

OVG Manchester:

Appendix 9.1 – Exterior Lighting Assessment



OVG

OVG Manchester

Exterior Lighting Installation Assessment

BRA-MEE-ZZ-ZZ-RP-EL-7001

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1 INTRODUCTION

1.1 General

This document has been prepared to outline the effects of the proposed permanent external lighting scheme for OVG Manchester on the surrounding environment and neighbouring properties.

A key requisite of any exterior lighting installation is to minimise consequent obtrusive spill light which might adversely affect local residential communities, vehicular traffic routes or surrounding environmental areas and wildlife.

The proposed works to the project will involve a new exterior amenity lighting system for the public realm as well as façade illumination of the building. The installation of media screens is also being proposed.

An ambient light level survey has been carried out at the site to ascertain the base-line spill light levels within the immediate surrounding area of the development. The results are presented in this report.

The lighting scheme presented in this report is to be viewed as a lighting design strategy rather than a detailed design solution. It is recommended that the lighting strategy outlined in this report is adopted including criteria, luminaire types, switching methods, lamp types etc by the developer's designers when undertaking the full external lighting design of the site.

1.2 Objectives

The general objective of this report is to assess the impact of a suitable lighting scheme for the proposed site on the surrounding area and environment. Also, it includes a record of the existing lighting conditions to allow reference to be made during the planning process. Commentary is also made in areas that are considered key focal points in the success of the redevelopment works.

Specific objectives of the proposed lighting scheme when fully designed include:

- To limit light pollution and sky glow
- To limit obtrusive light, spill light / trespass light and glare to neighbouring land and properties
- To mitigate the effects of the lighting scheme on bats
- To provide an adequate level of illuminance for the proposed exterior areas, in accordance with the CIBSE guidance and Clients requirements
- To provide a suitable lighting control strategy to minimise energy consumption and meet BREEAM aspirations.

2 STANDARDS AND GUIDANCE DOCUMENTS

2.1 Referred Units and Terminology

Where referred to in the report, the following units and terminology are used to define the associated lighting phenomena and/or illuminance plane

Candela:	unit used to define the intensity of a light source.
Lumen:	unit used to define luminous flux. 1 lumen is defined as the luminous flux passing through a 1-foot opening in the surface of a sphere with a radius of 1-foot and a 1-candela light source at its centre.
Lux:	unit used to define illumination. 1 lux is equal to 1-lumen falling on an area of 1-square meter.
Horizontal Light Level:	the illumination on a horizontal plane. Readings taken with the light meter in the horizontal position
Vertical Light Level:	the illumination on a vertical plane. Readings taken with the light meter in the vertical position.
Maximum Vertical Light Level:	the illumination measured on the vertical plane with the meter facing the brightest light source.
Line of Sight:	term used to express the condition in which a person's view is directly in line with a light source.
Spill Light:	for the purpose of this report spill light can be defined as the illumination that is produced by a light source or light sources at a point or surface on which the light is not intended or desirable.
Glare:	the discomfort or impairment of vision experienced when the image is excessively bright compared to the general surroundings.

2.2 Assessment Criteria

The light spill study has been completed with reference to the following industry standard guidelines:

- CIE 150:2003 – Guide on the limitation of the effects of obtrusive light from outdoor lighting installations.
- ILP: Guidance Notes for the Reduction of Obtrusive Light GN01:2011
- SLL Code for Lighting
- SLL Lighting Guide LG6: The exterior environment
- BS EN 12464-2
- ILP Guidance note PLG 05 – The Brightness of Illuminated Advertisements

Regulating Light Spill

The following tables are excerpts from the Guidance Notes for the Reduction of Obtrusive Light by the Institute of Lighting Engineers. The tables provide the limits of illuminance to minimise light spill, depending on environmental zones.

Different environmental zones are established within the UK to determine the required limitations for lighting installations depending on the surrounding environment that the development is being placed in. Table 1 below shows the various environmental zones.

Table 2.1 Guidance Notes for the Reduction of Obtrusive Light by the Institute of Lighting Engineers

Obtrusive Light Limitations for Exterior Lighting Installations – General Observers						
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	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

Environmental Zone:

E0 – Protected surrounding, dark lighting environment
E1 – Natural surroundings, intrinsically dark lighting environment
E2 – Rural surrounding, low district brightness lighting environment
E3 – Suburban surrounding, medium district brightness lighting environment
E4 – Urban surrounding, high district brightness lighting environment

Abbreviations:

ULR = Upward Light Ratio of the installation
Ev = Vertical illuminance in Lux
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.
* = Permitted only from only public road lighting installations

Table 2.2 Guidance Notes for the Reduction of Obtrusive Light by the Institute of Lighting Engineers

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

⁽¹⁾ Road Classification:

As defined in EN 13201-2(2015) road lighting performance requirements

Abbreviations:

TI = Threshold increment
Lv = Veiling luminance

For the purpose of comparison with the collated baseline readings, the current environmental zone for the site is considered to be best represented by E3– Suburban surrounding, medium district brightness lighting environment.

Based upon the above, the two main criteria which need to limit obtrusive light for general observers are:

- Light trespass on the vertical plane of any adjacent building should be less than 10 lux pre- curfew and less than 2 lux post curfew.
- Source Intensity of the luminaire should be less than 10,000cd pre- curfew and less than 1,000cd post curfew.

It shall be noted that these figures are for guidance only and can be supplemented or replaced by the Local Planning Authorities own guidance on sky glow ULR, light intrusion, luminaire intensity and specific pre-curfew and post-curfew limitations defined within planning approval requirements.

3 BASELINE CONDITIONS

3.1 Methodology

At various points within the immediate surroundings of the development, a horizontal illuminance reading is presented which was taken at floor level with the light meter orientated to aim straight up. Additional vertical illuminance readings are taken with the light meter orientated directly towards the development and when deemed relevant, away from it. These measurements are taken at 2m above ground level.

The illuminance levels presented within the results is the measurement of a single point reading of lux at the relevant location.

Locations of measurement positions are as indicated in the map below, with the associated GPS coordinates and light level being imposed provided within section 3.3 of this report.

Figure 3.1 Measurement positions



Measurements were taken at a distance up to 500m from the proposed development. Measurement points are set at circa 40 to 50m intervals in the immediate surrounding- 150m radius- