighting. | | | |
| | Lighting measurements Matchday (13/01/2020 21:15) | | | |
| | Direction of sensor | | Light reading in lux | |
| | Ground | | 7.0 | |
| North (at 1.5m) | | 6.0 | | |
| East (at 1.5m) | | 1.8 | | |

| | | | | |
|--|--|--|--|-----------------------------|
| | | | South (at 1.5m) | 0.66 |
| | | | West (at 1.5m) | 0.6 |
| | | | | |
| | Description of existing night-time view – Non-Matchday | | Summary of prevalent lighting – Non-Matchday | |
| | <p>This viewpoint is bright in the direction of Anfield Road on a non-matchday as indicated by the non-matchday readings. The only source of light is the Anfield Road street lights which are bright and yellow in appearance and emitting glare. The readings taken in the west and on the ground have increased due to resident's internal lighting that was operational at the time of the survey. Sky glow not apparent at this location.</p> | | Light sources: Anfield Road street lighting | |
| | | | Principal sources of glare: Anfield Road street lighting | |
| | | | Principal sources of spill light: Anfield Road street lighting | |
| | | | Sources of sky glow: Sky glow not apparent at this location. | |
| | | | Lighting measurements Non-Matchday (15/01/2020 00:00) | |
| | | | Direction of sensor | Light reading in lux |
| | | | Ground | 8.3 |
| | | | North (at 1.5m) | 5.0 |
| | | | East (at 1.5m) | 0.6 |
| | | | South (at 1.5m) | 0.6 |
| | | | West (at 1.5m) | 1.4 |

| | | | |
|-----------------------------------|---|---|---|
| 13 – Stanley Park – Straight Path | This viewpoint is located within Stanley Park on an unlit footpath. Viewing south, the view is of the grassed area and footpath within the park with the Stadium behind. The deciduous tree line and vegetation running between the Anfield Road car park/Fan zone area and Dahlia Walk is visible and sparse in places. Heritage style columns located on the curved footpath are visible. | Description of existing night-time view - Matchday | Summary of prevalent lighting - Matchday |
| | | This viewpoint is dark on a matchday as indicated by the readings. Viewing south, the stadium is lit by bright white internal floodlights which emit glare. The Anfield Road car park lighting is also visible as bright and white with some less intense glare and the exterior lighting mounted on the Anfield Road stand can be seen in places. The Anfield Road street lights are visible and yellow in appearance and create spill light onto the stand behind as a yellow hue. There are heritage style lights in the foreground located on the curved footpath and Dahlia Walk. No spill light is apparent at this location. Sky glow is visible above the stadium and is white in colour. | <p>Light sources: Stadium floodlights, Heritage style footpath columns, Anfield Road car park lights, Anfield Road street lighting, exterior lighting mounted on the Anfield Road stand</p> <p>Principal sources of glare: Stadium floodlights</p> <p>Principal sources of spill light: None at location.</p> <p>Sources of sky glow: Stadium floodlights</p> |
| | | Lighting measurements Matchday (13/01/2020 19:35) | |
| | | Direction of sensor | Light reading in lux |
| | | Ground | 0.1 |
| North (at 1.5m) | 0.1 | | |
| East (at 1.5m) | 0.2 | | |
| South (at 1.5m) | 0.4 | | |
| West (at 1.5m) | 0.15 | | |
| | | Description of existing night-time view – Non-Matchday | Summary of prevalent lighting – Non-Matchday |



In terms of spill light this viewpoint on a non-matchday is very similar to that of a matchday due to the distance from the stadium therefore non-matchday light measurements have not been taken. Viewing south, the heritage style columns on the footpaths and the Anfield Road car park lights are visible as white. The Anfield Road street lights are visible as a more intense light source and yellow in appearance. The stadium internal lights provide a yellow hue to the internal stadium areas visible at high level. There is yellow spill light visible on the Anfield Road stand façade. No skyglow is visible due to stadium obscuring view.

Light sources: Stadium internal lights, Anfield Road car park light and street lighting, heritage style lights located on footpaths.

Principal sources of glare: Anfield Road street lighting.

Principal sources of spill light: Anfield Road street lighting.

Sources of sky glow: None apparent at this location

| Lighting measurements Non-Matchday (14/01/2020 21:20) | |
|--|----------------------|
| Direction of sensor | Light reading in lux |
| Ground | NA |
| North (at 1.5m) | NA |
| East (at 1.5m) | NA |
| South (at 1.5m) | NA |
| West (at 1.5m) | NA |

Source: Mott MacDonald Ltd. (2020)

5 Proposed Scheme – Lighting Requirements

The following sections describe applications for external lighting which are required in various areas of the Proposed Scheme.

The lighting design should aim to:

- Deliver high quality and efficient lighting, which creates an attractive and safe environment for users and workers alike.
- Create a lighting solution that aspires to make use of modern luminaire and lamp technology to provide an energy efficient and flexible lighting scheme.
- Provide an environment where people feel safe and secure.
- Be sensitive to the setting while creating an enhanced and vibrant environment.
- Pay attention to the sensitive nature of the site's ecology and local amenity in order to preserve the landscape, minimise environmental impact and minimise cost.
- Provide a lighting installation that minimises sky glow, light spill and the luminous intensity that can be experienced from luminaires.
- Provide clear key routes during the evening for users and workers.

5.1 Construction Phase

The following provides the typical minimum design standards deemed suitable for the construction phase of the Proposed Scheme.

Construction Site, Access and Compound

During construction, a compound will be provided for use by contractors. This will include site offices and welfare facilities and be located within Stanley Park. The permitted hours of work are assumed to be:

- Monday-Friday 8.00am-6.00pm;
- Saturday 8.00am-1.00pm; and
- No working on Sundays or Bank Holidays (except with agreement of LCC Environmental Protection Unit).

It is anticipated that night time working will be restricted to hours indicated above, during the winter months, typical working hours will overlap with hours of darkness. During these winter months where work is required to take place during the hours of diminishing ambient lighting levels, task lighting for health and safety will be needed.

Floodlighting is typically used to provide construction phase task lighting. This type of lighting is often portable and will range in height depending on the type of tasks being undertaken. Where lighting is required for health and safety purposes lighting levels will be designed in accordance with BS EN 12464-2:2014 and / or BS 5489-1:2013 dependant on the tasks being undertaken

Security lighting is often required to deter crime in both site compounds or other areas where plant and materials are stored overnight. Lighting used for security will be centred around the site compound and offices. Lighting is likely to be provided from lighting columns and building

mounted floodlights and is anticipated to be restricted to heights similar to that of the existing car park lighting that has a 10m mounting height.

5.2 Operational Phase

Proposed Lighting Design

The following section is a description of the proposals for the stadium pitch floodlighting, external stadium public realm lighting, external building lighting, internal lighting, illuminated signage and projectors. In this instance the lighting designs for the proposed Anfield Road extension have been provided by Mott MacDonald.

Stadium Pitch Lighting

The existing installation was installed in 2016 and complies with the design standards of that time. Due to only one stand being affected by the proposed expansion it is assumed the new sports lighting design will be compliant with the design standards of that time, refer to Figure 3 for pitch floodlighting design criteria.

Figure 3: Original Stadium Pitch Floodlighting Installation Design Criteria

| Design Criteria | | | | | | | | | |
|------------------------|----------------|----------|---------|--------------------------------|--------------|------|----------|---------|--|
| | | Required | Offered | | | | Required | Offered | |
| Ev Towards Main Camera | E _v | 1650 | Yes | Stand | Centenary Ev | | | | |
| | U ₁ | 0.6 | Yes | | | >165 | Yes. | | |
| | U ₀ | 0.5 | Yes | | | >165 | Yes. | | |
| +Y Pitch Camera | E _v | 1000 | Yes | Seating | Kop | Ev | >165 | Yes. | |
| | U ₁ | 0.6 | Yes | | | | >165 | Yes. | |
| | U ₀ | 0.5 | Yes | | | | >165 | Yes. | |
| -Y Pitch Camera | E _v | 1000 | Yes | 12 rows | Anfield | Ev | | | |
| | U ₁ | 0.6 | Yes | | | | | | |
| | U ₀ | 0.5 | Yes | | | | | | |
| +X Pitch Camera | E _v | 1000 | Yes | Horizontal Illuminance | | | - | N/A | |
| | U ₁ | 0.6 | Yes | Horizontal/Vertical Ratio | | | 1-1.5 | Yes | |
| | U ₀ | 0.5 | Yes | Coefficient of Variation | | | max. 20% | Yes | |
| -X Pitch Camera | E _v | 1000 | Yes | Emergency TV (Ev Main Cam) | | | 800 | Yes | |
| | U ₁ | 0.6 | Yes | Maintenance Factor | | | 0.7 | Yes | |
| | U ₀ | 0.5 | Yes | Glare Rating Towards Players | | | 50 | Yes | |
| | | | | Glare Rating Towards TV Camera | | | 10 | No | |

Source: Philips Liverpool Floodlighting Proposal 2015

For details of the luminaires, lamp, photometric setting, arrangement, lamp output and overall maintenance factor utilised for the Stadium Pitch floodlighting design refer to Technical Note 405016-MMD-XX-00-TN-LG-1302 (included in Appendix H), for luminaire schedule summary please refer to Table 7.

Table 7: Luminaire Schedule Stadium Pitch Floodlighting

| Luminaire | Lamp/Optic | Quantity |
|----------------------|------------|----------|
| Philips Arena Vision | MVF404 B3 | 24 |
| Philips Arena Vision | MVF404 B4 | 12 |

| | | |
|----------------------|-----------|----|
| Philips Arena Vision | MVF404 B5 | 42 |
| Philips Arena Vision | MVF404 B6 | 12 |
| Philips Arena Vision | MVF404 B7 | 67 |
| Philips Arena Vision | MVF404 B8 | 45 |

Source: Mott MacDonald Ltd. (2020)

External Stadium Public Realm Lighting

The external stadium public realm lighting has been designed in accordance with BS5489-1:2013 to appropriate lighting levels for their intended use, see Table 8 and Table 9 for details.

Table 8: Required Lighting Levels (Match Day)

| Lit Area Descriptor | Lighting Standard/s | Average illuminance (Lux) | Minimum illuminance (Lux) | Uniformity (Uo) |
|-------------------------|--|---------------------------|---------------------------|-----------------|
| Anfield Road | BS 5489-1:2013 Section A.3.4.1 Table A.8 Class P1 Utilising an S/P ratio of 1.40 | 13.10 to 19.65 | 2.62 | N/A |
| Dahlia Walk | BS 5489-1:2013 Section A.3.3 Table A.6 Class P4 Utilising an S/P ratio of 1.15 | 4.03 to 6.04 | 0.81 | N/A |
| OB Compound | BS 5489-1:2013 Section 7.4.8.3 Table 5 Heavy Traffic | 20 | N/A | 0.25 |
| Footpath by OB Compound | BS 5489-1:2013 Section A.3.3 Table A.5 Class P1 Utilising an S/P ratio of 1.10 | 13.55 to 20.32 | 2.71 | N/A |

Source: Mott MacDonald Ltd. (2020)

Table 9: Required Lighting Levels (Non-Match Day)

| Lit Area Descriptor | Lighting Standard/s | Average illuminance (Lux) | Minimum illuminance (Lux) | Uniformity (Uo) |
|---------------------|--|---------------------------|---------------------------|-----------------|
| Anfield Road | BS 5489-1:2013 Section A.3.3 Table A.5 Class P3 Utilising an S/P ratio of 1.40 | 6.00 to 9.00 | 1.20 | N/A |
| Dahlia Walk | BS 5489-1:2013 Section A.3.3 Table A.6 Class P5 Utilising an S/P ratio of 1.15 | 2.23 to 3.34 | 0.45 | N/A |

| | | | | |
|-------------------------|-------|-----|-----|-----|
| OB Compound | Unlit | N/A | N/A | N/A |
| Footpath by OB Compound | Unlit | N/A | N/A | N/A |

Source: Mott MacDonald Ltd.

For details of the External Stadium Public Realm Lighting design refer to Technical Note 405016-MMD-XX-00-TN-LG-1301 (included in Appendix F). For summary information please refer to Table 10.

Table 10: Luminaire Schedule External Stadium Lighting

| Luminaire | Lamp/Optic | Quantity |
|--------------------------|-----------------------|----------|
| Arcluce Pantheon 2 | 41W LED F38 | 48 |
| Urbis Schröder Valentino | 36.1w LED Symmetrical | 11 |
| KingFisher Italo 2 | 99W LED S05 | 8 |

Source: Mott MacDonald Ltd. (2020)

Additional Lighting

The additional lighting proposals that have been provided within Technical Note 405016-MMD-XX-00-TN-LG-1301 (included in Appendix F) include the following elements: -

- Illuminated Signage
- External Building Lighting
- Internal Building Lighting
- Projectors

For details of the Additional Lighting design refer to Technical Note 405016-MMD-XX-00-TN-LG-1301 (included in Appendix F).

6 Predicted Impacts - Obtrusive Light Assessment

This section assesses the predicted mitigated impacts of the proposed lighting for both the construction and operational phases of the Proposed Scheme. Proposed lighting information which informs the assessment is supplied in Section 5. The predicted impacts relating to the identified receptor locations are detailed in Section 3 and shown in Appendix A. The predicted impacts identified below are assumed as worst case.

Maintenance Factor for Obtrusive Light calculations

To ensure that Obtrusive Light calculations cover the worst-case scenario the maintenance factor has been set at 1.0, as required by ILP guidance notes.

6.1 Construction Phase Obtrusive Light Assessment

This section discusses the predicted impacts of construction phase lighting installations associated with the Proposed Scheme in relation to the identified receptor locations.

The permitted hours of work are detailed within Section 5.1 Construction Phase.

It is anticipated that obtrusive light emissions produced during construction activities would be controlled through the implementation of a Construction Environmental Management Plan (CEMP). The mitigations incorporated within the CEMP will be informed by reference to the ILP GN01:2011 guidance note and would include prevention measures, such as those provided within Table 14 as appropriate and set out requirements for ongoing monitoring and liaison with the local community, and LCC.

During the construction phase it is assumed that the primary mitigation measures detailed within Table 14 will be an integral part of the Proposed Scheme and considered as part of the Schedule of Mitigation. Temporary site lighting will either be provided for the purposes of health and safety or site security. The main causes for concern for the lighting used during construction will be spill light and glare (luminaire intensity).

Lighting for health and safety will be needed where work is required to take place during the hours of diminishing ambient lighting levels which is likely to occur due to the construction works being carried out during the winter months in accordance with the proposed programme or if night working is carried out. This form of lighting should become non-operational outside of the operational working hours of the construction site. The effects caused by this type of lighting are thought to be **None/negligible effects** due to a combination of the fact that the construction compound and welfare facilities are situated largely within an existing lit car parking area and the unlikelihood that this lighting will be operation for any lengthy period during the hours of darkness. The majority of residential properties within the area are located in areas of existing highway lighting.

Security lighting will be operational during the night with the location, levels of light and hours of operation being dependent on the individual security concerns of the construction site. Security lighting is normally concentrated towards the perimeter and entrances to the construction site. It is not considered that significant lighting for security will be required as the majority of the construction compound lies within an existing lit car park with lighting that is anticipated to remain operational. Security lighting is predicted to have **None/negligible effects**.

6.2 Operational Phase Obtrusive Light Assessment

This section discusses the predicted impacts of the operational phase lighting installations associated with the Proposed Scheme in relation to the identified receptor locations.

Sky Glow - Upward Light Ratio (ULR)

Upward Light Ratio or ULR is the maximum permitted percentage of the luminaires flux that goes directly into the sky, the general term for ULR over a large area such as a city or town is referred to as Sky Glow. Please note that Upward Light Ratio is not subject to differing limits dependant on time and hence there are no pre and post curfew results, as they are not required.

The maximum permissible is detailed as a percentage in Section 3 Table 3.

Sky Glow Calculation

The following calculation is used in order to calculate sky glow.

$$ULR = \frac{Ev_{(MaximumUpwardSpill)}}{Ev_{(AverageIlluminance)}}$$

Table 11: Calculation Summary

| Label | Calculation Type | Units | Results |
|---------------|------------------|-------|---------|
| ULR Achieved | Ratio | % | 3.1% |
| Maximum Limit | Ratio | % | 5% |

Source: Mott MacDonald Ltd. (2020)

Photometric data and lighting model analysis show a total ULR of 3.1% therefore the level of effect has been classified as **None/negligible effect**.

Light Intrusion and Luminous Intensity

This section of the report assesses both the light intrusion and luminous intensity experienced by the identified receptors. The maximum permissible levels of obtrusive light for both criteria are detailed in Section 3 Table 3.

Light Intrusion

The assessment checks the level of spill light experienced at the identified receptor locations and onto windows of residential properties that are representative of the identified receptor locations. The spilling of light beyond the boundary of the area being lit onto adjacent areas may affect sensitive receptors, particularly residential properties. The 3D model has been constructed with the proposed luminaires as detailed within section 3.10 that have been inserted into the 3D model in the design positions provided to ensure that the results are realistic and accurate. Spill light is calculated at ground level, in the north, east, south and west directions at a height of 1.5m and has been undertaken for a matchday and a non-matchday during both pre and post curfew.

Please refer to 405016-MMD-AR-ZZ-DR-E-6301 - External Lighting Layout within Appendix G. This drawing provides a general overview of the spill light contours associated with this Proposed Scheme only and does not include any contribution from the lighting located on

Dahlia Walk. This is to indicate the level of spill light generated by the proposed public realm lighting into Stanley Park.

Luminous Intensity

The assessment checks the level of luminous intensity experienced at the identified receptor locations. Luminous intensity is a direct calculation, measured in Candelas, from an observer location at a given height looking at the luminaire. It is standard practice for the observer height to be 1.5m above ground level and we have followed this practice. Luminous intensity is calculated in the north, east, south and west directions and has been undertaken for a matchday and a non-matchday during both pre and post curfew.

Light Intrusion and Luminous Intensity – Assessment

Please refer to Table 12 for a full list of the baseline survey light readings, modelled light intrusion and luminous intensity calculations and both the quantitative and qualitative assessment for all 13 identified receptor locations. For further information relating to the location of the identified receptors please refer to drawing number 405016-MMD-XX-XX-DR-EN-0004 - Receptor Location Plan within Appendix A.

Table 12: Light Intrusion and Luminous Intensity Assessment

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact | | | | |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-------|--|-------|-------------------------------|--|---------------------------------------|-------------------------------------|---------------------|---------------------|---------------------|---------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | Luminaire Intensity Candelas – Maximum | | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | | | | | |
| 1 – Matchday | 2.7 | North | 4.15 | Pre-Curfew | 0.1 | North | 0.1 | 25 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | | |
| | | | | | | East | 0.5 | 123 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | | |
| | | East | | | | 3.8 | | | South | 0.4 | 114 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | West | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | South | 2.2 | Post-Curfew | 0 | North | 0.1 | 3 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | | | |
| | | | | | East | 0.2 | 9 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | | | |
| | | | | | West | 1.5 | | | South | 0.3 | 9 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | West | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 1 – Non-Matchday | 0.95 | North | 4.11 | Pre-Curfew | 0 | North | 0 | 6 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | | |
| | | | | | | East | 0 | 18 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | | |
| | | East | | | | 2.63 | South | 0 | 18 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|--|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | South | 1.3 | Post-Curfew | 0 | West | 0 | 0 | Negligible | Negligible | Negligible |
| | | | | | | North | 0 | 3 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 9 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0 | 9 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 2 – Matchday | 7.2 | North | 3.7 | Pre-Curfew | 0.4 | North | 0.1 | 104 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 1.2 | 315 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0.8 | 330 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.3 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | North | 0 | 7 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.5 | 126 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | | | | | |
| | | | | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | | | | | | | Negligible | Negligible | Negligible | Negligible |
| | | West | 2.1 | | South | 0.5 | 132 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 2 – Non-Matchday | 5.3 | North | 3.4 | Pre-Curfew | 0.1 | North | 0 | 14 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.3 | 126 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 6 | | | South | 0.2 | 132 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 1.2 | Post-Curfew | 0.1 | North | 0 | 7 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.3 | 126 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 1.75 | | | South | 0.2 | 132 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | 3.4 | North | 2.5 | Pre-Curfew | 0.3 | North | 0.3 | 437 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|--|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| 3 – Matchday | | | | | | | | Negligible | Negligible | Negligible | Negligible |
| | | | | | East | 0.8 | 459 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 2.5 | | South | 0.4 | 193 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.3 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 4 | Post-Curfew | 0.2 | North | 0.2 | 175 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | East | 0.4 | 184 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 1.5 | | South | 0.3 | 77 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | 1.9 | North | 2.0 | Pre-Curfew | 0.1 | North | 0.1 | 175 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | East | 0.2 | 184 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 3 – Non-Matchday | | East | 1.95 | | South | 0 | 77 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|--|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|---|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | | | | | | | Negligible | Negligible | Negligible | Negligible |
| | | South | 2.8 | Post-Curfew | 0.1 | North | 0.1 | 175 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.2 | 184 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 1.1 | | | South | 0 | 77 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 4 – Matchday | 3.5 | North | 0.3 | Pre-Curfew | 7.9 | North | 1.4 | 213 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible *Note 1 |
| | | | | | | East | 0.8 | 29 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 3.8 | | | South | 2.8 | 25 | None/ Negligible | None/ Negligible | None/ Negligible *Note 4 |
| | | | | | | West | 19.2 | 789 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible *Note 4 *Note 1 |
| | | South | 12.5 | Post-Curfew | 4 | North | 0.7 | 85 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible *Note 1 |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact | |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|--------------------|---------------------|-------------------------------|--|--------------------------------|--|---------------------------------------|--------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | |
| | | West | 6.3 | | | East | 0.4 | 14 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 1.4 | 12 | None/ Negligible | None/ Negligible | None/ Negligible *Note 4 | None/ Negligible |
| | | | | | | West | 9.6 | 394 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible *Note 4 | None/ Negligible *Note 1 |
| 4 – Non-Matchday | 2.2 | North | 0.2 | Pre-Curfew | 7.5 | North | 1.3 | 85 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible | None/ Negligible *Note 1 |
| | | | | | | East | 0.7 | 29 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 2.18 | South | 2 | 25 | None/ Negligible | None/ Negligible |
| | | South | 2.85 | Post-Curfew | 3.8 | West | 18.3 | 789 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible *Note 4 | None/ Negligible *Note 1 |
| | | | | | | North | 0.7 | 85 | None/ Negligible *Note 1 | None/ Negligible | None/ Negligible | None/ Negligible *Note 1 |
| | | | | | | East | 0.4 | 14 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact | |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-----|-------|--|-------------------------------|--|---------------------------------------|-------------------------------------|------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | | |
| | | West | 0.72 | | | South | 1.2 | 12 | Negligible | Negligible | Negligible | Negligible |
| | | | | | | | | | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 9.4 | 394 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | | |
| 5 – Matchday | 7.5 | North | 0.45 | Pre-Curfew | 6 | North | 2.3 | 134 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 3.8 | 151 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 1.2 | | | South | 7.3 | 3181 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 6.7 | 2865 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 12.2 | Post-Curfew | 1.3 | North | 1 | 67 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | East | | | | | 1.6 | 76 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | West | | | | | 2.8 | South | 0.5 | 6 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-----|-------|--|-------------------------------|--|---------------------------------------|------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | | |
| | | | | | | West | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 5 – Non-Matchday | 0.23 | North | 0.56 | Pre-Curfew | 2.5 | North | 1.9 | 134 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 3.1 | 151 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 0.49 | | | South | 0.4 | 12 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 0.3 | Post-Curfew | 1.2 | North | 1 | 67 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 1.6 | 76 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 0.17 | | | South | 0.3 | 6 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 6 – Matchday | 2.5 | North | 0.5 | Pre-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 16 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|--|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | East | 0.8 | 0 | South | 0.2 | 119 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.1 | 119 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 2.0 | | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | East | 0 | 8 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 5.0 | | South | 0.1 | 48 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.1 | 48 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 6 – Non-Matchday | NA | North | NA | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | East | 0 | 16 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | NA | | South | 0.1 | 48 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0 | 48 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | NA | | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-------|--|-------------------------------|--|---------------------------------------|------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | | |
| | | West | NA | | East | 0 | 8 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | South | 0 | 48 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0 | 48 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 7 – Matchday | 8.0 | North | 16.0 | Pre-Curfew | 0 | North | 0 | 31 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | South | 0.1 | 50 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.2 | 49 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | 11.0 | South | 11.0 | Post-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | South | 0.1 | 9 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.1 | 20 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact | |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-------|--|-----|-------------------------------|--|---------------------------------------|-------------------------------------|---------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | Luminaire Intensity Candelas – Maximum | | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | | |
| 7 – Non-Matchday | 8.47 | North | 15.8 | Pre-Curfew | 0 | North | 0 | 18 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0 | 18 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 20 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 12.37 | | | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0 | 9 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 20 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 10.15 | Post-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | West | 8.91 | | | South | 0 | 9 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | | | | | West | 0 | 20 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| 8 – Matchday | 3.6 | North | 1.2 | Pre-Curfew | 2.1 | North | 1.3 | 466 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 1.2 | 274 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 1.7 | 276 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | | | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | | | | | |
| | | South | 0.15 | Post-Curfew | 1 | West | 2.6 | 454 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | North | 0.7 | 233 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.6 | 137 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0.8 | 138 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 1.3 | 227 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 2.91 | | | North | 1.3 | 466 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 1.2 | 274 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 1.6 | 276 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 2.2 | 454 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | North | 0.7 | 233 | None/ Negligible | None/ Negligible | None/ Negligible |
| 8 – Non-Matchday | 0.5 | North | 0.7 | Pre-Curfew | 2 | East | 0.6 | 137 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0.4 | 233 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.6 | 137 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | North | 0.7 | 233 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.6 | 137 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|--|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| 9 – Matchday | 6.7 | West | 0.7 | | South | 0.8 | 138 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | West | 1.2 | | | | 227 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | 6.7 | North | 7.1 | Pre-Curfew | 0.5 | North | 1.5 | 231 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | East | 0.1 | | | | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | East | 4.2 | | | South | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | West | 1.6 | | | West | 267 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | 6.2 | South | 6.2 | Post-Curfew | 0.2 | North | 0.9 | 92 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | East | 0.1 | | | | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 9 – Non-Matchday | 5.0 | North | 9.8 | Pre-Curfew | 0.2 | North | 0.4 | 92 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact | | | |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-----|--|-------------------------------|--|---------------------------------------|------------------------|-------------------------------------|---------------------|---------------------|---------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | | | | | |
| | | East | 4.6 | Post-Curfew | 0.2 | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | South | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | West | 0.5 | 107 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | South | 2.8 | | | North | 0.4 | 92 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | West | 8.2 | South | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.5 | 107 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | | | | | | | | | |
| 10 – Matchday | 30.7 | North | 15 | Pre-Curfew | 2.5 | North | 5.6 | 2180 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | East | 2.7 | 2275 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | | East | 13.8 | South | 0.6 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | West | 1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | | | | |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|-------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | | | | | |
| | | | | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | South | 4.2 | Post-Curfew | 1 | North | 2.5 | 872 | None/ Negligible *Note 3 | None/ Negligible | None/ Negligible *Note 3 |
| | | | | | | East | 1.3 | 910 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 18.8 | | | South | 0.4 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.7 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 10 – Non-Matchday | 16.6 | North | 3.88 | Pre-Curfew | 1 | North | 2.1 | 872 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 1 | 910 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 2.05 | | | South | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 0.21 | Post-Curfew | 1 | North | 2.1 | 872 | None/ Negligible *Note 3 | None/ Negligible | None/ Negligible *Note 3 |
| | | | | | | East | 1 | 910 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 2.55 | | | South | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|-------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | | | | | |
| | | | | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | | | | | | | Negligible | Negligible | Negligible | Negligible |
| | | | | | West | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| 11 – Matchday | 7.7 | North | 9.2 | Pre-Curfew | 0.1 | North | 0.3 | 106 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 8.75 | | | South | 0.3 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.3 | 118 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 3.7 | Post-Curfew | 0.1 | North | 0.2 | 42 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.1 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 6.1 | | | South | 0.3 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.2 | 47 | None/ Negligible | None/ Negligible | None/ Negligible |
| 11 – Non-Matchday | 7.0 | North | 5.5 | Pre-Curfew | 0 | North | 0.1 | 42 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|---------------------|-------------------------------|--|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | | | | | |
| | | | | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | | | | | | | Negligible | Negligible | Negligible | Negligible |
| | | East | 7.6 | | South | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | West | 0.1 | 47 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 3.5 | Post-Curfew | 0 | North | 0.1 | 42 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | West | 2.7 | | | South | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.1 | 47 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 12 – Matchday | 7.0 | North | 6.0 | Pre-Curfew | 0.1 | North | 0.4 | 288 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0.2 | 11 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | East | 1.8 | | | South | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.2 | 290 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | 0.66 | | 0.1 | North | 0.2 | 115 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|-------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|---------------------|-------------------------------|-----|-------------------------------|--|---------------------------------------|-------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity | |
| | | | | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | | | | | |
| | | West | 0.6 | Post-Curfew | 0 | East | 0.2 | 4 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0.2 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0.1 | 116 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | |
| 12 – Non-Matchday | 8.3 | North | 5.0 | Pre-Curfew | 0 | North | 0.1 | 115 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 6 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 116 | None/ Negligible | None/ Negligible | None/ Negligible |
| | 0.6 | South | 0.6 | Post-Curfew | 0 | North | 0.1 | 115 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 4 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | South | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 116 | None/ Negligible | None/ Negligible | None/ Negligible |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact | |
|-------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|-------|-------|--|-------------------------------|--|---------------------------------------|------------------------|-------------------------------------|---------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas - Maximum | Light Intrusion & Luminaire Intensity | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | Negligible | Negligible | Negligible | Negligible | | |
| 13 – Matchday | 0.1 | North | 0.1 | Pre-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | | | | | | East | 0 | 53 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | | East | 0.2 | | | South | 0.1 | 56 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | | | | | | West | 0 | 55 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | South | 0.4 | Post-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | East | 0 | 21 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | | |
| | | | | | West | 0.15 | South | 0 | 21 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | West | 0 | 9 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| | | | | | | | | | | | | | |
| 13 – Non-Matchday | NA | North | NA | Pre-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | | | | | | East | 0 | 21 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |
| | | East | NA | | | South | 0 | 21 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | |

| Viewpoint Number | Baseline – Light Measurements | | | Calculated Light Levels | | | Quantitative Assessment | | Qualitative Assessment | Summary of Overall Predicted Impact |
|------------------|-------------------------------|---------------------|-------------------------------|-------------------------------|------|-------|--|-------------------------------|--|---------------------------------------|
| | Ground Level (Lux) | Direction of Sensor | 1.5m Above Ground Level (Lux) | Light Intrusion Lux - Maximum | | | Luminaire Intensity Candelas – Maximum | Light Intrusion Lux – Maximum | Luminaire Intensity Candelas – Maximum | Light Intrusion & Luminaire Intensity |
| | | | | | | | | | | |
| | | | | | | | | Negligible | Negligible | Negligible |
| | | | | | West | 0 | 17 | None/ Negligible | None/ Negligible | None/ Negligible |
| | | South | NA | Post-Curfew | 0 | North | 0 | 0 | None/ Negligible | None/ Negligible |
| | | | | | | East | 0 | 21 | None/ Negligible | None/ Negligible |
| | | West | NA | | | South | 0 | 21 | None/ Negligible | None/ Negligible |
| | | | | | | West | 0 | 9 | None/ Negligible | None/ Negligible |

***Note 1** – Whilst the calculated results are over the Pre and Post curfew limits, the proposed luminaires for the Dahlia Walk lighting columns have been replaced with higher output fittings which have a colour temperature of 2700K (warm white). The existing luminaire has a colour temperature of 4000K. The colour temperature has been agreed with the Biodiversity team and is in line with ILP guidance document GN08/18 in order to mitigate potential impact on bats. There are no residential properties located in the immediate vicinity to impact upon. In order to assess the impact of the Proposed Scheme, an illuminance calculation has been performed which omits the lighting columns located on Dahlia Walk. This calculation indicates that the Proposed Scheme has **None/negligible** impact in this location and in conjunction with the removal of the Fanzone has an impact that could be deemed to be **Positive/Moderate beneficial effects**. Spill light contours that omit the contribution from Dahlia walk and indicate the spill light generated by the Proposed Scheme are detailed within the External Lighting Layout 405016-MMD-ZZ-DR-E-6301 which is included in Appendix G.

***Note 2** – The two luminaires in the OB compound in close proximity to Stanley Park and the two luminaires on the OB footpath have been fitted with back shields to mitigate spill light from the luminaires into Stanley Park. This mitigation method cannot be included in the 3D model and therefore forms part of the qualitative assessment process.

***Note 3** – The Illuminance measurement has been taken in the middle of the Sir Kenny Dalglish Car Park close to the Bill Shankly gates. This location is a short distance from the identified receptor windows. An illuminance calculation has been performed at the rear windows of the identified receptors adjacent to the car park (37 and 39 Skerries Road). These measurements indicate that the Proposed Scheme has **None/Negligible** impact to the receptor windows. Refer to Table 13 below for the specific details.

***Note 4** – ‘Warm white’ lighting with a 2700K colour temperature to be utilised within internal areas that have potential to spill light onto Stanley Park, refer to Lighting Philosophy Technical Note 405016-MMD-XX-00-TN-LG-1301 (included in Appendix F) for further details.

Table 13 provides the calculated results for spill light levels experienced at the assumed window locations in proximity to the identified receptors.

Table 13 Light Intrusion Results – Receptor Window Locations

| Survey Viewpoint | Property Location | Window Location | | | Calculated Light Level Intrusion (lux) Matchday Pre-Curfew | Calculated Light Level Intrusion (lux) Matchday Post-Curfew |
|------------------|-------------------|-----------------|--------|---------------------|---|--|
| | | Aspect | Floor | Location | | |
| 1 | 45 Anfield Road | Front | Ground | Bay Window – Middle | 0.1 | 0.1 |
| | | | | Bay Window – Right | 0.5 | 0.4 |
| | | Side | First | Left | 0.2 | 0.1 |
| | | | | Right | 0.2 | 0.2 |
| | | | Second | Sky Light | 0.2 | 0.2 |
| | | | | | 0.2 | 0.2 |
| | | | Ground | | 1.4 | 1.2 |
| 2 | 144 Anfield Road | Front | Ground | | 1.3 | 1.0 |
| | | | | Bay Window – Left | 1.1 | 0.5 |

| | | | | Bay Window – Middle | | | 0.3 | 0.1 |
|---|------------------|--------------|--------|---------------------------|----------|-----|-----|-----|
| | | | | First | Left | 0.4 | 0.1 | |
| | | | | | Right | 0.3 | 0.1 | |
| 3 | 144 Anfield Road | Side | Ground | Left | 0.8 | 0.4 | | |
| | | | | Right | 0.8 | 0.4 | | |
| | | | First | Left | 0.9 | 0.5 | | |
| | | | | Right | 0.9 | 0.5 | | |
| | | 2 Alroy Road | Front | Ground | Left | 0.6 | 0.4 | |
| | | | | | Right | 0.7 | 0.4 | |
| | | | | First | Left | 0.7 | 0.4 | |
| | | | | | Right | 0.8 | 0.4 | |
| | 4 Alroy Road | Front | Ground | Left | 0.6 | 0.4 | | |
| | | | | Right | 0.6 | 0.4 | | |
| | | | First | Left | 0.6 | 0.4 | | |
| | | | | Right | 0.7 | 0.4 | | |
| 9 | 73 Anfield Road | Front | Ground | Coach House | 0.7 | 0.4 | | |
| | | | | Left Bay – Left Window | 0.4 | 0.2 | | |
| | | | | Left Bay – Middle Window | 0.2 | 0.1 | | |
| | | | | Left Bay – Right Window | 0.1 | 0.1 | | |
| | | | | Right Bay – Left Window | 0.2 | 0.1 | | |
| | | | | Right Bay – Middle Window | 0.1 | 0.1 | | |
| | | | | Right Bay – Right Window | 0.1 | 0.1 | | |
| | | | | First | Far Left | 0.6 | 0.3 | |

| | | | | | | | | | |
|----|------------------|-------|--------|---------------------|-----------|--------|--------|-----|-----|
| | | | | | Left | 0.2 | 0.1 | | |
| | | | | | Right | 0.2 | 0.1 | | |
| | | | | | Far Right | 0.1 | 0.1 | | |
| | | | | | Side | Ground | Left | 2.1 | 1.3 |
| | | | | | | | Middle | 1.1 | 0.5 |
| | | | | | | | Right | 1.1 | 0.5 |
| | | | | | First | | 2.4 | 1.1 | |
| | | | | | | Second | | 2.2 | 1.0 |
| 10 | 37 Skerries Road | Rear | First | Left | 0.8 | 0.6 | | | |
| | | | | Right | 0.8 | 0.6 | | | |
| | 39 Skerries Road | Rear | First | Left | 1.1 | 0.7 | | | |
| | | | | Right | 0.8 | 0.5 | | | |
| 11 | 250 Anfield Road | Front | Ground | Bay Window – Middle | 0.1 | 0.1 | | | |
| | | | | Bay Window – Right | 0.3 | 0.2 | | | |
| | | | First | Left | 0.1 | 0.1 | | | |
| | | | | Right | 0.1 | 0.1 | | | |
| 12 | 36 Skerries Road | Front | Ground | Bay Window – Left | 0.4 | 0.3 | | | |
| | | | | Bay Window – Middle | 0.4 | 0.3 | | | |
| | | | | Bay Window – Right | 0.2 | 0.1 | | | |
| | | | First | Left | 0.4 | 0.2 | | | |
| | | | | Right | 0.4 | 0.3 | | | |

7 Mitigation

The design development process has applied the following primary mitigation where legally compliant, practicable and safe to do so, taking into account the operational requirements of the site as outlined in Table 14 below.

Table 14: Primary Mitigation Measures

| Applicable Development Phase (Construction and/or operation) | Mitigation Measures | Description |
|--|---|---|
| C/O | Selection of suitable colour temperatures for light sources | Selection of suitable colour temperatures for the light sources where required to mitigate impacts on wildlife, reduce sky glow and minimise risk of human response to lighting where legally compliant, practicable and safe to do so. |
| O | Selection of appropriate lighting | Utilise applicable lighting standards from relevant British / European / UEFA standards to ensure lighting is appropriate to the work that is being undertaken and that areas are not over lit to reduce wasted energy. |
| C/O | Considerate landscaping and built environment design | Ensure that the reduction and control of obtrusive light is an integral part of the landscaping and built environment design process. |
| C/O | Considerate lighting design | Ensuring sensitive receptors and areas are considered during the lighting design process with a view to reducing obtrusive light. |
| C/O | Specification of suitable photometric control methods | Specification of suitable photometric distribution during design development to reduce sky glow, control spill light and luminous intensity. |
| C/O | Specification of lighting control equipment | Specification of suitable lighting control equipment to enable dimming or switching of light sources during times when artificial lighting is not required. |
| C/O | Consideration of luminaire position | Considering the position, tilt, orientation and mounting height of luminaires to reduce obtrusive light. |
| C/O | Specification of supplementary photometric control methods | Where appropriate apply supplementary photometric control methods such as baffles, shields or louvres. |
| C/O | Provision of obtrusive light calculations in line with ILP GN01:2011. | The limitations for obtrusive light provided in Table 3 of this report should be adhered to during the construction and operational phase. |

| | | |
|-----|---|--|
| C | Provision of applicable lighting levels for construction tasks | Lighting levels should be selected from relevant British / European standards to ensure lighting is appropriate to the work that is being undertaken and that areas are not over lit. Refer to British Standard Light and Lighting – Lighting of workplaces Part 2: Outdoor work places BS EN 12464-2 2014 |
| C | Reduction of temporary lighting mounting angles. | Temporary floodlighting should be mounted at a tilt of 0° and utilise a double asymmetrical photometric configuration. The ILP advises in GN01:2011 (ILP – 2011) that a maximum main beam angle of 70° should be utilised to minimise the effects of glare along with spill and upward light. |
| C | Consideration of placements for temporary lighting. | Temporary lighting will be located and directed away from residential properties. |
| O | Management of lighting controls. | Management of lighting controls to ensure lighting is switched off when not required or dimmed in periods of reduced usage. |
| C | Provision of solid site hoarding. | The use of solid site hoarding to contain and limit light spill and improve security, should be considered by the appointed Contractor |
| C | Consideration of alternatives to lighting for security purposes. | Where security lighting is considered as a form of deterrent for vandalism and theft, the appointed contractor will consider alternative forms of security to limit the burden on lighting for example, the use of infrared spectrum security lighting. |
| C/O | Obtrusive light monitoring | LFC will monitor the effectiveness of lighting mitigation measures for the site. Monitoring will consist of surveys that will involve the measurement of lighting levels following the baseline assessment methodology with measurements compared against the assessment. Improvements will be carried out where necessary and practicable to do so. |
| O | Asset manager to monitor effectiveness of lighting mitigation measures and carry out periodic inspection and maintenance. | Periodic inspection and maintenance regime in line with the recommendations of BS 5489-1:2013, to include as a minimum: light source replacement, luminaire cleaning, renewal of failed parts, checking of gaskets, optical components and screens or baffles, checking of alignment and monitoring of operation. (BSi 2012) |

Source: Mott MacDonald (2020)

8 Summary

This report provides an obtrusive light assessment for the proposed re-development works at Liverpool Football Club. The assessment includes Sky Glow, Luminous Intensity and Light Intrusion.

Standard

The results were compared against the Institute of Lighting Professionals (ILP) Guidance for Reduction of Obtrusive Light (GN01:2011), as summarised below:

Table 15: ILP Guidance for Reduction of Obtrusive Light

| Environmental Zone | Sky Glow ULR (Max %) | Light Intrusion (into Windows) Ev (Lux) | | Luminaire Intensity I (Candelas) | | Building Luminance Pre-curfew |
|--------------------|----------------------|---|-------------|----------------------------------|-------------|-------------------------------|
| | | Pre-curfew | Post-curfew | Pre-curfew | Post-curfew | Average, L (cd/m2) |
| E3 | 5.0 | 6* | 2 | 10,000 | 1,000 | 10 |

Source: ILP GN01:2011* As amended by LCC.

Findings

Table 16: Summary of Findings

| ILP Guidance | Guidance Criteria | | Quantitative Assessment of Performance | | Qualitative Assessment of Performance | | Summary of Overall Impact |
|--------------------|-------------------|-------------|--|---------------------|---------------------------------------|---------------------|---------------------------|
| | Pre-Curfew | Post Curfew | Pre-Curfew | Post Curfew | Pre-Curfew | Post Curfew | Post Curfew |
| Light Intrusion | 6 Lux | 2 Lux | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| Luminous Intensity | 10,000 | 1,000 | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible | None/ Negligible |
| Sky Glow | 5% | | None/ Negligible | | None/ Negligible | | None/ Negligible |

Source: Mott MacDonald Ltd. (2020)

9 Glossary of Terms

Table 17: Glossary of terms lighting assessment

| Term | Definition |
|----------------------------|---|
| Artificial Light | Light that is made or produced by human beings rather than occurring naturally. |
| Building Luminance | The measure of light emitted, passing through or reflected from a building that will be detected by an eye looking at the surface from an observer position. |
| Candela | International System of Units (SI) for Luminous Intensity, a common candle emits light with a luminous intensity of approximately one candela. |
| Colour Temperature | Colour temperature refers to a characterisation of the spectral properties of a light source (the higher the colour temperature, the bluer it appears and the lower the colour temperature the redder it appears). |
| Eav | The illuminance on a vertical plane at any specific point, measured in Lux. |
| Glare | The uncomfortable brightness of a light source when viewed against a darker background. |
| I | Light intensity in Candelas. |
| Illuminance | Measurement of luminous flux at a point on a surface. |
| Light Intrusion | Light that falls beyond the boundary or area being lit. |
| Light Pollution | See Obtrusive Light. |
| Louvre | Device fitted either externally or internally to a luminaire to reduce obtrusive light being emitted from the luminaire. |
| Lumens | SI unit for Luminous Flux, a measure of the total amount of visible light emitted by a given source. |
| Luminaire | Complete light fitting housing the lamp, control gear and optical distribution control. |
| Luminaire Intensity | Measured in Candelas, this is a measure of the amount of light that a source radiates in a given direction. This can be considered as the power of light in one specific angle (or given direction) often to an observer. |

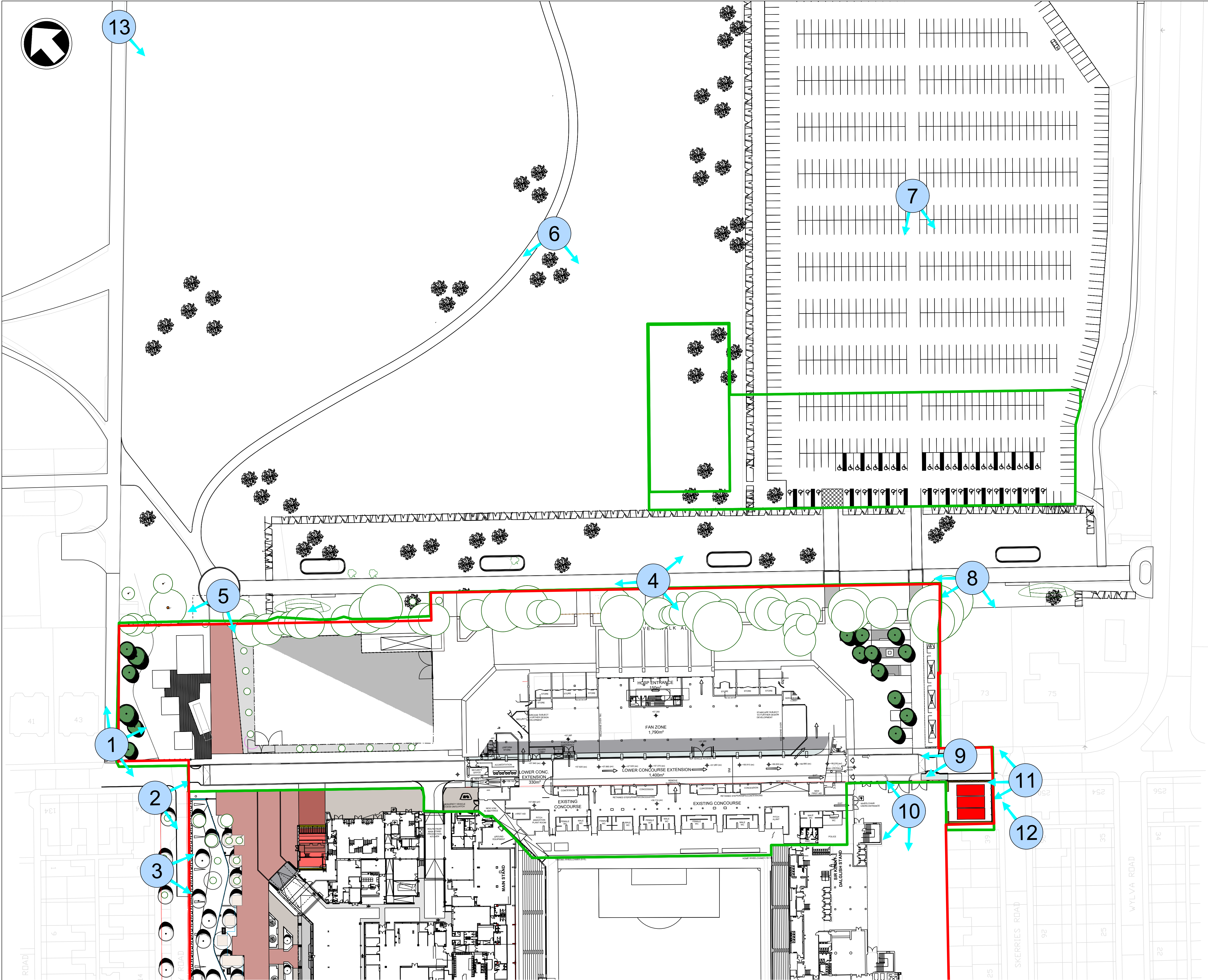
| Term | Definition |
|--|--|
| Luminance | Luminance describes the measurement of the amount of light emitting, passing through or reflected from a surface from a solid angle to an observer position (indicates how much luminous power can be perceived by the human eye). |
| Luminous Flux or Luminous Power | Measurement (in Lumens) of visible light produced by a light source. |
| Luminous Intensity | See Luminaire Intensity. |
| Lux | SI unit for Illuminance, one lumen per square metre. |
| Maintenance Factor | Ratio applied to the average Illuminance levels in the calculation model which accounts for the depreciation of lumens emitted from the lamp over time and dirt accumulated on the luminaire. |
| NC Low Poly Model | A low polygon version of the original Revit file for use in AGi32 software. |
| Obtrusive Light | Light that falls or can be viewed beyond the boundary of the area being lit which may cause a nuisance, discomfort, distraction or disruptive effect on natural cycles and inhibits the observation of stars and planets. |
| Photometric | The distribution of luminous intensity, in candelas for the transverse and axial planes, in layman's terms this is the "footprint" of the light distribution for a given luminaire. |
| Radiosity Stopping Criterion | AGi32 uses a radiosity calculation engine to predict lighting distribution in a 3 dimensional environment. The stopping criterion indicates the amount of light that can remain in the environment before calculations are concluded. When the stopping criterion is high calculation times are also high however the accuracy of results is improved. |
| Sky Glow | The illumination of the sky at night by artificial light sources including light emitted directly upward from the light source and also reflected from the ground or a surface. |
| Spill Light | See Light Intrusion. |
| Supplementary photometric control methods | Additional lighting equipment such as shields, louvres and baffles attached to the luminaire or support structure which can be used to reduce the level of obtrusive light in a given direction. |

| Term | Definition |
|--------------------------|---|
| Upward Light Ratio (ULR) | Percentage of luminaire flux emitted from the installation that goes directly into the sky. |

Appendices

| | |
|---|-----|
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A. 405016-MMD-XX-XX-DR-EN-0004 - Receptor Location Plan



| Notes | |
|------------------------------------|---|
| 1. Do not scale from this drawing. | |
| Key to symbols | |
| | Receptor location with camera direction indicators and reference number |
| | Construction Works Area - 2.64 ha |
| | Application Boundary - 6.73 ha |
| Receptor Number | Receptor Location |
| 1 | 45 Anfield Road |
| 2 | 144 Anfield Road |
| 3 | 2 Alroy Road |
| 4 | Stanley Park - Middle of Dahlia Walk behind stadium |
| 5 | Stanley Park - Behind LFC TV cabins on Dahlia Walk |
| 6 | Stanley Park - Curved Footpath |
| 7 | Stanley Park - Car Park |
| 8 | Dahlia Walk at rear of 73 Anfield Road/Chairman's Villa |
| 9 | Stanley House/Chairman's Villa - Front |
| 10 | Sir Kenny Dalglish Carpark/39 Skerries Road (Rear of) |
| 11 | 250 Anfield Road |
| 12 | 36 Skerries Road |
| 13 | Stanley Park - Straight footpath |

| Reference drawings | | | | | |
|--|--|--|--|--|--|
| OS MasterMap_601014_796492 - OS Tile 405016-MMD-AR-ZZ-DR-E-6301 - External Lighting Philosophy Drawing ARS-PLA-XX-XX-DR-L-0006 - Application and Construction Boundaries | | | | | |

| P1 | 11/03/20 | RH | First Issue | JM | LM |
|-----|----------|-------|-------------|--------|-------|
| Rev | Date | Drawn | Description | Ch'k'd | App'd |

M

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Client
Liverpool Football Club and Athletic Grounds Ltd
20 Chapel Street
Liverpool
L3 9AG

Title
**Anfield Road Stadium Extension
Lighting Impact Assessment
Receptor Location Plan**

| | | | | | |
|-------------|----------|--------|--------------|-----------|-----|
| Designed | R Harvey | RH | Eng check | D Boldero | DB |
| Drawn | R Harvey | RH | Coordination | L Bagshaw | LB |
| Dwg check | J McKay | JM | Approved | L Meek | LM |
| Scale at A1 | NTS | Status | PLA | Rev | P1 |
| | | | | Security | STD |

Drawing Number
405016-MMD-XX-XX-DR-EN-0004

B. ILP Guidance Notes for the Reduction of Obtrusive Light 2011 (GN01:2011)

GUIDANCE NOTES FOR THE REDUCTION OF OBTRUSIVE LIGHT

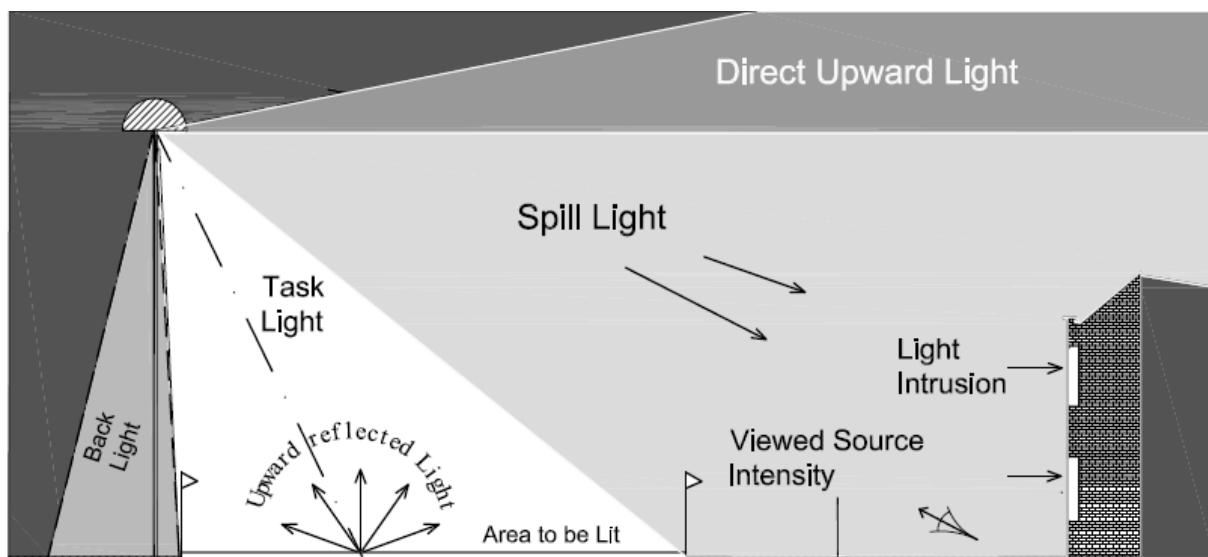
“Think before you light - The right amount of light, where wanted, when wanted.”

Man's invention of artificial light has done much to safeguard and enhance our night-time environment but, if not properly controlled, **obtrusive light** (sometimes referred to as light pollution) can present serious physiological and ecological problems.

Obtrusive Light, whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task.

Sky glow, the brightening of the night sky, **Glare** the uncomfortable brightness of a light source when viewed against a darker background, and **Light Intrusion (“Trespass”)**, the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others and waste money and energy. Think before you light. Is it necessary? What effect will it have on others? Will it cause a nuisance? How can you minimise the problem?

Figure 1 – Types of obtrusive light



Do not "over" light. This is a major cause of obtrusive light and is a waste of energy. There are published standards for most lighting tasks, adherence to which will help minimise upward reflected light. Organisations from which full details of these standards can be obtained are given on the last page of this leaflet.

Dim or switch off lights when the task is finished. Generally a lower level of lighting will suffice to enhance the night time scene than that required for safety and security.

“Good Design equals Good Lighting”

Any lighting scheme will consist of three basic elements: a light source, a luminaire and a method of installation.

Light sources (Lamps)

Remember that the light source output in LUMENS is not the same as the wattage and that it is the former that is important in combating the problems of obtrusive light.

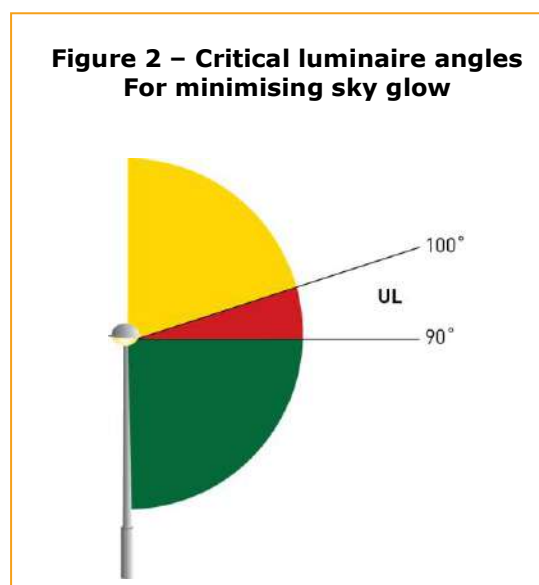
Most nighttime visual tasks are only dependant on light radiated within the visual spectrum. It is therefore NOT necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically designed to do so. It is also understood that light from the shorter wavelengths of the spectrum has important effects on both flora and fauna that should be considered.

Research indicates that light from the blue end of the spectrum has important non-visual effects on the health of the human body, in particular in our sleep/wake patterns. It is therefore important to appreciate that while in obtrusive light terms the use of blue light should be minimised, there are many night-time tasks such as driving and sports where to be fully awake is an important aid to safety.

Luminaires

Care should always be taken when selecting luminaires to ensure that appropriate products are chosen and that their location will reduce spill light and glare to a minimum.

Use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal. The most sensitive/critical zones for minimising sky glow are those between 90° and 100° as shown in Figure 2 and referred to as the lower, upward light output zone (UL).



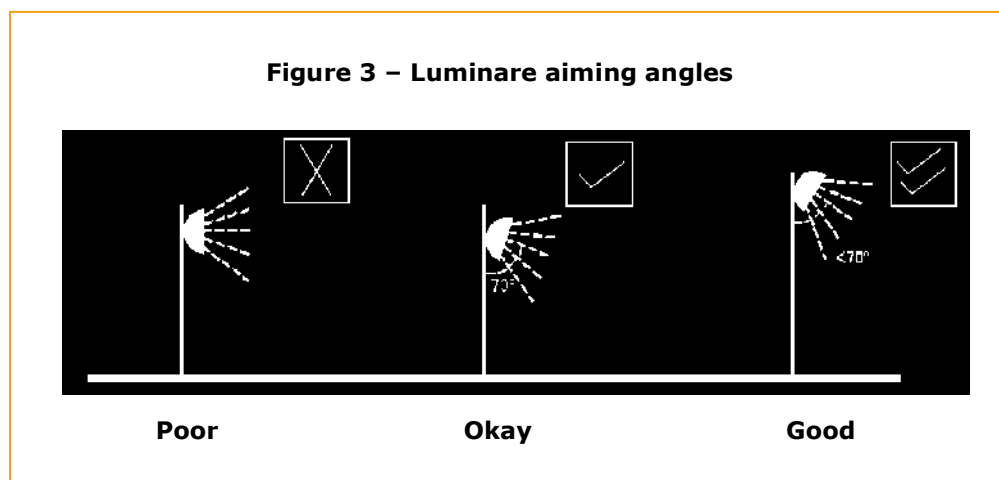
For most sports and area lighting installations the use of luminaires with double-asymmetric beams designed so that the front glazing is kept at or near parallel to the surface being lit should, if correctly aimed, ensures minimum obtrusive light.

Appendices 1 and 2 to these notes gives more details of how to choose and if necessary modify luminaires.

Installation

In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation. The requirements to control glare for the safety of road users are given in Table 3.

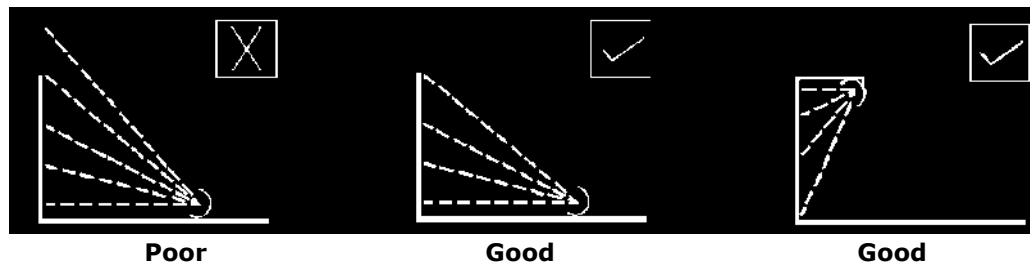
Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any potential observer is not more than 70° . Higher mounting heights allow lower main beam angles, which can assist in reducing glare. In areas with low ambient lighting levels, glare can be very obtrusive and extra care should be taken when positioning and aiming lighting equipment. With regard to domestic security lighting the ILP produces an information leaflet GN02:2009 that is freely available from its website.



When lighting vertical structures such as advertising signs, direct light downwards wherever possible. If there is no alternative to up-lighting, as with much decorative lighting of buildings, then the use of shields, baffles and louvres will help reduce spill light around and over the structure to a minimum.

For road and amenity lighting installations, (see also design standards listed on Page 5) light near to and above the horizontal should normally be minimised to reduce glare and sky glow (Note ULR's in Table 2). In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, also help to minimise visual intrusion within the open landscape. However in some urban locations, luminaires fitted with a more decorative bowl and good optical control of light should be acceptable and may be more appropriate.

Figure 4 – Façade Illumination



Since 2006 “Artificial Light” has been added to the list of possible Statutory Nuisances in England, Wales and Scotland. The monitoring of such nuisances will be the responsibility of Environmental Health Officers (EHOs) for which separate guidance is being produced.

With regard to the planning aspect, many Local Planning Authorities (LPAs) have already produced, or are producing, policies that within the planning system will become part of their local development framework. For new developments there is an opportunity for LPAs to impose planning conditions related to external lighting, including curfew hours.

The Scottish Executive has published a design methodology document (March 2007) entitled [“Controlling Light Pollution and Reducing Energy Consumption”](#) to further assist in mitigating obtrusive light elements at the design stage.

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 |

Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

NB: Zone E0 must always be surrounded by an E1 Zone.

DESIGN GUIDANCE

The following limitations may be supplemented or replaced by a LPA's own planning guidance for exterior lighting installations. As lighting design is not as simple as it may seem, you are advised to consult and/or work with a professional lighting designer before installing any exterior lighting.

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 |

ULR = **Upward Light Ratio of the Installation** is the maximum permitted percentage of luminaire flux that goes directly into the sky.

E_v = **Vertical Illuminance in Lux** - measured flat on the glazing at the centre of the window.

I = **Light Intensity in Candelas (cd)**

L = **Luminance in Candelas per Square Metre (cd/m²)**

Curfew = **the time after which stricter requirements (for the control of obtrusive light) will apply**; often a condition of use of lighting applied by the local planning authority. If not otherwise stated - 23.00hrs is suggested.

***** = **Permitted only from** Public road lighting installations

(1) Upward Light Ratio – Some lighting schemes will require the deliberate and careful use of upward light, e.g. ground recessed luminaires, ground mounted floodlights, festive lighting, to which these limits cannot apply. However, care should always be taken to minimise any upward waste light by the proper application of suitably directional luminaires and light controlling attachments.

- (2) Light Intrusion (into Windows)** – These values are suggested maxima and need to take account of existing light intrusion at the point of measurement. In the case of road lighting on public highways where building facades are adjacent to the lit highway, these levels may not be obtainable. In such cases where a specific complaint has been received, the Highway Authority should endeavour to reduce the light intrusion into the window down to the post curfew value by fitting a shield, replacing the luminaire, or by varying the lighting level.
- (3) Luminaire Intensity** – This applies to each luminaire in the potentially obtrusive direction, outside of the area being lit. The figures given are for general guidance only and for some sports lighting applications with limited mounting heights, may be difficult to achieve.
- (4) Building Luminance** – This should be limited to avoid over lighting, and related to the general district brightness. In this reference building luminance is applicable to buildings directly illuminated as a night-time feature as against the illumination of a building caused by spill light from adjacent luminaires or luminaires fixed to the building but used to light an adjacent area.

| Table 3 – Obtrusive Light Limitations for Exterior Lighting Installations – Road Users | | |
|---|---|-------------------------------|
| Road Classification ⁽¹⁾ | Threshold Increment (TI) | Veiling Luminance (Lv) |
| No road lighting | 15% based on adaptation luminance of 0.1cd/m ² | 0.04 |
| ME6/ ME5 | 15% based on adaptation luminance of 1cd/m ² | 0.25 |
| ME4/ ME3 | 15% based on adaptation luminance of 2cd/m | 0.40 |
| ME2 / ME1 | 15% based on adaptation luminance of 5cd/m ² | 0.84 |

TI = Threshold Increment is a measure of the loss of visibility caused by the disability glare from the obtrusive light installation

Lv = Veiling Luminance is a measure of the adaptation luminance caused by the disability glare from the obtrusive light installation

(1) = Road Classifications as given in BS EN 13201 - 2: 2003 Road lighting Performance requirements. Limits apply where users of transport systems are subject to a reduction in the ability to see essential information. Values given are for relevant positions and for viewing directions in path of travel. For a more detailed description and methods for determining, calculating and measuring the above parameters see CIE Publication 150:2003.



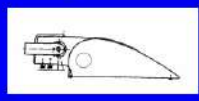
RELEVANT PUBLICATIONS AND STANDARDS:

| | |
|--|--|
| British Standards: www.bsi.org.uk | BS 5489-1: 2003 Code of practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas BS EN 13201-2:2003 Road lighting – Part 2: Performance requirements BS EN 13201-3:2003 Road lighting – Part 3: Calculation of performance BS EN 13201-4:2003 Road lighting – Part 4: Methods of measuring lighting performance. BS EN 12193: 1999 Light and lighting – Sports lighting BS EN 12464-2: 2007 Lighting of work places – Outdoor work places |
| Countryside Commission/ DOE | Lighting in the Countryside: Towards good practice (1997) (<i>Out of Print but available on www.communities.gov.uk/index.asp?id=1144823</i>) |
| UK Government / Defra www.defra.gov.uk | Statutory Nuisance from Insects and Artificial Light – Guidance on Sections 101 to 103 of the Clean Neighbourhoods and Environment Act 2005 Road Lighting and the Environment (1993) (Out of Print) |
| CIBSE/SLL Publications: www.cibse.org | CoL Code for Lighting (2002) LG1 The Industrial Environment (1989) LG4 Sports (1990+Addendum 2000) LG6 The Exterior Environment (1992) FF7 Environmental Considerations for Exterior Lighting (2003) |
| CIE Publications: www.cie.co.at | 01 Guidelines for minimizing Urban Sky Glow near Astronomical Observatories (1980) 83 Guide for the lighting of sports events for colour television and film systems (1989) 92 Guide for floodlighting (1992) 115 Recommendations for the lighting of roads for motor and pedestrian traffic – Second Edition (2010) 126 Guidelines for minimizing Sky glow (1997) 129 Guide for lighting exterior work areas (1998) 136 Guide to the lighting of urban areas (2000) 150 Guide on the limitations of the effect of obtrusive light from outdoor lighting installations (2003) 154 The Maintenance of outdoor lighting systems (2003) |
| ILP Publications: www.theilp.org.uk | TR 5 Brightness of Illuminated Advertisements (2001) TR24 A Practical Guide to the Development of a Public Lighting Policy for Local Authorities (1999) GN02 Domestic Security Lighting, Friend or Foe |
| ILP/CIBSE Joint Publications | Lighting the Environment - A guide to good urban lighting (1995) |
| ILP/CSS Publications | Joint Code of Practice for the installation, maintenance and removal of seasonal decorations. (2005) |
| ILP/CfDS Joint Publication www.dark-skies.org | Towards Understanding Sky glow. 2007 |
| IESNA www.iesna.org | TM-15-07 (R) Luminaire Classification System for Outdoor luminaires |

NB: These notes are intended as guidance only and the application of the values given in Tables 2 & 3 should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced.

APPENDIX 1 - PROPOSED OUTDOOR LUMINAIRE CLASSIFICATION SYSTEM

Variable Aim Luminaires – General Classifications:

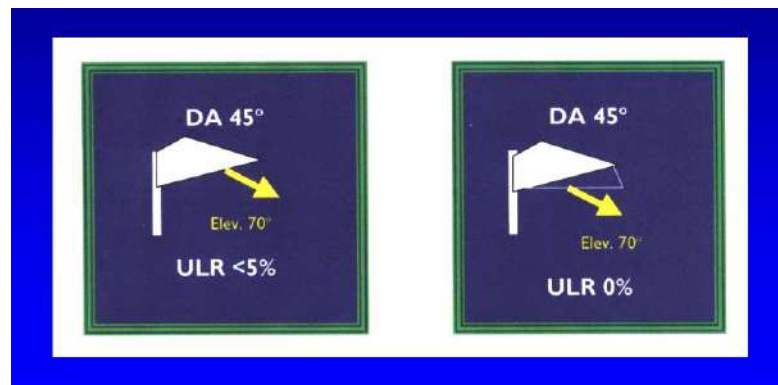
| | | |
|----------|---------------------|---|
| ➤ Type A | Symmetrical |  |
| ➤ Type B | Asymmetrical |  |
| ➤ Type C | Double-Asymmetrical |  |

Proposed labelling System:

Fixed Position luminaires



Variable Aim Luminaires
(Shown here for a 45° Double-Asymmetric luminaire aimed at 70° – with and without a cowl).



APPENDIX 2 - ILLUSTRATIONS OF LUMINAIRE ACCESSORIES FOR LIMITING OBTRUSIVE LIGHT (images provided by Philips and Thorn)

Cowl (or Hood)



External Louvre



SHIELD



SHEILD "Barn Doors"



Double Asymmetric Luminaire



Simple Hood



Circular Louvre



Cowl & Louvre



Internal Louvre (horizontal)



Internal Louvre (vertical)



C. Light Meter Calibration Certificate

Certificate of Calibration

Certificate number
STD_119531

Issued by: BSRIA Instrument Solutions - A division of BSRIA Limited

Date of issue: 18 December 2019

Page 1 of 3 Pages



Old Bracknell Lane West, Bracknell,
Berkshire RG12 7AH

T: +44 (0) 1344 459 314 | 0800 254 5566

E: instruments@bsria.co.uk

W: www.bsria.com/uk/instrument/

A handwritten signature in blue ink, appearing to read 'Martin Trotter'.

MARTIN TROTTER

Approved signatory

Customer: Instrument Solutions
Old Bracknell Lane West
Bracknell Berkshire RG12 7AH

Date received: 11 December 2019

Instrument: BSRIA I.D.: 202941
Description: Light meter
Manufacturer: Konica Minolta
Model: T-10A
Serial number: 20016343
Procedure version: B6F11V2

Laboratory conditions:

Temperature: $20^{\circ}\text{C} \pm 4^{\circ}\text{C}$

Relative humidity: $< 75\% \text{rh}$

Mains voltage: $240\text{ V} \pm 10\text{ V}$

Mains frequency: $50\text{ Hz} \pm 1\text{ Hz}$

Comments:

Instrument calibration conducted as found - no adjustments undertaken.

Instrument was zeroed prior to the start of the calibration.

Calibration information:

The instrument was calibrated by comparison against laboratory reference equipment whose values are traceable to recognised National Standards. This is an electronic document that has been signed digitally.

The uncertainties quoted refer to the calibration only and are not intended to indicate any long-term instrument specification/performance. This certificate only relates to the items calibrated.

Calibrated by: A. Lennard

A handwritten signature in blue ink, appearing to read 'A. Lennard'.

Date of calibration: 18 December 2019

This certificate provides traceability of measurement to recognised National Standards, and to the units of measurement realised at the National Physical Laboratory or other recognised National Standards laboratories.

Copyright of this certificate is owned by the issuing laboratory and may not be reproduced except with the prior written approval of the issuing laboratory. This certificate complies with the requirements of BS EN ISO 10012:2003.

Certificate of Calibration

Certificate number
STD_119531

As Found Results

Page 2 of 3 Pages

Reference equipment used in the calibration:

| Instrument description | Serial number | Certificate number | Last cal. date | Cal. period |
|-------------------------------------|-------------------|--------------------|----------------|-------------|
| Light Bench (ZZMLB02) | 18425/2 & 18426/1 | 120821 | 23/01/2019 | 12 Months |
| Light Bench (ZZMLB03) | 18425/1 & 18427/1 | 120822 | 23/01/2019 | 12 Months |
| Distance Measuring System (ZZMLB04) | 4816 | 120820 | 11/01/2019 | 12 Months |

Calibration uncertainties:

Illuminance : 0 to 2000 lux $\pm 5\%$ of applied value or 0.1 lux whichever is greatest.

Total uncertainty equals the above plus the devices indicated resolution as reported in the results section.

Instrument contents:

| | |
|---------------------|-----|
| Main unit | Yes |
| Detector head | Yes |
| Zero cap | Yes |
| Meter adapter head | Yes |
| Cat 5 cable | Yes |
| Receptor head | Yes |
| x2 batteries fitted | Yes |
| x2 batteries spare | Yes |
| Manual | Yes |
| Certificate | Yes |
| Soft case | Yes |
| Hard carry case | Yes |

Inspection results:

| | |
|-------------------|------|
| Visual inspection | Pass |
| Integrity seals | Pass |
| Memory cleared | Pass |
| Mode set to lx | Pass |

Certificate of Calibration

Certificate number
STD_119531

As Found Results

Page 3 of 3 Pages

Calibration procedure:

The instrument was calibrated against laboratory standards which are themselves traceable back to National Standards. The illuminance measurements were conducted in accordance with the methodology contained in BS667 using a tungsten filament lamp with a colour temperature of 2856k. Illuminance levels were calculated using an inverse square law with respect to distance away from a tungsten filament lamp source.

Calibration results:

Illuminance - lux range

Unit under test display zeroed before test

Pass

| Applied | Indicated | Correction | Specification | % of Spec. | Comment |
|------------|------------|------------|---------------|------------|---------|
| 50.00 lux | 49.6 lux | 0.40 lux | ±2.50 lux | 16.0 % | |
| 100.0 lux | 98.9 lux | 1.1 lux | ±5.0 lux | 22.0 % | |
| 200.0 lux | 197.3 lux | 2.7 lux | ±10.0 lux | 27.0 % | |
| 500.0 lux | 488.0 lux | 12.0 lux | ±25.0 lux | 48.0 % | |
| 1000.0 lux | 969.0 lux | 31.0 lux | ±50.0 lux | 62.0 % | |
| 2000.0 lux | 1909.0 lux | 91.0 lux | ±100.0 lux | 91.0 % | |

Any test points marked with a * do not comply with instrument specification.

End.

D. Baseline Survey Photograph Sheets

D.1 Viewpoint Location 01 – 45 Anfield Road

Viewpoint Location 01 – Day - Direction Northeast



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Matchday Night - Direction Northeast



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Non Matchday Night - Direction Northeast



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Day - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Non Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 01 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

D.2 Viewpoint Location 02 – 144 Anfield Road

Viewpoint Location 02 – Day - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 02 –Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 02 – Non Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 02 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 02 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 02 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

D.3 Survey Viewpoint 03 – 2 Alroy Road

Viewpoint Location 03 – Day - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 03 – Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 03 – Non Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 03 –Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 03 –Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 03 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

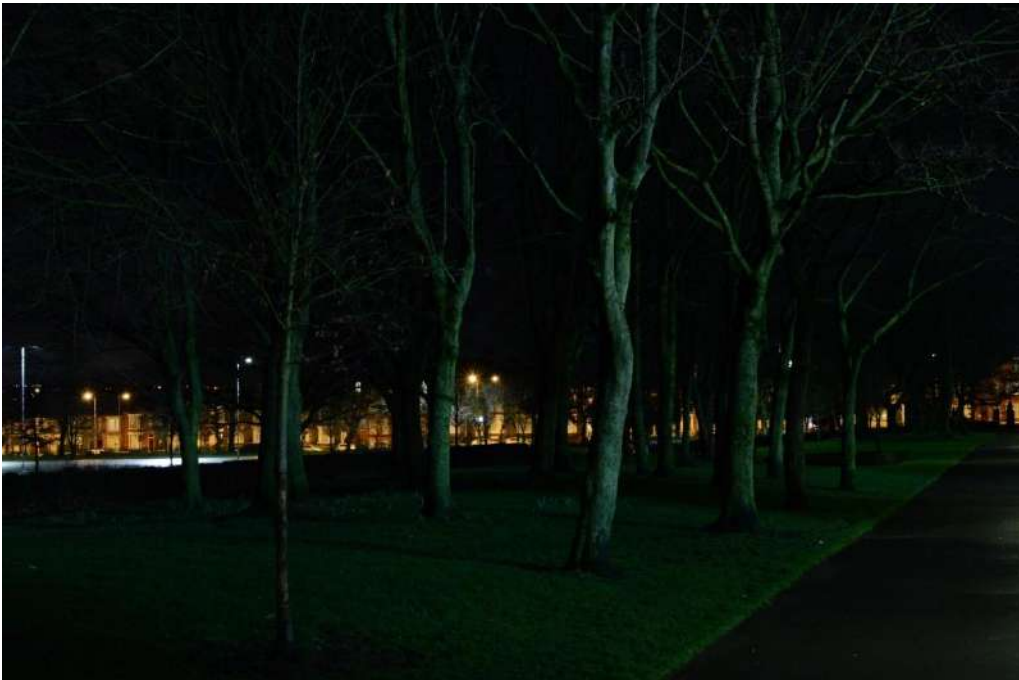
D.4 Survey Viewpoint 04 – Stanley Park– Middle of Dahlia Walk

Viewpoint Location 04 –Day - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Non Matchday Night - Direction East



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Non Matchday Night – Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Day - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 04 – Non Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

D.5 Survey Viewpoint 05 – Stanley Park – Dahlia Walk behind LFCTV cabins

Viewpoint Location 05 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 05 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 05 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 05 – Day - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 05 – Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 05 – Non Matchday Night - Direction West



Source: Mott MacDonald (2020)

D.6 Survey Viewpoint 06 – Stanley Park – Curved Footpath

Viewpoint Location 06 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 06 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 06 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 06 – Day - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 06 – Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 06 – Non Matchday Night - Direction West



Source: Mott MacDonald (2020)

D.7 Survey Viewpoint 07 – Stanley Park – Car park

Viewpoint Location 07 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 07 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 07 – Non Matchday Night - Direction South



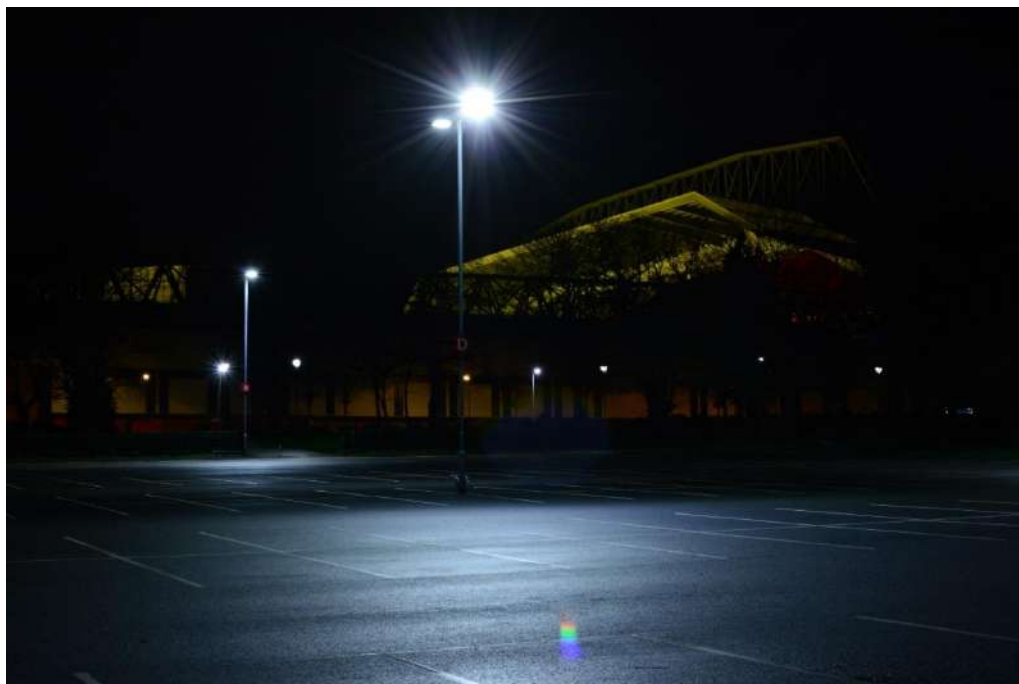
Source: Mott MacDonald (2020)

Viewpoint Location 07 – Matchday Night - Direction Southwest



Source: Mott MacDonald (2020)

Viewpoint Location 07 – Non Matchday Night - Direction Southwest



Source: Mott MacDonald (2020)

D.8 Survey Viewpoint 08 – Dahlia Walk at rear of 73 Anfield Road/Chairman's Villa

Viewpoint Location 08 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Matchday - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Non Matchday Night - Direction West



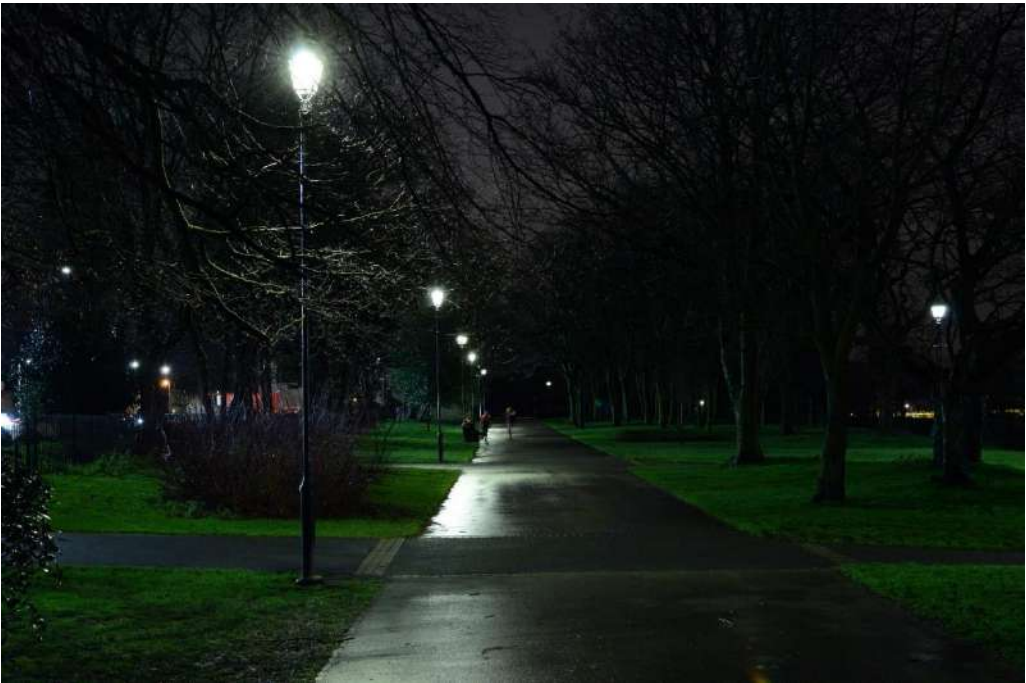
Source: Mott MacDonald (2020)

Viewpoint Location 08 – Day - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 08 – Non Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

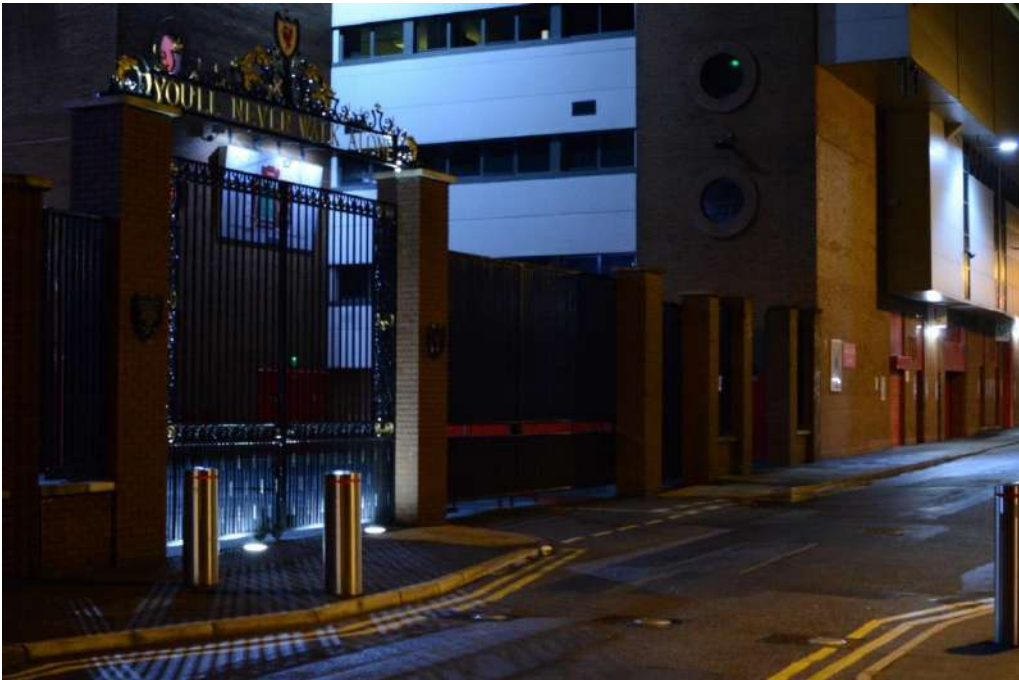
D.9 Survey Viewpoint 09 – 73 Anfield Road/Chairman's Villa - Front

Viewpoint Location 09 – Day - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 09 – Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 09 – Non Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 09 – Day - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 09 – Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 09 – Non Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

D.10 Survey Viewpoint 10 – Sir Kenny Dalglish Car Park/39 Skerries Road Rear

Viewpoint Location 10 – Day - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Matchday Night - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Non Matchday Night - Direction North



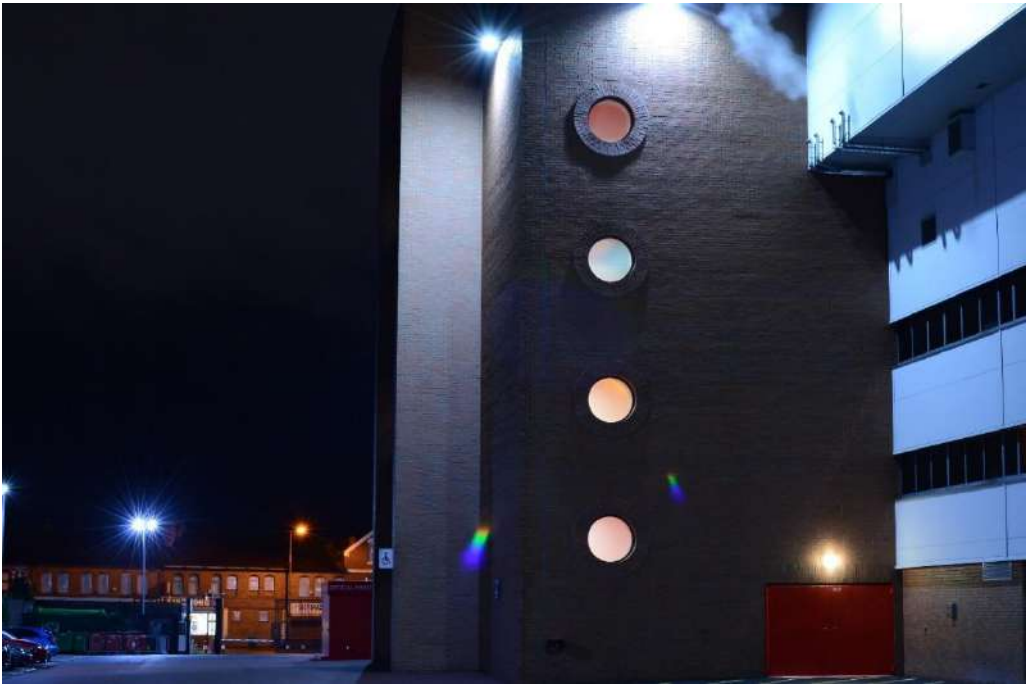
Source: Mott MacDonald (2020)

Viewpoint Location 10 – Day - Direction South-Southwest



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Matchday Night - Direction South-Southwest



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Non Matchday Night - Direction South-Southwest



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Day - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 10 – Non Matchday Night - Direction West



Source: Mott MacDonald (2020)

D.11 Survey Viewpoint 11 – 250 Anfield Road

Viewpoint Location 11 – Day - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 11 – Matchday Night - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 11 – Non Matchday Night - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 11 – Matchday - Direction West



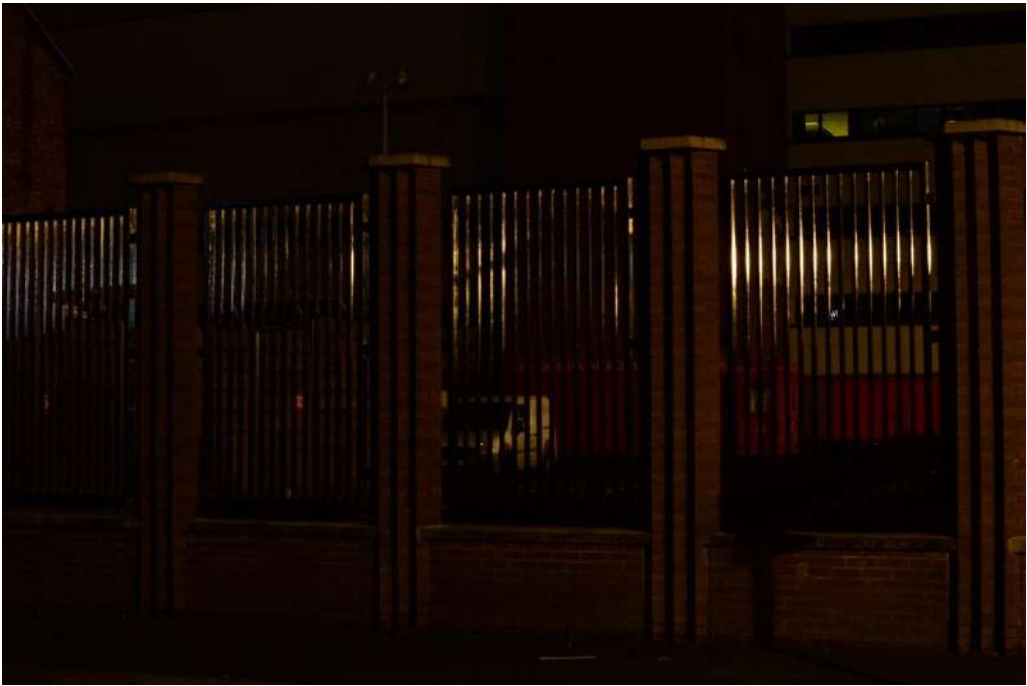
Source: Mott MacDonald (2020)

Viewpoint Location 11 – Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 11 – Non Matchday Night - Direction West



Source: Mott MacDonald (2020)

Viewpoint Location 11 – Day - Direction Northwest



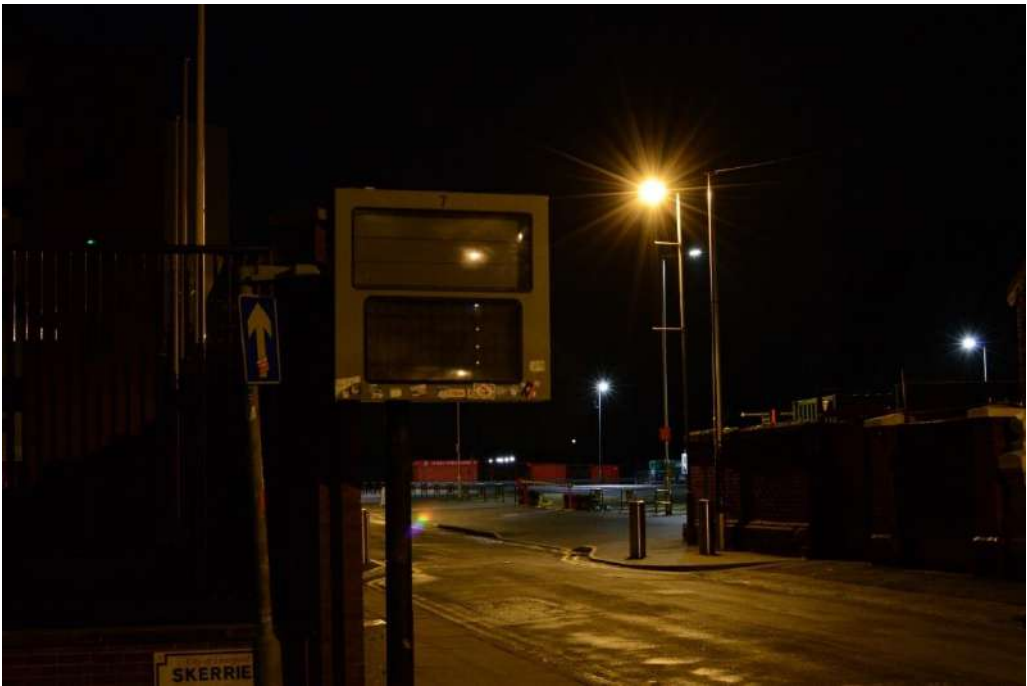
Source: Mott MacDonald (2020)

Viewpoint Location 11 – Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

Viewpoint Location 11 – Non Matchday Night - Direction Northwest



Source: Mott MacDonald (2020)

D.12 Survey Viewpoint 12 – 36 Skerries Road

Viewpoint Location 12 – Day - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 12 – Matchday Night - Direction North



Source: Mott MacDonald (2020)

Viewpoint Location 12 – Non Matchday Night - Direction North



Source: Mott MacDonald (2020)

D.13 Survey Viewpoint 13 – Stanley Park – Straight Footpath

Viewpoint Location 13 – Day - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 13 – Matchday Night - Direction South



Source: Mott MacDonald (2020)

Viewpoint Location 13 – Non Matchday Night - Direction South



Source: Mott MacDonald (2020)

E. Dr Ian Rushforth Confirmation

Boldero, Dawn P

From: Rushforth, Ian <Ian.Rushforth@liverpool.gov.uk>
Sent: 11 December 2019 10:52
To: Boldero, Dawn P
Cc: McKay, Jamie M
Subject: RE: Liverpool Football Club - Light pollution limits etc...

Categories: LFC Lighting Assessment

That's fine. I was going to say 6 lux is our standard criterion at nearby habitable room windows, but I can see that it's mentioned below.

Regards,
Ian

Dr Ian Rushforth
Senior Enforcement Officer
Environmental Protection Unit
Liverpool City Council
T: 0151 233 3055

Correspondence Address
Liverpool City Council
6th Floor
Venture Place
Sir Thomas Street
Liverpool
L1 6BW

From: Boldero, Dawn P [mailto:Dawn.Boldero@mottmac.com]
Sent: 11 December 2019 09:21
To: Rushforth, Ian <Ian.Rushforth@liverpool.gov.uk>
Cc: McKay, Jamie M <Jamie.McKay@mottmac.com>
Subject: FW: Liverpool Football Club - Light pollution limits etc...

Good Morning Ian,

We are contacting you regarding the proposed Phase 2 development at Liverpool FC.
The below e-mail trail relates to the Phase 1 development. Please could you confirm that the agreed classification, limits and curfew detailed below are applicable to Phase 2.

Kind Regards

Dawn Boldero
Lighting Engineer

D +44(0)1603226746
dawn.boldero@mottmac.com

From: Rushforth, Ian <Ian.Rushforth@liverpool.gov.uk>
Sent: 02 May 2014 16:17
To: McKay, Jamie M <Jamie.McKay@mottmac.com>
Subject: RE: Liverpool Football Club - Light pollution limits etc...

Jamie,

That is fine.

Regards,
Ian

From: McKay, Jamie M [<mailto:Jamie.McKay@mottmac.com>]
Sent: 02 May 2014 15:33
To: Rushforth, Ian
Cc: Lawrance, Andrew L; Jenkins, Hattie E; Ellen Freegard (ellen.freegard@crystalmanagement.co.uk); Clibborn, Richard W
Subject: Liverpool Football Club - Light pollution limits etc...
Importance: High

Mr Rushforth,

As discussed I have summarised your requirements with regard to environmental zones and the associated light pollution restrictions to be implemented for the Liverpool Football Club development.

Environmental Zone Classification for Liverpool Football Club

To assess the levels of obtrusive light an appraisal was carried out to classify the site in terms of its 'Environmental Zone' which equates to the district brightness of the surroundings, see Table 1.1 for environment zone information.

In the case of a site being between two possible environmental zones, ILP guidance recommends that the most difficult environmental zone of the two options to achieve is assigned for assessment purposes.

In this case it could be argued that the site lies between an E3 and E4 zone. Therefore in line with ILP guidance, we have applied E3.

Site – Environmental Zone Categorised as E3 – Suburban

Table 1.1: Environmental Zones

| Zone | Surrounding | Lighting Environment | Examples |
|------|-------------|----------------------------|---|
| E0 | Protected | Dark | UNESCO Starlight Reserves, IDA Dark Sky Parks |
| E1 | Natural | Intrinsically dark areas | 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 |

Source: ILP guidance notes for the reduction of obtrusive light – 2011

Obtrusive Light Limitations for an E3 zone

It can be seen from Table 1.2 below that a lighting installation located in an area deemed to be more sensitive will understandably equate to greater constraints with regards to obtrusive light. Based on our appraisal, see below for maximum levels of obtrusive light associated with an E3 Zone.

Table 1.2: Obtrusive Light Limitations (ILP guidance notes for the reduction of obtrusive light 2011)

| Environmental Zone | Sky Glow ULR (Max %) | Light Intrusion (onto Windows) Ev (Lux) | | Luminaire Intensity (Candelas) | | Building Luminance Pre-curfew |
|--------------------|-------------------------|--|-------------|-----------------------------------|-------------|----------------------------------|
| | | Pre-curfew | Post-curfew | Pre-curfew | Post-curfew | Average, L (cd/m2) |
| E0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E1 | 0 | 2 | 0 | 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 | 2,5000 | 25 |

Source: ILP guidance notes for the reduction of obtrusive light - 2011

You have also stated that Liverpool Council require the Pre-Curfew limit for light intrusion onto windows to be reduced from 10 Lux to 6 Lux.

You have also kindly confirmed that the curfew for control of obtrusive light is 23:00 hrs.

Please confirm your agreement of the classification, limits and curfew within this e-mail to enable us to complete the lighting impact assessment.

Thanks you for your assistance with this matter.

Kind Regards

Jamie McKay

Senior Lighting Engineer



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F. 405016-MMD-XX-00-TN-LG-1301 - Technical Note –Lighting Philosophy

Project: LFC ARS Extension Lighting Assessment

Our reference: 405016-MMD-XX-00-TN-LG-1301

Your reference: N/A

Lighting Philosophy

Prepared by: C Carrington-Sykes, R Harvey & R Page

Date: 05/03/2020

Approved by: A Hilton

Checked by: J Brazendale

1. Introduction

Tech note for calculations relating to the proposed layout of Anfield Road during a matchday and non-matchday scenario. The proposal requires the removal of existing columns situated on Anfield Road as well as the adjoining carpark. According to the proposal Anfield road will no longer be a public thoroughfare nor is there any plans for it to be adopted by the local highway authority. Therefore, the landscape architect has specified that the area be lit solely by means of columns and luminaires in keeping with the concourse area running adjacent to the main stand.

2. Data used in the tech note

Reference drawing: Topographical Survey 3D and Linework

2.1 Anfield Road

Current inventory provided by Andy Bullen (Principal Engineer – Street Lighting at LCC) shows that the majority of the existing columns along Anfield Road will be affected by the proposed design.

Luminaires to be used are Arcluce Pantheon 2 (supplied by Kingfisher Lighting), this is to ensure the new design is in keeping with the previous main stand extension. Information relating to the previous main stand extension design provided by James Miles (Technical Manager at Kingfisher Lighting). This includes position of columns, maintenance factors for the luminaires, SP ratios and the calculations used for the scheme.

A 4000k colour temperature has been used to match in with the lighting around the Main Stand. The SP ratio, as stated by Kingfisher Lighting, is 1.4. The luminaires have been permanently dimmed to 80% output via a preprogrammed driver.

The calculated overall maintenance factor for the Pantheon 2 is 0.73 (LMF = 0.92, LLMF = 0.8).

2.2 Dahlia Walk

Luminaire locations provided on topographical survey, locations that were not specified were able to be ascertained using the external lighting service ducts layout provided by Andy Bullen. Also, on this PDF the heights and type of luminaires is specified as being Kingfisher Villa 1.0 mounted post-top on 5m columns.

As the current luminaires are of a heritage style it is required to use a similar style for any replacements. The type chosen is the Urbis Schröder Valentino.

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A 2700k colour temperature has been used to reduce the impact on the potential bat foraging route. The SP ratio, as stated by Urbis Schröder, is 1.15.

The calculated overall maintenance factor for the Urbis Schröder Valentino is 0.75 (LMF=0.84, LLMF=0.90)

2.3 OB Compound

Luminaire locations, type, tilt, height and orientation all provided on PDF 26148K Location and Tilt Table from James Miles (Kingfisher Lighting – Technical Manager). They are 128w (5 Module) Italo 2 with STW optic, bracket mounted on 8m columns.

Replacements are to have a reduced output and different optic at a colour temperature of 2700k due to the close proximity to a potential bat foraging route. From information given by Kingfisher; to account for 2700k colour temperature; a reduction factor of 0.85 can be applied. The SP ratio, as stated by Kingfisher Lighting, is 1.1.

The outreach of the Italo 2 has been calculated using the data sheet on the Kingfisher Lighting website as 0.49 to the photometric centre for a post-top mounting arrangement.

The calculated overall maintenance factor for the Kingfisher Italo 2 is 0.82 (LMF=0.92, LLMF=0.90).

2.4 Footpath by OB Compound

Information relating to this area is the same as for the above: 2.3 OB Compound. The two luminaires located on this footpath have been permanently dimmed to 85% output via a preprogrammed driver.

3. Existing conditions

3.1 Anfield Road

As the proposal is for Anfield Road to no longer be a thoroughfare to motorized vehicles the scheme will be designed to match the levels and design of the open pavement area of the concourse adjacent to the main stand.

This area is currently lit by a series of 15m columns each with 4no. Pantheon 2 mounted in a rectangular arrangement (0.9m x 1.4m) at a height of 13m. The columns are spaced approximately 20m apart.

The standard achieved on the concourse of the previous scheme was an average Lux of 23.54, a minimum of 7 Lux and a uniformity of 0.3. It is proposed to light the new area on Anfield Road to a similar level.

3.2 Dahlia Walk

The pathway is currently lit by 14no. 5m Kingfisher Villa 1.0. this gives an average illuminance of 4.21 Lux with a minimum of 0.32 Lux. The uniformity for the area is 0.08. There is no British standard that this adheres to.

3.3 OB Compound

The compound is currently lit directly by 6no. 8m Kingfisher Italo 2 inside the compound and indirectly via a further 2 situated on the footpath running adjacent to the compound. The achieved average illuminance level is 20.05 Lux with a minimum of 5 Lux and a uniformity of 0.25. This is in keeping with the standard defined in BS 5489-1:2013 Section 7.4.8.3 Table 5 Outdoor Car Parks with Heavy Traffic.

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3.4 Footpath by OB Compound

The footpath is lit directly by 2no. 8m Kingfisher Italo 2 and indirectly via columns situated in the OB compound. The achieved average illuminance is 17.24 Lux with a minimum of 2.01 Lux and a uniformity of 0.12. This is in keeping with the standards along the concourse area and as such will be calculated to the same standard to be used for Anfield Road.

4. Lighting class assessment

4.1 Anfield Road

Given that the road will no longer provide public vehicular access, and thoroughfare, and will predominantly be a pedestrianised area BS 5489-1:2013 Table A.8 provides the most adequate lighting class assessment. The environmental zone confirmed for the area by Dr Ian Rushforth (Environmental Enforcement Officer – LCC) is E3. On a matchday the traffic flow will be high so a P2 class would be required. However, given the need for crime prevention on a matchday this can be increased to a lighting class of P1.

Table A.8 Lighting classes for city and town centres

| Type of traffic | Lighting class | | | |
|---|---------------------|------------------|-------------------|------------------|
| | Normal traffic flow | | High traffic flow | |
| | E3 ^{A)} | E4 ^{A)} | E3 ^{A)} | E4 ^{A)} |
| Pedestrian thoroughfare | S2 or P2 | S1 or P1 | S2 or P2 | S1 or P1 |
| Pedestrian only | CE4 or C4 | CE3 or C3 | CE3 or C3 | CE2 or C2 |
| Mixed vehicle and pedestrian with separate footways | CE3 or C3 | CE2 or C2 | CE2 or C2 | CE1 or C1 |
| Mixed vehicle and pedestrian on same surface | CE2 or C2 | CE1 or C1 | CE1 or C1 | CE1 or C1 |

^{A)} Environmental zone, as given in ILP GN01 [N5].

Source: BS 5489-1:2013

There will be external mounted building luminaires under the soffit at the hospitality entrance and standard entrances. Each final exit will have a wall mounted bulkhead for emergency lighting purposes only designed in accordance with BS 5266 2016.

4.2 Dahlia Walk

As Dahlia Walk falls within Stanley Park and offers no access to motorised vehicles, other than that of park maintenance, BS 5489-1:2013 Table A.6 provides the most adequate lighting class assessment. The ambient luminance confirmed for the area by Dr Ian Rushforth (Environmental Enforcement Officer – LCC) is E3. The traffic flow for the area would be classed as normal therefore a P5 class would be required. Given the concerns of crime in the area and the increase of people on a matchday this has been raised to a P4 class.

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Table A.6 Lighting classes for subsidiary roads with mainly slow-moving vehicles, cyclists and pedestrians

| Traffic flow | Lighting class | |
|----------------------|---|--|
| | Ambient luminance: very low (E1) or low (E2) | Ambient luminance: moderate (E3) or high (E4) |
| Busy ^{a)} | S4 or P4 | S4 or P4 |
| Normal ^{b)} | S5 or P5 | S5 or P5 |
| Quiet ^{c)} | S6 or P6 | S6 or P6 |

Source: BS 5489-1:2013

Given the immediate proximity to the potential bat foraging route it is advised to dim these luminaires post-curfew, when the need for greater illuminance is lessened. A recommended dimming to achieve a P5 class has been calculated.

4.3 OB Compound

The proposed use of the OB compound has not differed in the proposed plans therefore the same lighting class is to be used whereby a minimum average illuminance of 20 Lux will be achieved with a uniformity of 0.25.

Table 5 Maintained lighting levels for outdoor car parks

| Type of area and usage | \bar{E} lx | U_a |
|---|-----------------|-------|
| 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 schools, churches, major sports and multipurpose sports and building complexes | 20 | 0.25 |

Source: BS 5489-1:2013

The columns within the OB Compound shall be 8m columns with post-top mounted luminaires at a 0° tilt. The two columns in close vicinity to the park are to have back shield affixed to further reduce spill light into the potential bat foraging route.

4.4 Footpath by OB Compound

As previously stated, the footpath is to match the standards to be applied to Anfield Road, which will be a P1 classification. The column and luminaire specification shall match the OB Compound, with a slight decrease in lumen output to ensure the area is not over lit. The two luminaires in this area are to have back shields affixed to reduce spill light behind the columns.

5. Modelled results

5.1 Anfield Road

Calculation 405016-MMD-HWA-00-CA-LG-1304 has been set up in accordance with the requirements of BS 5489-1:2013.

The following table depicts the results for the area:

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| Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--|-----------------------------------|-------------------------|
| 17.74 | 2.63 | 0.15 |

Source: Mott MacDonald (2020)

Average illuminance - the horizontal illuminance averaged across points plotted at 1.5m intervals on the specified road area;

Minimum illuminance - the lowest level of illumination.

Overall uniformity - the ratio of the lowest to the average and gives an indication of the consistency of the illuminance across the area.

The output of the Anfield Road luminaires can be dimmed to 40% output via Bluetooth Low Energy technology to drop the lighting class to P3 from 23:00 and dimmed to P3 on non-matchdays.

The following table depicts the results for the area:

| Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--|-----------------------------------|-------------------------|
| 7.98 | 1.39 | 0.17 |

Source: Mott MacDonald (2020)

5.2 Dahlia Walk

Calculation 405016-MMD-HWA-00-CA-LG-1301 has been set up in accordance with the requirements of BS 5489-1-2013.

The following table depicts the results for the pathway:

| Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--|-----------------------------------|-------------------------|
| 5.52 | 0.91 | 0.16 |

Source: Mott MacDonald (2020)

The output of the Dahlia Walk luminaires can be dimmed to 50% output via a preprogrammed driver to drop the lighting class to P5 post-curfew.

The following table depicts the results for the pathway:

| Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--|-----------------------------------|-------------------------|
| 3.00 | 0.48 | 0.16 |

Source: Mott MacDonald (2020)

5.3 OB Compound

Calculation 405016-MMD-HWA-00-CA-LG-1302 has been set up in accordance with the requirements of BS 5489-1-2013.

The following table depicts the results for the area:

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Luminaires within the OB compound are to be on the day before, on matchday and the day after, but are to be switched off at 23:00 each day as stated by the LCC curfew.

| Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--|-----------------------------------|-------------------------|
| 20.04 | 5.18 | 0.26 |

Source: Mott MacDonald (2020)

5.4 Footpath by OB Compound

Calculation 405016-MMD-HWA-00-CA-LG-1303 has been set up in accordance with the requirements of BS 5489-1-2013.

The luminaires on the OB footpath shall be switched off at 23:00 in accordance with the LCC curfew.

The following table depicts the results for the area:

| Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--|-----------------------------------|-------------------------|
| 17.00 | 4.24 | 0.25 |

Source: Mott MacDonald (2020)

6. Compare and summarise results vs standards

6.1 Anfield Road

| | Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--------------------------------------|--|-----------------------------------|-------------------------|
| Required for P1 with SP ratio of 1.4 | 13.10 | 2.62 | N/A |
| Achieved | 17.74 | 2.63 | 0.15 |

Source: Mott MacDonald (2020)

The lower and upper limit for Ea of a P1 class specification, whereby a SP ratio of 1.4 is applied, is 13.10 - 19.65 Lux. The achieved Ea of 17.74 is within this scope. The required minimum is 2.62 Lux the proposed lighting design exceeds this. This is in order to maintain the appearance from the previously built concourse along the main stand.

The output of the Anfield Road luminaires can be dimmed further to 40% output via Bluetooth Low Energy technology to drop the lighting class to P3 from 23:00 and dimmed to P3 on non-matchdays.

| | Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--------------------------------------|--|-----------------------------------|-------------------------|
| Required for P3 with SP ratio of 1.4 | 6.00 | 1.20 | N/A |
| Achieved | 7.98 | 1.39 | 0.17 |

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Source: Mott MacDonald (2020)

The lower and upper limit for Ea of a P3 class specification, whereby a SP ratio of 1.4 is applied, is 6.00 - 9.00 Lux. The achieved Ea of 7.98 is within this scope. The required minimum is 1.20 Lux the proposed lighting design exceeds this.

6.2 Dahlia Walk

| | Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|---------------------------------------|--|-----------------------------------|-------------------------|
| Required for P4 with SP ratio of 1.15 | 4.03 | 0.81 | N/A |
| Achieved | 5.52 | 0.91 | 0.16 |

Source: Mott MacDonald (2020)

The lower and upper limit for Ea of a P4 class specification, whereby a SP ratio of 1.15 is applied, is 4.03 – 6.04 Lux. The achieved Ea of 5.52 is within this scope. The required minimum is 0.81 Lux the proposed lighting design exceeds this.

The output of the Dahlia Walk luminaires can be dimmed to 50% output via a preprogrammed driver to drop the lighting class to P5 post-curfew.

| | Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|---------------------------------------|--|-----------------------------------|-------------------------|
| Required for P5 with SP ratio of 1.15 | 2.23 | 0.45 | N/A |
| Achieved | 3.00 | 0.48 | 0.16 |

Source: Mott MacDonald (2020)

The lower and upper limit for Ea of a P5 class specification, whereby a SP ratio of 1.15 is applied, is 2.23 – 3.34 Lux. The achieved Ea of 3.00 is within this scope. The required minimum is 0.45 Lux the proposed lighting design exceeds this.

6.3 OB Compound

| | Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|---|--|-----------------------------------|-------------------------|
| Required for outdoor carpark with heavy traffic | 20 | N/A | 0.25 |
| Achieved | 20.04 | 5.18 | 0.26 |

Source: Mott MacDonald (2020)

The minimum maintained average illuminance required is 20 Lux while maintaining an overall uniformity of 0.25. The calculation has achieved both stipulations.

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Columns in close vicinity to the park are to have back shield affixed to further reduce spill light into the potential bat foraging route

6.4 Footpath by OB Compound

| | Minimum Maintained Average Illuminance in Lux (Ea) | Minimum Illuminance in Lux (Emin) | Overall Uniformity (Uo) |
|--------------------------------------|--|-----------------------------------|-------------------------|
| Required for P1 with SP ratio of 1.1 | 13.55 | 2.71 | N/A |
| Achieved | 17.00 | 4.24 | 0.25 |

Source: Mott MacDonald (2020)

The lower and upper limit for Ea of a P1 class specification, whereby a SP ratio of 1.1 is applied, is 13.55 - 20.32 Lux. The achieved Ea of 17.00 Lux is within this scope. The required minimum is 2.71 Lux the proposed lighting design exceeds this.

Columns on footpath by OB compound are also to have back shield affixed to further reduce spill light behind columns.

6.5 Illuminated Signage

There will be two illuminated Liverpool club crests on either side of the end Façade of the new stand. They will be illuminated using an IP67 low glare architectural linear luminaire on long arm brackets with a cowl to wash down the signs from high level. Such as the ACDC Blade luminaire.

The crests will be illuminated on both matchdays and non-matchdays until the agreed curfew cut off at 23:00

The lighting will comply with a Zone E3 ILP Guidance Note 01/2011 Guidance notes for the reduction of obtrusive light and having upward light ratio of 0% and with good optical control and ILP guidance note 05 - 2014 – The Brightness of illuminated Advertisements to not exceed 600cdm⁻²

| Table 4: Maximum permitted recommended luminance (cdm ⁻²) | | | | | |
|---|---------|---------|---------|---------|---------|
| Illuminated area (m ²) | Zone E0 | Zone E1 | Zone E2 | Zone E3 | Zone E4 |
| Up to 10 | 0 | 100 | 400 | 600 | 600 |
| Over 10 | 0 | n/a | 200 | 300 | 300 |

ILP guidance note 05 -2014 – The Brightness of illuminated Advertisements

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ACDC Blade Luminaire

6.6 External Building Lighting

There will be external mounted building luminaires under the soffit at the hospitality entrance and standard entrances under the soffits to provide illumination of a P1 classification on a matchday in line with BS 5489-1:2013. Lighting shall be 4000Kelvin to align with Anfield Road Lighting.

Each final exit and around the compactors will have a wall mounted bulkhead for emergency lighting purposes only designed in accordance with BS 5266 2016.

Under the soffit lighting can be automatically switched off between 23:00 hr and 07:00 hr for both matchday and non-matchday. This can be achieved by providing a timer set to the appropriate hours. An override switch can be provided for select matches that override the curfew.

It is not proposed to directly illuminate the Anfield Road stand extension as a night-time feature.



ACDC Ora RC12i



Thorn EyeKon LED (92900828)

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Soffit Lighting Positions



Hospitality Entrance

6.7 Internal Building Lighting

Hospitality Entrance luminaires shall be ceiling recessed downlights at <2700Kelvin such as the Zumtobel Panos Infinity. Luminaires shall be selected as ceiling recessed as much as possible to reduce over spill as per ILP guidance note 08/18 Bats and artificial lighting in the UK.

Entrance lobby shall be designed to 300lux and 0.4Uo in the areas with glass facades as per CIBSE guidelines.

Internal luminaires on the first and second floors shall be track mounted spotlights or linear recessed luminaires incorporated into an architectural raft beam and will be <2700Kelvin Such as the Zumtobel Spotlight.

Internal lighting levels shall be designed to 200lux 0.4 Uo on in the areas with glass facades as per CIBSE guidelines.

Control of lighting will be kept simple with a single switch installed to allow the operations team to switch from non-matchday scenes with local occupancy type control and matchday where all spectator occupied areas will be 100% on throughout the game period as required by the Green Guide.

New hospitality areas will be provided with LED lighting solutions and will be provided with variable switching arrangements to cater for various uses on matchdays and non-matchdays when occupancy and operations will be different.

On a non-matchday lighting will be controlled via PIR sensors for all front of house areas. Back of house areas will be controlled by manual on/off switches.

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Internal lighting



Zumtobel Panos Infinity

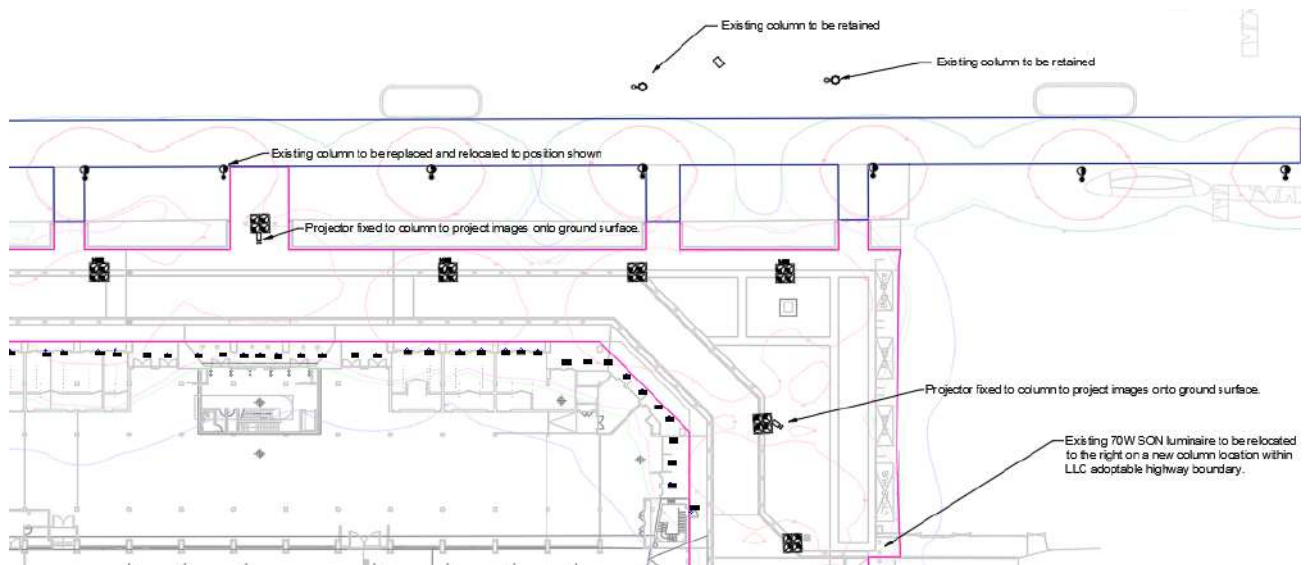


Zumtobel Vivo

6.8 Projectors

The two proposed projectors will be installed on lighting columns as per the locations in the image below. The projectors will project images on the ground to form part of the artwork strategy.

The projector schedule will be controlled by LFC for both matchdays and non-matchdays but will not exceed the curfew of 23:00 hr set by LCC.



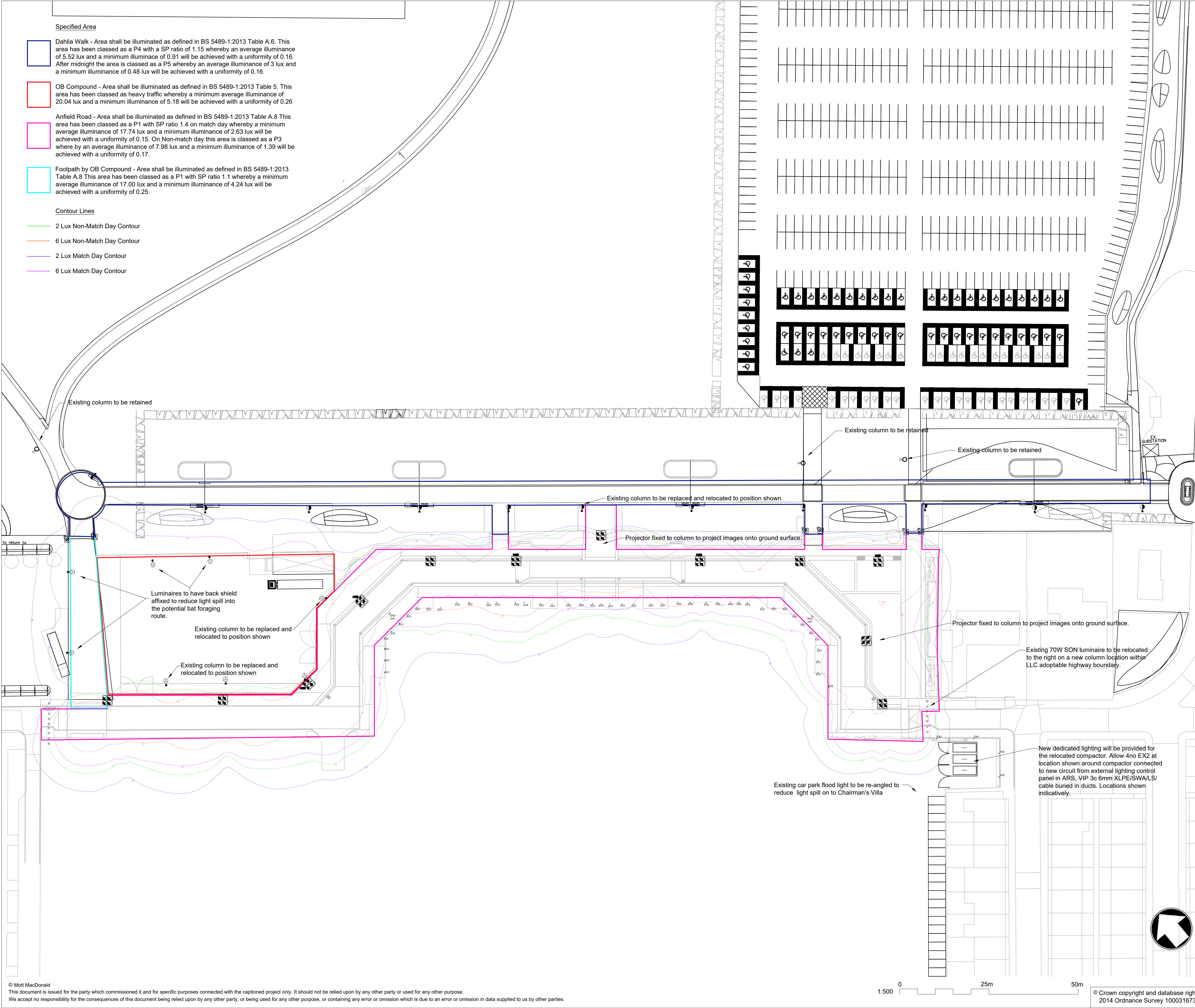
Projector Locations

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G. 405016-MMD-AR-ZZ-DR-E-6301 – External Lighting Layout for Planning



Specified Area

- Dahlia Walk - Area shall be illuminated as defined in BS 5489-1:2013 Table A.6. This area has been classed as a P4 with a SP ratio of 1.15 whereby an average illuminance of 5.52 lux and a minimum illuminance of 0.91 will be achieved with a uniformity of 0.16. After midnight the area is classed as a P5 whereby an average illuminance of 3 lux and a minimum illuminance of 0.48 lux will be achieved with a uniformity of 0.16.
- OB Compound - Area shall be illuminated as defined in BS 5489-1:2013 Table 5. This area has been classed as heavy traffic whereby a minimum average illuminance of 20.04 lux and a minimum illuminance of 5.18 will be achieved with a uniformity of 0.26
- Anfield Road - Area shall be illuminated as defined in BS 5489-1:2013 Table A.8 This area has been classed as a P1 with SP ratio 1.4 on match day whereby a minimum average illuminance of 17.74 lux and a minimum illuminance of 2.63 lux will be achieved with a uniformity of 0.15. On Non-match day this area is classed as a P3 where by an average illuminance of 7.98 lux and a minimum illuminance of 1.39 will be achieved with a uniformity of 0.17.
- Footpath by OB Compound - Area shall be illuminated as defined in BS 5489-1:2013 Table A.8 This area has been classed as a P1 with SP ratio 1.1 whereby a minimum average illuminance of 17.00 lux and a minimum illuminance of 4.24 lux will be achieved with a uniformity of 0.25.

Contour Lines

- 2 Lux Non-Match Day Contour
- 6 Lux Non-Match Day Contour
- 2 Lux Match Day Contour
- 6 Lux Match Day Contour

- Notes
- Do not scale from this drawing.
 - All dimensions are in millimeters unless specified otherwise.
 - Drawing originator shall be notified in writing of any discrepancies.
 - This drawing shall be read in conjunction with all other MEP, Structural and Architectural drawings, specifications and equipment schedules.
 - All trenching and groundworks in the vicinity of existing trees shall be carried out in accordance with NJUG guidance for The Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees - Volume 4. No new trees should be planted within 5m of any proposed street lighting column.
 - External lighting to be dimmed at 11pm curfew in line with the lighting impact report, allow control panel in mezzanine LV Switchroom to control dimming.
 - Contour lines shown do not include Dahlia Walk spill light or contributions from EX1, EX2 and EX3 Luminaire fittings.

Key to symbols

- Proposed 13m mounted floodlight on 15m column, Arcluce - Pantheon 2 with flood optic, 4000K colour temperature, 3.75klm output and 38W power consumption
- Proposed post-top mounted luminaire on existing 8m column, KingFisher - Italo 2 with S05 Optic, 2700K colour temperature, 10.98klm output and 99W power consumption (using a 3000K photometric at 12.92klm output with a 0.85 derating factor supplied from KingFisher)
- Proposed post-top mounted Heritage luminaire on existing 5m column, Urbis Schreder - Valentino LED with Symmetrical Optic, 2700K colour temperature, 4.25klm output and 36.1W power consumption
- Existing post-top mounted Heritage luminaire on 5m column
- Concourse Lighting- 15m column with 1No. 2x2 frame
- Proposed CCTV camera mounted on 6m column
- EX1 LUX-TSI N/A Ora RC12i 1200-840 W
- EX2 Thorn 92900829 (STD - Standard) EyeKon L LED 1050-840 MWS L BK (C/W Halo Visor)
- EX3 Wall mounted blade LED located above emblem
- Projector fixed to column

Reference drawings

| | | | | | |
|-----|------------|-------|-------------------|--------|-------|
| P02 | 19/03/2020 | CCS | Updated to layout | JB | AH |
| P01 | 06/03/2020 | CCS | Planning Issue | JB | AH |
| Rev | Date | Drawn | Description | Ch'k'd | App'd |

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Title

Anfield Road Stadium Extension
External Lighting Layout for Planning

| | | | | | |
|-------------|--------------|-----|--------------|--------------|----|
| Designed | C C-Sykes | CCS | Eng check | J Brazendale | JB |
| Drawn | C C-Sykes | CCS | Coordination | D France | DF |
| Dwg check | J Brazendale | JB | Approved | A Hilton | AH |
| Scale at A1 | Status | Rev | Security | | |
| 1:500 | S2 | P02 | STD | | |

Drawing Number

405016-MMD-AR-ZZ-DR-E-6301

H. 405016-MMD-XX-00-TN-LG-1302 - Technical Note - Floodlighting

Document Number: 405016-MMD-XX-00-TN-LG-1302

Prepared by: David Richardson

Date: 02/03/2020

Approved by: John Naylor

Checked by: Richard Clibborn

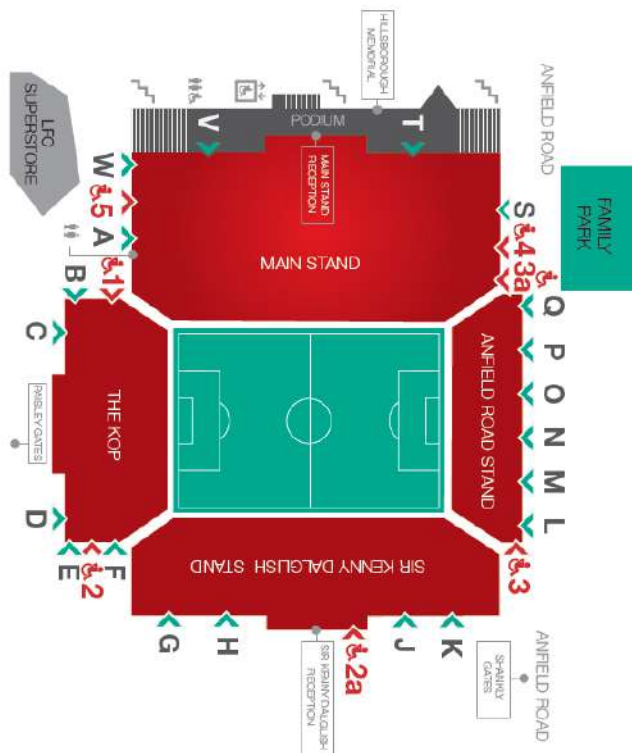
1 Introduction

A preliminary sports lighting design model has been produced for use within the Environmental Impact Assessment for the proposed expansion of the Anfield Road Stand within Liverpool FC Anfield Stadium.

This technical note has been produced to provide a narrative to accompany the lighting calculation file – 405016-MMD-XX-00-CA-LG-1306.agi and to illustrate design criteria and assumptions.

The existing installation was installed in 2016 and complies with the design standards of that time. Due to only one stand being affected by the proposed expansion it is assumed the new sports lighting design will be compliant with the design standards of that time.

Figure 1.1: Existing Stadium Plan



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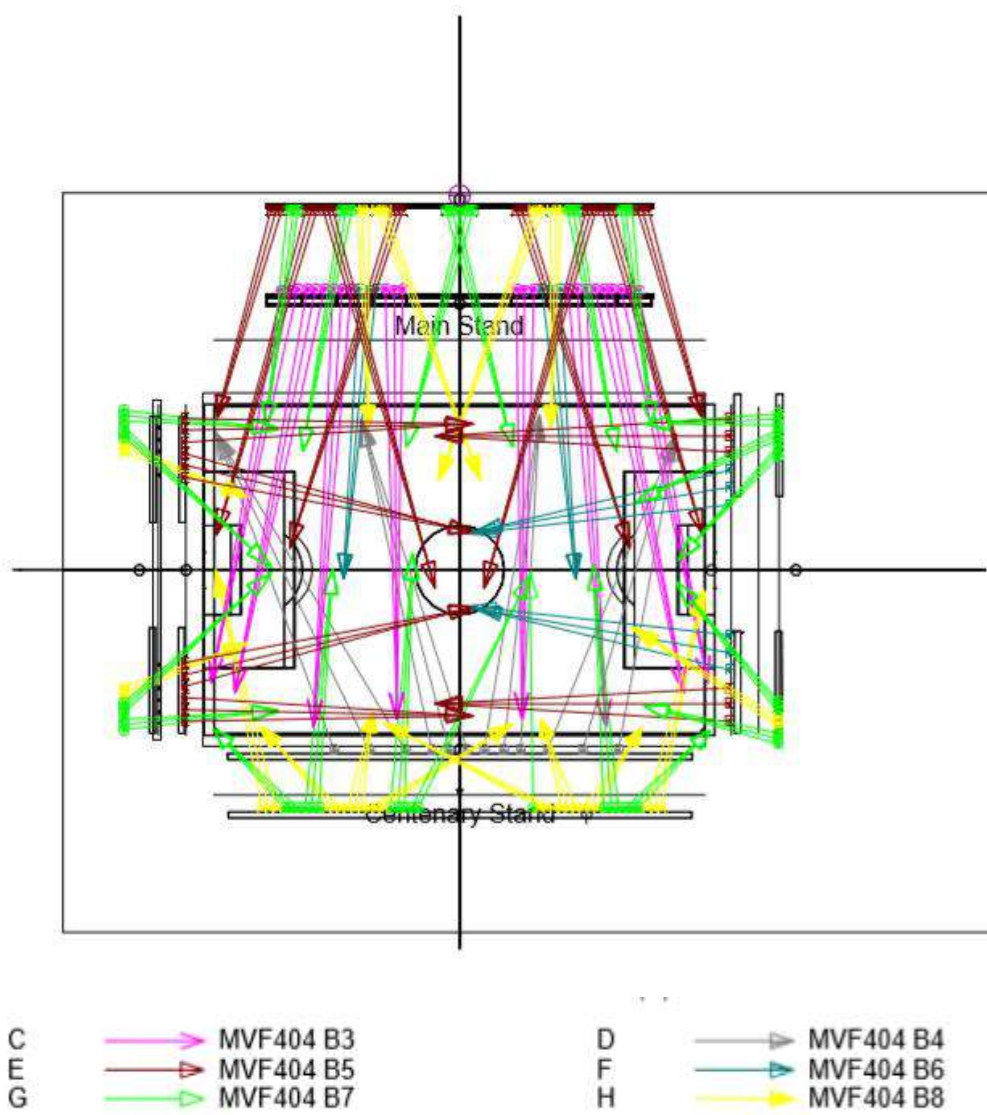
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Source: www.Liverpoolfc.com

2 Existing Installation

The existing installation utilises 198 Philips Arena Vision metal halide luminaires set out as illustrated below.

Figure 2.1: Existing Floodlighting Arrangement



Source: floodlighting design specification – Philips

Figure 2.2: Existing Luminaire Schedule

| Code | Qty | Luminaire Type | Lamp Type | Power (W) | Flux (lm) |
|------|-----|----------------|------------------------------|-----------|------------|
| C | 24 | MVF404 B3 | 1 * MHN-SEH2000W/400V/956 | 2133.0 | 1 * 220000 |
| D | 12 | MVF404 B4 | 1 * MHN-SEH2000W/400V/956 | 2133.0 | 1 * 220000 |
| E | 42 | MVF404 B5 | 1 * MHN-SEH2000W/400V/956 | 2133.0 | 1 * 220000 |
| F | 12 | MVF404 B6 | 1 * MHN-SEH2000W/400V/956 | 2133.0 | 1 * 220000 |
| G | 63 | MVF404 B7 | 1 * MHN-SEH2000W/400V/956 | 2133.0 | 1 * 220000 |
| H | 45 | MVF404 B8 | 1 * MHN-SEH2000W/400V/956 | 2133.0 | 1 * 220000 |

Source: floodlighting design specification – Philips

3 Design Criteria

The criteria for the pitch lighting design are illustrated below

Figure 3.1: Original Installation Design Criteria

| Design Criteria | | | | | | | | |
|------------------------|-------|----------|---------|--------------------------------|--------------|----------|---------|------|
| | | Required | Offered | | | Required | Offered | |
| Ev Towards Main Camera | E_v | 1650 | Yes | Stand | Centenary Ev | | | |
| | U_1 | 0.6 | Yes | | | >165 | Yes. | |
| | U_0 | 0.5 | Yes | | | | | |
| +Y Pitch Camera | E_v | 1000 | Yes | Seating | Kop | Ev | >165 | |
| | U_1 | 0.6 | Yes | | | | | Yes. |
| | U_0 | 0.5 | Yes | | | | | Yes. |
| -Y Pitch Camera | E_v | 1000 | Yes | 12 rows | Anfield | Ev | >165 | |
| | U_1 | 0.6 | Yes | | | | | |
| | U_0 | 0.5 | Yes | | | | | |
| +X Pitch Camera | E_v | 1000 | Yes | Horizontal Illuminance | | - | N/A | |
| | U_1 | 0.6 | Yes | Horizontal/Vertical Ratio | | 1-1.5 | Yes | |
| | U_0 | 0.5 | Yes | Coefficient of Variation | | max. 20% | Yes | |
| -X Pitch Camera | E_v | 1000 | Yes | Emergency TV (Ev Main Cam) | | 800 | Yes | |
| | U_1 | 0.6 | Yes | Maintenance Factor | | 0.7 | Yes | |
| | U_0 | 0.5 | Yes | Glare Rating Towards Players | | 50 | Yes | |
| | | | | Glare Rating Towards TV Camera | | 10 | No | |

Source: Philips Liverpool Floodlighting Proposal 2015

It has been assumed that the design of the new floodlighting will match the standards of the existing.

It has been assumed that the existing floodlighting design and installation followed the design criteria set out above.

4 Assumptions and Limitations

To undertake the preliminary design several assumptions have been made and limitations identified.

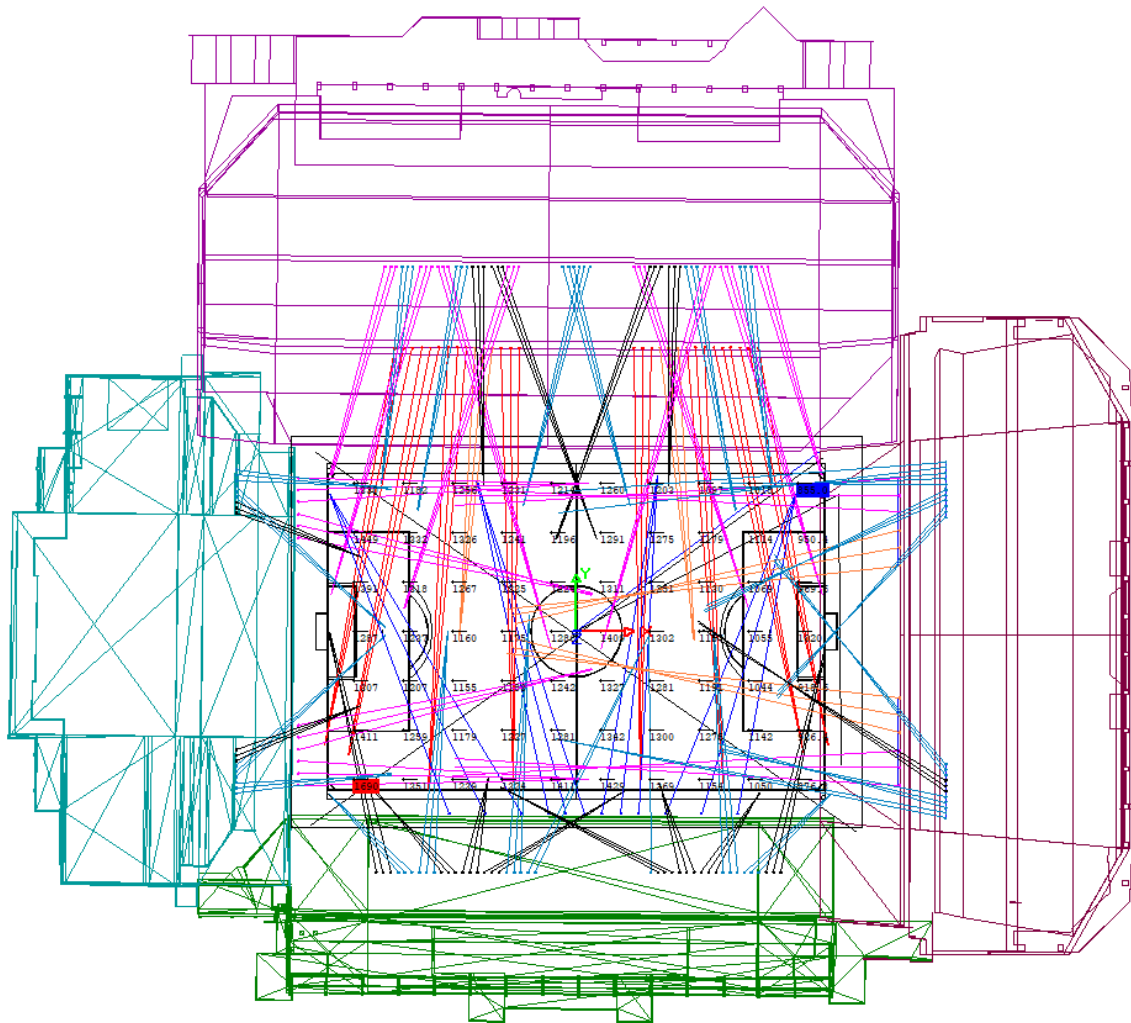
1. This preliminary pitch lighting design is for the purposes of estimating environmental spill light only. Not for tender or construction.
2. Principal camera gantry is assumed to be at approximately 30m above pitch level in the centre of the main stand.
3. As the existing installation is being modified rather than replaced the design standards of that time are to be utilised.
4. Geometry utilised has been taken from existing as-built models and work in progress architectural models
5. The only part of the existing installation to be revised is the Anfield Road Stand.
6. Maintenance factor of 0.7 is used for all pitch illuminance calculations, however this may need to be increased to 1.0 for spill light calculations.
7. The design excludes consideration of switching groupings, phase balancing etc.
8. The design approximates the likely luminaire positions, types and aiming to target the illuminance criteria on the pitch. The final detailed design will be subject to manufacturer choice, optic changes, luminaire location coordination, aiming optimisation and grouping of luminaires for switching.
9. No glare shields have been used for this design.
10. The software used was AGI32 (Version 19.0)

5 Results

To achieve the design criteria and suit the new architectural/ structural configuration of the proposed expansion the floodlights within the Anfield Road Stand have been relocated and supplemented with an additional 4.no floodlights.

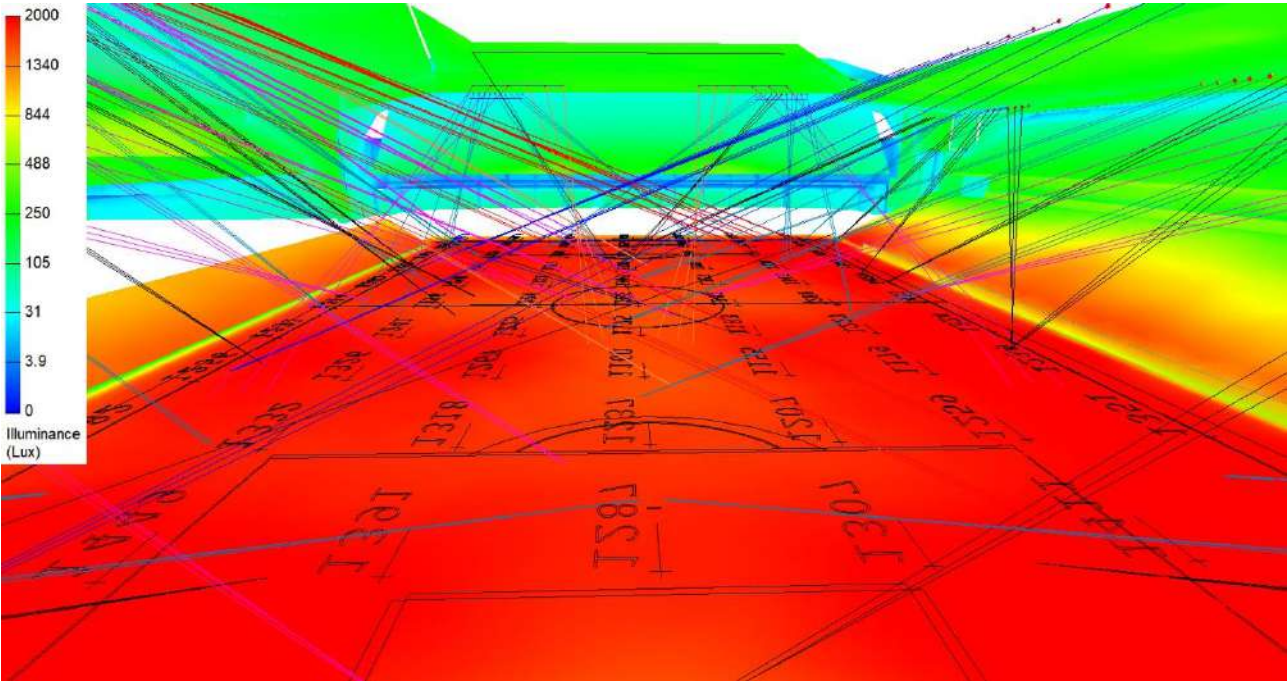
The results achieved are compliant with the standards of the original installation as demonstrated below

| Calculation Summary | | | | | | Criteria | | |
|---------------------|-------------|-------|------|---------|---------|----------|---------|---------|
| Label | CalcType | Units | Avg | Min/Avg | Min/Max | Avg | Min/Avg | Min/Max |
| Eh Football | Illuminance | Lux | 1859 | 0.84 | 0.58 | | | |
| Ev Football +X | Illuminance | Lux | 1219 | 0.7 | 0.51 | 1000 | 0.6 | 0.5 |
| Ev Football +Y | Illuminance | Lux | 1515 | 0.74 | 0.55 | 1000 | 0.6 | 0.5 |
| Ev Football -X | Illuminance | Lux | 1072 | 0.74 | 0.51 | 1000 | 0.6 | 0.5 |
| Ev Football -Y | Illuminance | Lux | 1071 | 0.81 | 0.61 | 1000 | 0.6 | 0.5 |
| EV TV | Illuminance | Lux | 1787 | 0.81 | 0.66 | 1650 | 0.6 | 0.5 |

Figure 5.1: Preliminary Revised Lighting Plan

Source: Mott MacDonald AGI32 Model

Figure 5.2: Psuedo Colour



Source: Mott MacDonald AGI32 Model

6 Luminaire Schedule

Figure 6.1: Luminaire Schedule

| Code | Qty | Luminaire | Product Code | Power (W) | Flux (lm) |
|------|-----|----------------------|--------------|-----------|-----------|
| C | 24 | Philips Arena Vision | MVF404 B3 | 2133 | 220000 |
| D | 12 | Philips Arena Vision | MVF404 B4 | 2133 | 220000 |
| E | 42 | Philips Arena Vision | MVF404 B5 | 2133 | 220000 |
| F | 12 | Philips Arena Vision | MVF404 B6 | 2133 | 220000 |
| G | 67 | Philips Arena Vision | MVF404 B7 | 2133 | 220000 |
| H | 45 | Philips Arena Vision | MVF404 B8 | 2133 | 220000 |

7 Luminaire Location Schedule

All Coordinates taken from Centre of Pitch

Black – No Modification to existing
 Red – Relocated
 Blue – New Luminaire

Figure 7.1: Luminaire Location and Aiming Summary

| LumNo | Label | X | Y | Z | X-Aimpt | Y-Aimpt | Z-Aimpt |
|-------|-------|--------|-------|-------|---------|---------|---------|
| 1 | D | -18.55 | -37 | 26.65 | -50.09 | 28.15 | 0 |
| 2 | D | -11.19 | -37 | 26.65 | -50.09 | 28.15 | 0 |
| 3 | D | -5.63 | -37 | 26.65 | -20.23 | 30.9 | 0 |
| 4 | D | -2.16 | -37 | 26.65 | -20.13 | 30.68 | 0 |
| 5 | D | 1.63 | -37 | 26.65 | -20.23 | 30.79 | 0 |
| 6 | C | -36.84 | 57.49 | 34.75 | -51.04 | -23.16 | 0 |
| 7 | C | -34.99 | 57.54 | 34.75 | -51.04 | -23.16 | 0 |
| 8 | C | -33.25 | 57.59 | 34.75 | -51.15 | -23.16 | 0 |
| 9 | C | -31.25 | 57.64 | 34.75 | -46.22 | -25.3 | 0 |
| 10 | C | -29.66 | 57.59 | 34.75 | -46.22 | -25.1 | 0 |
| 11 | C | -27.86 | 57.64 | 34.75 | -46.12 | -25.2 | 0 |
| 12 | C | -26.04 | 57.69 | 34.75 | -30.01 | -31.99 | 0 |
| 13 | C | -24.14 | 57.69 | 34.75 | -30.01 | -32.29 | 0 |
| 14 | C | -22.34 | 57.64 | 34.75 | -30.01 | -32.29 | 0 |
| 15 | F | -20.59 | 57.59 | 34.75 | -23.92 | -1.91 | 0 |
| 16 | F | -18.74 | 57.54 | 34.75 | -23.82 | -1.71 | 0 |
| 17 | F | -17 | 57.59 | 34.75 | -23.92 | -1.81 | 0 |
| 18 | C | -15.27 | 57.59 | 34.75 | -12.87 | -30.68 | 0 |
| 19 | C | -13.37 | 57.54 | 34.75 | -12.87 | -30.68 | 0 |
| 20 | C | -11.64 | 57.59 | 34.75 | -12.87 | -30.68 | 0 |
| 21 | C | 11.64 | 57.59 | 34.75 | 12.87 | -30.68 | 0 |
| 22 | C | 13.37 | 57.54 | 34.75 | 12.87 | -30.68 | 0 |
| 23 | C | 15.27 | 57.59 | 34.75 | 12.87 | -30.68 | 0 |
| 24 | F | 17 | 57.59 | 34.75 | 23.92 | -1.81 | 0 |
| 25 | F | 18.74 | 57.54 | 34.75 | 23.82 | -1.71 | 0 |
| 26 | F | 20.59 | 57.59 | 34.75 | 23.92 | -1.91 | 0 |
| 27 | C | 22.34 | 57.64 | 34.75 | 30.01 | -32.29 | 0 |
| 28 | C | 24.14 | 57.69 | 34.75 | 30.01 | -32.29 | 0 |
| 29 | C | 26.04 | 57.69 | 34.75 | 30.01 | -31.99 | 0 |
| 30 | C | 27.86 | 57.64 | 34.75 | 46.12 | -25.2 | 0 |
| 31 | C | 29.66 | 57.59 | 34.75 | 46.22 | -25.1 | 0 |
| 32 | C | 31.25 | 57.64 | 34.75 | 46.22 | -25.3 | 0 |
| 33 | C | 33.25 | 57.59 | 34.75 | 51.15 | -23.16 | 0 |

Figure 7.1: Luminaire Location and Aiming Summary

| | | | | | | | |
|----|---|--------|-------|-------|--------|--------|---|
| 34 | C | 34.99 | 57.54 | 34.75 | 51.04 | -23.16 | 0 |
| 35 | C | 36.84 | 57.49 | 34.75 | 51.04 | -23.16 | 0 |
| 36 | E | -38.81 | 74 | 37.5 | -49.97 | 31.44 | 0 |
| 37 | E | -37.62 | 74 | 37.5 | -49.8 | 31.5 | 0 |
| 38 | E | -36.51 | 74 | 37.5 | -49.68 | 31.5 | 0 |
| 39 | G | -35.4 | 74 | 37.5 | -39.63 | 29.9 | 0 |
| 40 | G | -34.24 | 74 | 37.5 | -39.56 | 29.97 | 0 |
| 41 | G | -33.18 | 74 | 37.5 | -39.63 | 29.9 | 0 |
| 42 | E | -31.56 | 74 | 37.5 | -49.91 | 7.31 | 0 |
| 43 | E | -30.43 | 74 | 37.5 | -49.91 | 7.21 | 0 |
| 44 | E | -29.26 | 74 | 37.5 | -49.91 | 7.31 | 0 |
| 45 | E | -28.05 | 74 | 37.5 | -5.06 | -3.71 | 0 |
| 46 | E | -27.1 | 74 | 37.5 | -5.06 | -3.61 | 0 |
| 47 | E | -26.07 | 74 | 37.5 | -5.06 | -3.71 | 0 |
| 48 | G | -24.4 | 74 | 37.5 | -32.19 | 24.31 | 0 |
| 49 | G | -23.34 | 74 | 37.5 | -32.36 | 24.48 | 0 |
| 50 | G | -22.15 | 74 | 37.5 | -32.28 | 24.48 | 0 |
| 51 | H | -21.04 | 74 | 37.5 | -18.74 | 29.2 | 0 |
| 52 | H | -19.93 | 74 | 37.5 | -18.74 | 29.2 | 0 |
| 53 | H | -18.82 | 74 | 37.5 | -18.74 | 29.2 | 0 |
| 54 | H | -17.18 | 74 | 37.5 | 4.17 | 18.51 | 0 |
| 55 | H | -16 | 74 | 37.5 | 4.29 | 18.45 | 0 |
| 56 | H | -15.02 | 74 | 37.5 | 4.17 | 18.45 | 0 |
| 57 | E | -13.8 | 74 | 37.5 | -34.99 | 4.63 | 0 |
| 58 | E | -12.67 | 74 | 37.5 | -34.99 | 4.53 | 0 |
| 59 | E | -11.64 | 74 | 37.5 | -34.9 | 4.43 | 0 |
| 60 | G | -2.8 | 74 | 37.5 | 10.89 | 25.27 | 0 |
| 61 | G | -1.61 | 74 | 37.5 | 10.89 | 25.27 | 0 |
| 62 | G | -0.57 | 74 | 37.5 | 10.89 | 25.27 | 0 |
| 63 | G | 0.57 | 74 | 37.5 | -10.89 | 25.27 | 0 |
| 64 | G | 1.61 | 74 | 37.5 | -10.89 | 25.27 | 0 |
| 65 | G | 2.8 | 74 | 37.5 | -10.89 | 25.27 | 0 |
| 66 | E | 11.64 | 74 | 37.5 | 34.9 | 4.43 | 0 |
| 67 | E | 12.67 | 74 | 37.5 | 34.99 | 4.53 | 0 |
| 68 | E | 13.8 | 74 | 37.5 | 34.99 | 4.63 | 0 |
| 69 | H | 15.02 | 74 | 37.5 | -4.17 | 18.45 | 0 |
| 70 | H | 16 | 74 | 37.5 | -4.29 | 18.45 | 0 |
| 71 | H | 17.18 | 74 | 37.5 | -4.17 | 18.51 | 0 |
| 72 | H | 18.82 | 74 | 37.5 | 18.74 | 29.2 | 0 |
| 73 | H | 19.93 | 74 | 37.5 | 18.74 | 29.2 | 0 |

Figure 7.1: Luminaire Location and Aiming Summary

| | | | | | | | |
|-----|---|--------|--------|-------|---------|---------|---|
| 74 | H | 21.04 | 74 | 37.5 | 18.74 | 29.2 | 0 |
| 75 | G | 22.15 | 74 | 37.5 | 32.28 | 24.48 | 0 |
| 76 | G | 23.34 | 74 | 37.5 | 32.36 | 24.48 | 0 |
| 77 | G | 24.4 | 74 | 37.5 | 32.19 | 24.31 | 0 |
| 78 | E | 26.07 | 74 | 37.5 | 5.06 | -3.71 | 0 |
| 79 | E | 27.1 | 74 | 37.5 | 5.06 | -3.61 | 0 |
| 80 | E | 28.05 | 74 | 37.5 | 5.06 | -3.71 | 0 |
| 81 | E | 29.26 | 74 | 37.5 | 49.91 | 7.31 | 0 |
| 82 | E | 30.43 | 74 | 37.5 | 49.91 | 7.21 | 0 |
| 83 | E | 31.56 | 74 | 37.5 | 49.91 | 7.31 | 0 |
| 84 | G | 33.18 | 74 | 37.5 | 39.63 | 29.9 | 0 |
| 85 | G | 34.24 | 74 | 37.5 | 39.56 | 29.97 | 0 |
| 86 | G | 35.4 | 74 | 37.5 | 39.63 | 29.9 | 0 |
| 87 | E | 36.51 | 74 | 37.5 | 49.68 | 31.5 | 0 |
| 88 | E | 37.62 | 74 | 37.5 | 49.8 | 31.5 | 0 |
| 89 | E | 38.81 | 74 | 37.5 | 49.97 | 31.44 | 0 |
| 90 | H | -40.64 | -48.85 | 21.25 | -50.07 | -0.28 | 0 |
| 91 | H | -39.22 | -48.85 | 21.25 | -50.22 | -0.13 | 0 |
| 92 | H | -37.69 | -48.85 | 21.25 | -50.16 | -0.02 | 0 |
| 93 | G | -36.09 | -48.85 | 21.25 | -50.4 | -32.81 | 0 |
| 94 | G | -34.8 | -48.85 | 21.25 | -50.4 | -32.81 | 0 |
| 95 | G | -33.31 | -48.85 | 21.25 | -50.4 | -32.81 | 0 |
| 96 | G | -31.81 | -48.85 | 21.25 | -26.11 | 0.39 | 0 |
| 97 | G | -30.43 | -48.85 | 21.25 | -26.11 | 0.29 | 0 |
| 98 | G | -28.88 | -48.85 | 21.25 | -26.11 | 0.29 | 0 |
| 99 | H | -27.36 | -48.85 | 21.25 | -40.61 | -32.29 | 0 |
| 100 | H | -25.97 | -48.85 | 21.25 | -40.49 | -32.53 | 0 |
| 101 | H | -24.59 | -48.85 | 21.25 | -41.2 | -32.41 | 0 |
| 102 | H | -23.05 | -48.85 | 21.25 | -17.82 | -29.43 | 0 |
| 103 | H | -21.55 | -48.85 | 21.25 | -17.72 | -29.53 | 0 |
| 104 | H | -20.11 | -48.85 | 21.25 | -17.82 | -29.33 | 0 |
| 105 | H | -18.67 | -48.85 | 21.25 | 10.91 | -31.73 | 0 |
| 106 | H | -17.28 | -48.85 | 21.25 | 10.71 | -31.76 | 0 |
| 107 | H | -15.79 | -48.85 | 21.25 | 10.79 | -31.76 | 0 |
| 108 | G | -14.17 | -48.85 | 21.25 | -9.6 | 3.16 | 0 |
| 109 | G | -12.57 | -48.85 | 21.25 | -9.65 | 3.47 | 0 |
| 110 | G | -11.34 | -48.85 | 21.25 | -9.6 | 3.25 | 0 |
| 111 | E | 65.7 | -31.18 | 28.4 | -24.937 | -25.621 | 0 |
| 112 | E | 65.7 | -27.55 | 28.4 | -24.792 | -27.444 | 0 |
| 113 | E | 65.7 | -24.2 | 28.4 | -25.242 | -29.128 | 0 |

Figure 7.1: Luminaire Location and Aiming Summary

| | | | | | | | |
|-----|---|--------|--------|-------|---------|---------|---|
| 114 | F | 65.7 | -20.47 | 28.4 | -12.618 | -1.477 | 0 |
| 115 | F | 65.7 | -16.99 | 28.4 | -13.368 | -3.226 | 0 |
| 116 | F | 65.7 | -13.42 | 28.4 | -14.449 | -4.479 | 0 |
| 117 | F | 65.7 | 13.42 | 28.4 | -14.449 | 4.479 | 0 |
| 118 | F | 65.7 | 16.99 | 28.4 | -13.368 | 3.226 | 0 |
| 119 | F | 65.7 | 20.47 | 28.4 | -12.618 | 1.477 | 0 |
| 120 | E | 65.7 | 24.2 | 28.4 | -25.242 | 29.128 | 0 |
| 121 | E | 65.7 | 27.55 | 28.4 | -24.792 | 27.444 | 0 |
| 122 | E | 65.7 | 31.18 | 28.4 | -24.937 | 25.621 | 0 |
| 123 | G | 75 | 23.19 | 27.8 | 40.73 | -12.328 | 0 |
| 124 | G | 75 | 24.33 | 27.8 | 40.477 | -13.225 | 0 |
| 125 | G | 75 | 25.46 | 27.8 | 40.731 | -13.763 | 0 |
| 126 | G | 75 | 26.7 | 27.8 | 26.138 | 5.369 | 0 |
| 127 | G | 75 | 27.73 | 27.8 | 25.634 | 4.412 | 0 |
| 128 | G | 75 | 28.82 | 27.8 | 25.97 | 3.918 | 0 |
| 129 | G | 75 | 29.81 | 27.8 | 29.222 | 30.13 | 0 |
| 130 | G | 75 | 30.95 | 27.8 | 28.987 | 29.113 | 0 |
| 131 | G | 75 | 32.13 | 27.8 | 29.34 | 28.541 | 0 |
| 132 | E | -56.44 | -31.12 | 20.35 | 2.76 | -29.96 | 0 |
| 133 | E | -56.44 | -28.7 | 20.35 | 2.76 | -29.96 | 0 |
| 134 | E | -56.44 | -26.29 | 20.35 | 2.55 | -30.03 | 0 |
| 135 | E | -56.44 | -23.87 | 20.35 | 3.15 | -7.38 | 0 |
| 136 | E | -56.44 | -21.45 | 20.35 | 3.4 | -7.76 | 0 |
| 137 | E | -56.44 | -19.04 | 20.35 | 3.53 | -7.63 | 0 |
| 138 | E | -56.44 | 19.04 | 20.35 | 3.53 | 7.63 | 0 |
| 139 | E | -56.44 | 21.45 | 20.35 | 3.4 | 7.76 | 0 |
| 140 | E | -56.44 | 23.87 | 20.35 | 3.15 | 7.38 | 0 |
| 141 | E | -56.44 | 26.29 | 20.35 | 2.55 | 30.03 | 0 |
| 142 | E | -56.44 | 28.7 | 20.35 | 2.76 | 29.96 | 0 |
| 143 | E | -56.44 | 31.12 | 20.35 | 2.76 | 29.96 | 0 |
| 144 | G | -69 | -32.83 | 15.6 | -37.38 | -28.9 | 0 |
| 145 | G | -69 | -31.73 | 15.6 | -37.28 | -28.7 | 0 |
| 146 | G | -69 | -30.63 | 15.6 | -37.28 | -29.2 | 0 |
| 147 | G | -69 | -29.53 | 15.6 | -38.66 | -0.5 | 0 |
| 148 | G | -69 | -28.43 | 15.6 | -38.63 | -0.72 | 0 |
| 149 | G | -69 | -27.33 | 15.6 | -38.63 | -0.64 | 0 |
| 150 | H | -69 | -26.23 | 15.6 | -43.67 | -14.97 | 0 |
| 151 | H | -69 | -25.13 | 15.6 | -43.67 | -14.97 | 0 |
| 152 | H | -69 | -24.03 | 15.6 | -43.67 | -14.97 | 0 |
| 153 | H | -69 | 24.03 | 15.6 | -43.67 | 14.97 | 0 |

Figure 7.1: Luminaire Location and Aiming Summary

| | | | | | | | |
|-----|---|-------|--------|-------|--------|---------|---|
| 154 | H | -69 | 25.13 | 15.6 | -43.67 | 14.97 | 0 |
| 155 | H | -69 | 26.23 | 15.6 | -43.67 | 14.97 | 0 |
| 156 | G | -69 | 27.33 | 15.6 | -38.63 | 0.64 | 0 |
| 157 | G | -69 | 28.43 | 15.6 | -38.63 | 0.72 | 0 |
| 158 | G | -69 | 29.53 | 15.6 | -38.66 | 0.5 | 0 |
| 159 | G | -69 | 30.63 | 15.6 | -37.28 | 29.2 | 0 |
| 160 | G | -69 | 31.73 | 15.6 | -37.28 | 28.7 | 0 |
| 161 | G | -69 | 32.83 | 15.6 | -37.38 | 28.9 | 0 |
| 162 | D | 5.13 | -37 | 26.65 | 16.47 | 31.75 | 0 |
| 163 | D | 9.05 | -37 | 26.65 | 16.47 | 31.75 | 0 |
| 164 | D | 12.61 | -37 | 26.65 | 16.47 | 31.75 | 0 |
| 165 | D | 18.07 | -37 | 26.65 | 44.52 | 28.03 | 0 |
| 166 | D | 25.35 | -37 | 26.65 | 44.36 | 27.69 | 0 |
| 167 | D | 32.73 | -37 | 26.65 | 44.52 | 27.94 | 0 |
| 168 | G | -9.85 | -48.85 | 21.25 | 14.71 | -0.91 | 0 |
| 169 | G | -8.4 | -48.85 | 21.25 | 14.71 | -0.71 | 0 |
| 170 | G | 15.08 | -48.85 | 21.25 | 14.61 | -0.51 | 0 |
| 171 | H | 16.55 | -48.85 | 21.25 | -15.39 | -31.52 | 0 |
| 172 | H | 17.96 | -48.85 | 21.25 | -15.5 | -31.45 | 0 |
| 173 | H | 19.46 | -48.85 | 21.25 | -15.6 | -31.5 | 0 |
| 174 | H | 20.98 | -48.85 | 21.25 | 16.98 | -30.79 | 0 |
| 175 | H | 22.34 | -48.85 | 21.25 | 16.98 | -30.89 | 0 |
| 176 | H | 23.92 | -48.85 | 21.25 | 16.68 | -30.79 | 0 |
| 177 | H | 25.31 | -48.85 | 21.25 | 37.56 | -32.54 | 0 |
| 178 | H | 26.8 | -48.85 | 21.25 | 37.44 | -32.54 | 0 |
| 179 | H | 28.27 | -48.85 | 21.25 | 37.26 | -32.54 | 0 |
| 180 | G | 29.71 | -48.85 | 21.25 | 27.62 | 1.16 | 0 |
| 181 | G | 31.22 | -48.85 | 21.25 | 27.62 | 1.16 | 0 |
| 182 | G | 32.6 | -48.85 | 21.25 | 27.62 | 1.16 | 0 |
| 183 | G | 34.1 | -48.85 | 21.25 | 51.51 | -32.99 | 0 |
| 184 | G | 35.48 | -48.85 | 21.25 | 51.41 | -32.89 | 0 |
| 185 | G | 36.96 | -48.85 | 21.25 | 51.61 | -33.09 | 0 |
| 186 | H | 38.52 | -48.85 | 21.25 | 50.21 | -4.44 | 0 |
| 187 | H | 40.01 | -48.85 | 21.25 | 50.51 | -4.64 | 0 |
| 188 | H | 41.4 | -48.85 | 21.25 | 50.11 | -3.94 | 0 |
| 189 | G | 75 | -35.75 | 27.8 | 28.583 | -22.777 | 0 |
| 190 | G | 75 | -34.64 | 27.8 | 29.088 | -23.638 | 0 |
| 191 | G | 75 | -33.5 | 27.8 | 28.786 | -24.317 | 0 |
| 192 | H | 75 | -32.42 | 27.8 | 24.454 | 2.305 | 0 |
| 193 | H | 75 | -31.38 | 27.8 | 24.792 | 1.76 | 0 |

Figure 7.1: Luminaire Location and Aiming Summary

| | | | | | | | |
|-----|---|-------|---------|-------|--------|---------|---|
| 194 | H | 75 | -30.26 | 27.8 | 25.465 | 0.657 | 0 |
| 195 | G | 75 | -29.2 | 27.8 | 39.888 | 15.819 | 0 |
| 196 | G | 75 | -28.04 | 27.8 | 40.056 | 14.688 | 0 |
| 197 | G | 75 | -26.9 | 27.8 | 40.057 | 14.243 | 0 |
| 198 | D | -25.8 | -37 | 26.65 | -50.02 | 28.15 | 0 |
| 199 | G | 75 | 33.275 | 27.8 | -3.871 | 24.109 | 0 |
| 200 | G | 75 | -36.696 | 27.8 | -4.396 | -21.716 | 0 |
| 201 | G | 75 | -37.834 | 27.8 | -4.266 | -21.805 | 0 |
| 202 | G | 75 | 34.287 | 27.8 | -3.731 | 28.337 | 0 |

8 Conclusions

It has been demonstrated that the existing installation can be amended to suit the new architectural arrangement and achieve the required design criteria with 4no. supplementary luminaires. The calculation model is deemed appropriate to be utilised for an Environmental Impact Assessment as it provides a representative example of what may be installed.

I. 405016-MMD-XX-00-TN-LG-1303 – Technical Note - Event Lighting

| | | | |
|-----------------------|-------------------------------------|------------------------|-------------|
| Project: | LFC ARS Extension – Event Lighting | | |
| Our reference: | 405016-MMD-XX-00-TN-LG-1303 | Your reference: | - |
| Prepared by: | Dawn Boldero | Date: | 20/03/2020 |
| Approved by: | Lauren Bagshaw/Lorna Meek | Checked by: | Jamie McKay |
| Subject: | Lighting Impact Assessment – Events | | |

1.1 Introduction

Mott MacDonald has been commissioned by Liverpool Football Club (LFC) to undertake a review of potential impacts in relation to lighting with respect to a planning application for an extension to the Anfield Road stand (the Proposed Scheme). LFC currently holds a temporary permission to hold up to six events within the stadium in the closed football season (mid-May to end-June); that permission expires in 2021. This application is for the staging of music concerts and other major events; there are no events permitted in July. As part of the Proposed Scheme permission is being sought for permanent permission to hold up to twelve concerts and major events (such as boxing) in the stadium for the same period. This technical note covers in particular the potential effects of such uses of the stadium in relation to lighting and provides a recommendation as to their significance.

1.2 Study Area

The study area is limited to areas of external lighting that are under LFC control and/or ownership and that are likely to be operational during an event. This equates to the following areas:

1. Anfield Stadium
2. The concourse public realm area (external to Main Stand, Kop Stand and the Proposed Scheme)
3. Car parking areas
 - Stanley Park Car Park
 - Utting Avenue/Priory Road Car Park
 - Sir Kenny Dalglish Car Park

1.3 Existing and baseline knowledge

Lighting related planning conditions

The following section provides extracts of external lighting related planning conditions associated with LFC planning applications.

In summary, there is a requirement for a 6 lux limit at habitable windows and a requirement for designs to be submitted to Liverpool City Council (LCC) for approval prior to construction, both are common planning conditions related to external lighting.

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Main Stand expansion and associated public realm works – planning application number 14F/1262 – dated 26 September 2014

An Environmental Lighting Impact Assessment (ELIA) was submitted to LCC for consideration. During the planning review process a lighting related planning condition was imposed, see extract below for details.

“The capacity of the Main Stand shall not exceed 12,000 spectators until a comprehensive scheme for lighting that shows the full details of the location, design, luminance and fields of illumination of all lights, including those for illumination of the playing surface, the exterior of the stadium, the car parking and bicycle storage areas, including footways has been submitted to and approved in writing by the local planning authority. All external light fittings shall be orientated so that any measurements taken at any nearby habitable room windows do not exceed 6 lux. The proposed scheme should take into account inclusive design principals ensuring the needs of visually impaired are met. The approved scheme shall be implemented prior to the additional seating capacity in the expanded main stand being brought into use and no other external lighting installed without the prior consent of the local planning authority.”

This planning application included football pitch playing surface floodlighting, stadium architectural building or façade lighting, concourse public realm lighting, Fanzone lighting and car park lighting.

To vary planning conditions attached to 14F/1262 so as to make alterations to surface of public realm areas – planning application reference number 15F/2160 – dated 14 August 2015

Alterations were made to external lighting under this application therefore the application was issued lighting related planning condition number 7. This condition is as described above under planning application number 14F/1262.

Following submission of a detailed lighting assessment in June 2016 this condition was discharged on the 7 September 2016 by LCC. This confirms that the football pitch playing surface floodlighting, stadium architectural building or façade lighting, concourse public realm lighting, car park lighting, public walkway lighting, road lighting, stall and Fanzone area lighting associated with this application has been provided in compliance with LCC’s obtrusive lighting requirements.

Stanley Park improvement works – car parking area – planning application number 15F/2790 – dated 18 January 2016

During the planning review process, a lighting related planning condition was imposed, see extract below for details.

“All external lighting fittings shall be orientated so that any measurements taken at any nearby habitable roomed windows do not exceed 6 lux.”

This planning application included car park and footpath lighting.

To erect club store on Walton Breck Road frontage (Outline application) – planning application number 16O/0518 – dated 31 May 2016

During the planning review process a lighting related planning condition was imposed, see extract below for details.

Planning condition number 4.

“Prior to their implementation, details of the following shall be submitted to and approved in writing by the local planning authority. The scheme shall be implemented in accordance with the approved details and completed to the satisfaction of the local planning authority before the development is occupied/brought into use.

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(iii) location, design, height, orientation and luminance levels of any external lighting”

This planning application included concourse public realm lighting and architectural building or façade lighting.

Application for reserved matters following outline approval 16O/0518 for the erection of a new club store on Walton Breck Road frontage – planning application number 16RM/1451 – dated 15 September 2016

As part of this planning application lighting related planning condition number 4 as provided under planning application number 16O/0518 needed to be discharged. It is assumed that sufficient details have been provided to LCC and that any light pollution criteria set by LCC have been achieved by this external lighting installation.

This planning application included concourse public realm lighting and architectural building or façade lighting.

Anfield Stadium – Landscaping works at Paisley Square – planning application number 17F/0892 – dated 19 May 2017

This application included the installation of external lighting that contributes to the achievement of the original design principles, aims and objectives for the area. The proposed site plan, drawing number PL1312.5.GA.101 issue 02, notes that “*all lighting shall not exceed 6 lux at the window of any habitable room and mustn’t cause glare to motorists or pedestrians*”. A specific light pollution condition was not issued in this case, this is likely due to the afore mentioned design consideration aligning with previous LCC lighting related planning conditions.

This planning application included concourse public realm lighting and architectural building or façade lighting.

Current external lighting

The existing lighting that will remain and is under LFC control consists of:

- pitch surface floodlighting;
- architectural building or façade lighting; and
- concourse public realm lighting.

There are three lit car parks areas in regular use during matchdays which are either under direct ownership of LFC or under LFC temporary control. These car parks are:

- the Sir Kenny Dalglish Car Park (under direct LFC ownership and control);
- Stanley Park (controlled by LFC on a match day); and
- Utting Avenue/Priory Road car park (controlled by LFC on a match day).

On non-match days (with the exception of special events, see below for details) the majority of lighting is either not in use or not under LFC control. Additional exception to this is the Sir Kenny Dalglish Car Park at the rear of the Sir Kenny Dalglish stand which is in regular use until midnight.

On match days, the switch off times vary dependant on the type and duration of the match. On a standard evening league football match, the pitch surface floodlighting is switched off between 23:00 and midnight. The existing architectural building or façade lighting and concourse public realm lighting switches off between 23:00 and midnight. The Stanley Park car park lighting switches off at midnight and the Sir Kenny Dalglish Car Park lighting switches off at 00:30. The Utting Avenue/Priory Road car park lighting is subject to

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a match day planning restriction curfew which instructs that lighting shall be switched off one hour after the end of the match and no later than 23:00.

On an evening cup football match external lighting switch off times are extended if extra time and a penalty shootout take place. In this case the pitch surface floodlighting can be switched off between 23:00 and 01:00. Other lit areas are adjusted to meet the requirements for safe egress from the stadium. The exception to this is the Utting Avenue/Priory Road car park lighting which is subject to the matchday planning restriction curfew times as described above.

Special events such as weddings, galas or balls can extend until 01:00. These events do not require pitch floodlighting. Safe parking and egress from the event is required therefore the Sir Kenny Dalglish and Stanley Park parking areas switch off as late as 02:00 to 02:30 to suit the event requirements. While the Stanley Park car park can be used as overflow for these events, this is unusual. Utting Avenue/Priory Road car park is not used for this type of event.

The Proposed Scheme Lighting

Details of the Proposed Scheme lighting have been discussed within section 5 of the Lighting Impact Assessment Report 405016-MMD-XX-XX-RP-EN-0002. This section provides a description of the proposals for the stadium pitch floodlighting, external stadium public realm lighting, external building lighting, internal lighting, illuminated signage and projectors.

1.4 Assumptions and limitations

Assumptions

For details of the Proposed Scheme lighting configurations utilised for a matchday and non-matchday both pre and post curfew refer to Table 5 within the Lighting Impact Assessment Report 405016-MMD-XX-XX-RP-EN-0002.

For details of the Proposed Scheme lighting configurations utilised for cup games, other sporting events and weddings or gala type events please refer to Table 1.

Table 1: Event Lighting Switch Off Times and Dimming Profiles

| Type/Area of lighting | Cup Games & other sporting events | | Weddings & Gala events | |
|----------------------------------|-----------------------------------|--|--|--|
| | Pre-curfew | Post-curfew | Pre-curfew | Post-curfew |
| Anfield Road | ON | 40% output | 40% output | 40% output |
| Dahlia Walk | ON | 50% output | ON | 50% output |
| OB Compound | **ON | OFF | OFF | OFF |
| OB Footpath | ON | OFF | ON | OFF |
| External Building Lighting | ON | ON – switch off adjusted for safe egress | ON | OFF |
| LFC Crests (Illuminated Signage) | ON | OFF | ON | OFF |
| Interior lights | ON | ON – switch off adjusted for safe egress | *Local occupancy control (Assumed ON) | *Local occupancy control (Assumed ON) |
| Projector | ON | OFF | ON | OFF |

Source: Mott MacDonald (2020).

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* As a precautionary principle it has been assumed that the interior lighting is ON. See Lighting Impact Assessment Report 405016-MMD-XX-XX-RP-EN-0002.

** The lighting within the OB Compound will be switched on the day before a match, on matchday and the day after.

Where each of the planning applications (referred to in section 1.3) required details of lighting to be approved, those details were submitted and subsequently agreed by the council prior to installation. In these circumstances, it is assumed that any current external lighting such as stadium architectural building or façade lighting, public realm lighting and car park lighting associated with previous planning applications has been provided in compliance with LCC's obtrusive lighting requirements.

It is assumed that both the Utting Avenue/Priory Road and Stanley Park car parking areas adhere to LCC requirements in terms of obtrusive light.

The additional events are planned from mid-May to late-June therefore it is assumed that tree lines and vegetation are suitable for screening purposes due to anticipated levels of foliage.

The Stanley Park Car Park lighting manual override switch will be visually inspected to ensure the manual override is disengaged after use allowing reversion back to automatic control that is set to switch lighting off at midnight.

This assessment is based on the assumption that suitable improvements will be made in accordance with Drawing No. 405016-MMD-AR-ZZ-DR-E-6301 to the Sir Kenny Dalglish Car Park in order to reduce spill light onto 73 Anfield Road/Chairman's Villa in line with the limits set out in Table 3 of the Lighting Impact Assessment Report 405016-MMD-XX-XX-RP-EN-0002.

Limitations

Any street lighting adopted by LCC is excluded from this assessment as this lighting is under LCC control and is assumed to be operational regardless of events.

No ecological or heritage related receptors have been assessed as part of this technical note.

No landscape and visual impact assessment viewpoints have been assessed as part of this technical note.

The information relating to the current external lighting within this technical note has been based on a desktop study of previous lighting designs/drawings, LFC planning applications, client-based discussions and information gained from previous stages of design development and assessment. This information has been relied upon to enable the lighting assessment.

At this stage of works no site walkover, visit or survey was undertaken as part of the additional events assessment as no proposed changes to the current stadium architectural building or façade lighting, concourse public realm lighting and car park lighting (other than the Sir Kenny Dalglish Car Park) are anticipated.

For further details relating to the Proposed Scheme assumptions and limitations refer to Section 3 of the Lighting Impact Assessment Report 405016-MMD-XX-XX-RP-EN-0002.

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1.5 Guidance and Best Practice

In considering the potential effects of the proposed development, the following aspects of obtrusive light, taken from the Institution of Lighting Professionals (ILP) Guidance Note for the Reduction of Obtrusive Light GN01:2011 should be considered and assessed:

Sky Glow – The illumination of the sky at night by artificial light sources including light emitted directly upward from the light source and reflected from the ground or surface

Light Intrusion – Light that falls beyond the boundary of the area being lit

Luminaire Intensity – The measure of the amount of light that a source radiates in a given direction

Building or Façade Lighting – Buildings directly illuminated as a night time feature

During the assessment the following legislation and guidance will be consulted as appropriate, although not exhaustive:

- BS 5489-1:2013, Code of practice for the design of road lighting Part 1: Lighting of roads and public amenity areas (2013)
- BS EN 13201-2:2015, Road lighting – Part 2: Performance requirements (2015)
- BS EN 12464-1:2011, Light and Lighting – Lighting of work places Part 1: Indoor work places (2011)
- BS EN 12464-2:2014, Light and Lighting – Lighting of work places Part 2: Outdoor work places (2014)
- BS 8300-1:2018, Design of an accessible and inclusive built environment – Part 1: External environment – Code of practice (2018)
- CIE 150:2017 International Commission on Illumination, Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations, 2nd Edition (2017)
- BS EN 12193:2018 Light and lighting. Sports lighting (2018)
- UEFA Stadium Lighting Guide (2016)
- Institution of Lighting Professional (ILP) GN2/18 Guidance for lighting of televised sporting events (2018)
- ILP PLG05 Professional Lighting Guide 05, The Brightness of Illuminated Advertisements (2015)
- Chartered Institution of Building Service Engineers (CIBSE), LG06 Lighting Guide 6: The exterior environment (2016)
- CIBSE LG04 Lighting Guide 04: Sports Lighting (2006)
- The Society of Light and Lighting (SLL) Code for Lighting (2012)
- ILP and Bat Conservation Trust Guidance Note 08/18 Bats and Artificial Lighting in the UK, Bats and the Built Environment series (2018)
- Bats and Lighting – Overview of Current Evidence and Mitigation. Stone, Emma (2014).
- BREEAM UK New Construction – Non-domestic buildings – England (2018)
- ILP PLG04 Professional Lighting Guide 04, Guidance on Undertaking Environmental Lighting Impact Assessments (2013)

The remainder of this report considers that these documents are current. These documents should be verified as current and, if superseded, the standards and lighting levels discussed in this report should be reassessed.

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1.6 Current Proposal

It is proposed that the concerts and events would take place over a window of 6 weeks at the end of the football season, from mid-May to the end of June. The application is requesting that up to 12 events per annum be permitted during this period. The proposed events are planned to end at 23:00 except for the boxing or other combative sporting events that are planned to end at 23:30. The attending public and hosting staff will need time to leave the stadium, reach local parking areas and exit safely. It is anticipated that the lighting associated with car parking areas will be switched off at 01:00.

It is anticipated that music concerts will provide stage lighting of various colours, light sources types, aiming angles, beam angles, reflector types, directions and intensities. It is assumed that effect lighting will be used to enhance the visual appearance of the concert, this may include laser and/or pyrotechnical displays.

Additional sporting events are likely to require floodlighting however it is assumed that the existing floodlighting will be adequate for pitch playing surface-based sports. Boxing or other combative sporting events would require additional lighting for the boxing ring and are unlikely to require the use of pitch playing surface floodlighting.

It has been confirmed that the event lighting will be shielded from direct views due to a combination of the enclosed nature and height of the stadium.

To facilitate events no proposed changes are anticipated to the football pitch playing surface floodlighting, stadium architectural building or façade lighting, public realm lighting or car park lighting other than hours of use.

1.7 Potential effects, mitigation and monitoring

At this time of year, the period of daylight hours is high in comparison to winter months, see below for typical sunset times for mid-May to the end of June:

14th May 2020 to 31st May 2020 – Sunset range from 21:03 to 21:28

1st June 2020 to 30th June 2020 – Sunset range from 21:29 to 21:43

These sunset times result in limited hours of operation of artificial lighting during the hours of darkness due to the relatively late sunset times and anticipated switch off times.

Event lighting within the stadium

Event lighting including any pyrotechnics or laser/light shows or additional lighting for events such as boxing will be shielded from direct views due to the enclosed nature and height of the stadium. Considering this information, it is anticipated no light intrusion or luminaire intensity issues will be experienced at residential areas surrounding the stadium. The majority of proposed events are planned to end at 23:00, the only exception to this is the boxing/combative sporting event which is proposed to end at 23:30. The potential effect of light intrusion or luminaire intensity from the event lighting within the stadium on local residential properties is predicted to be **none/negligible**.

Event lighting including any pyrotechnics or laser/light shows associated with music concerts may cause some sky glow however the duration will be short due to a planned end time of 23:00 and the number of additional events will be low therefore the potential effect is predicated to be **none/negligible**.

Architectural building or façade lighting

During the main stand extension ELIA, the architectural building or façade lighting design was checked in comparison to the limits associated with ILP E3 environmental zone. The proposed design was within the ILP limits by some margin. It is assumed that this lighting and any other architectural building or façade lighting

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was designed to be sympathetic and proportional to the ambient luminance of the area and has been subject to planning permission prior to installation. The switch off times for this lighting during league and cup matches is between 23:00 and midnight and for galas, weddings and balls can extend to 02:30. It is not anticipated that the operation of this lighting will extend past existing usage times. Considering these points and the planned low number of additional events the effect is predicted to be **none/negligible**.

Concourse Public Realm Lighting (Main Stand and Proposed Scheme)

The concourse lighting provided during the Main Stand extension has been subject to an ELIA, design development and a lighting related planning condition set by LCC. This concourse lighting and any design iterations are assumed to be compliant with LCC obtrusive lighting limits prior to construction. The switch off times for this lighting during league and cup matches is between 23:00 and 01:00 and for galas, weddings and balls can extend to 02:30.

Operational phase lighting planned for the Proposed Scheme has been assessed within the main body of the Lighting Impact Assessment on a matchday and non-matchday for both pre and post curfew and is predicted to have a **none/negligible** effect to the identified receptor locations.

It is not anticipated that the operation of this lighting will extend past existing usage times. Given this assumption the predicted effect on local residential properties is **none/negligible**.

Car Park Lighting Areas

The current proposals will necessitate extended car parking hours and associated lighting in comparison to a standard evening league match. Evening cup matches can already require extended hours of parking due to end times of up to 23:00, whereby the Sir Kenny Dalglish Car Park lighting can be operational until 00:30 and the Stanley Park car park lighting can be operational until 01:00.

Stanley Park Car Park

This car parking area and associated footpath lighting has been upgraded in recent years during the Stanley Park improvements works. The lighting consists of LED luminaires mounted on 10m high columns for the car park with 5m and 6m mounting heights for the associated footpaths including Dahlia Walk. As the proposed events are to be held in mid-summer the existing tree line screening will form an effective barrier to both spill light and luminaire intensity. The distance to residential properties on Arkles Lane, Utting Avenue and Anfield Road will also be beneficial as mitigation. On non-match days this car park lighting is in regular use until midnight therefore the predicted extension until 01:00 is relatively minor. Considering these points and the assumed compliance with the lighting related planning condition imposed as part of the Main Stand planning process (highlighted in section 1.3) it is predicted that the potential effect of light intrusion or luminaire intensity from this lighting is **none/negligible**.

The lighting in this area may cause some skyglow however the level of direct upward light is anticipated to be very low given the age, type and mounting angle of the luminaires. The extended duration of 1 hour is short and the number of additional events will be low therefore the potential effect is predicted to be **none/negligible**.

Utting Avenue/Priory Road Car Park (former Anfield Community Comprehensive School site)

Following a review of design drawing D137617 dated 6 January 2016, details of the existing lighting have been located and supplemented by a desktop study of the area. The lighting design drawing indicates that the lighting has a mounting height of 10m with a combination of twin and single luminaires with 250w high pressure sodium lamps, glass bowl optical covers with the luminaires mounted at a 5-degree tilt, these details have been approved by LCC pursuant to planning application 16F/0311. The locations of the majority of lighting columns are beneficial as they are not mounted in close proximity to local residential properties. Significant tree lines are in place on the north-eastern boundary, at the rear of the residential properties on

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Ince Avenue and on Utting Avenue. The proposed events are to be held in mid-May to the end of June therefore the existing tree line will form an effective screening barrier to both spill light and luminaire intensity when viewed from either the rear of Ince Avenue or the frontages of the properties on Utting Avenue. There is a significant distance from the car park lighting to the residential properties on Utting Avenue. The switch off times for this lighting during league and cup matches is 23:00. It is anticipated that the operation of this lighting will extend past existing usage times to 01:00. Considering these points and assuming compliance with similar lighting related planning conditions issued for Stanley Park, it is predicted that the potential effect of light intrusion or luminaire intensity from this lighting to local residential properties is **none/negligible**.

The lighting in this area may cause some sky glow however the level of direct upward light is anticipated to be low given the luminaire type and mounting angle. The number of additional events will be low therefore the potential effect is predicated to be **none/negligible**.

Sir Kenny Dalglish Car Park

Design details of the existing lighting design have not been located for this car park. As part of a desktop study of the area it was concluded that the lighting has an approximate mounting height of 6/8m with twin floodlights predominantly angled towards the parking area at various tilt angles. Some building mounted floodlighting is present, this lighting is mounted at high level and orientated towards the rear of the properties on Skerries Road. The power and output of the car park lighting is unknown at this stage. The majority of column mounted floodlights are unlikely to cause issues related to light intrusion or luminaire intensity due to the orientation and mounting angles.

During the baseline survey for the Proposed Scheme undertaken in January 2020 it was noted that the existing spill light levels on the front aspect of receptor location 9 - 73 Anfield Road/Chairman's Villa were excessive. The source of the obtrusive light was identified as the floodlighting within the Sir Kenny Dalglish Car Park. To alleviate this issue the design team have advised that measures will be taken to mitigate the existing spill light. Refer to drawing 405016-MMD-AR-ZZ-DR-E-6301 (supplied in Appendix G of the Lighting Impact Assessment Report) which states that the floodlight in the car park is to be re-angled. Due to this amendment, the predicted effect of the existing Sir Kenny Dalglish Car Park lighting on the front aspect of receptor location 9 - 73 Anfield Road/Chairman's Villa is predicted to be **none/negligible**.

In its amended form the Sir Kenny Dalglish Car Park lighting has a combination of some poorly directed column mounted floodlights and high-level building mounted floodlighting therefore it is predicted that the car park lighting may be obtrusive from the perspective of the local residential properties on Skerries Road. The potential predicted effect is **minor adverse** as it is likely to provide a slight increase in use of the car park outside of the usual switch off time of midnight, during the proposed 12 additional events.

The lighting in this area may cause some sky glow due to the mounting angles of the column mounted and building mounted floodlighting however the duration will be short, and the number of additional events will be low therefore the potential effect is predicated to be **minor adverse**. A minor adverse effect will provide a slight increase in sky glow due to the car park needing to have extended hours of operation.

Monitoring

While no specific monitoring is recommended, any complaints received by either LFC or LCC should be directed to the local environmental health officer or lighting engineer and checked on site with appropriate and reasonable actions taken to mitigate the issues/s by LFC.

1.8 Conclusion

The proposed event lighting is screened from direct views due to the height and nature of the stadium. With 12 additional events proposed with limited hours of darkness due to comparatively late sunset times a **none/negligible effect** on the local residential properties is predicted.

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Additional lighting or increased lighting levels are not anticipated to be required for the public areas due to the proposed amendments to the existing use of the Anfield Road Stadium. While some car park lighting durations will extend in comparison to a typical league football match, when compared to a cup match with extra time and penalties the switch off times will be similar in most instances. Currently planning restrictions impose curfew times for Utting Avenue/Priory Road car parking areas, there are no curfew times for the use of external lighting in other areas. Due to the anticipated extension of hours of use associated with the additional 12 events some minor impacts are predicted.

The 12 additional events will require extension to the hours of use of the Sir Kenny Dalglish Car Park which has the potential to extend the timeframe of existing predicted obtrusive light issues.

The existing lighting designs that have been reviewed, indicate that best practice design principles and modern lighting specifications have been utilised and approved by LCC pursuant to other planning applications that suitable planning controls are in place. It has been assumed installations reflect the reviewed designs. The potential impacts of the Proposed Scheme have been assessed within the Lighting Impact Assessment Report 405016-MMD-XX-XX-RP-EN-0002 and predicted to have an overall **none/negligible effect** on the identified receptors. For these reasons the reviewed lighting designs are unlikely to affect the surrounding environment in a significant manner.

The ILP GN01:2011 provides applicable maximum permissible levels of obtrusive light for particular 'environmental zones' in addition to the requirements of LCC. It is recommended that obtrusive lighting calculations are carried out at all future stages of lighting design to illustrate that obtrusive light limitations for the relevant environmental zone are not exceeded.

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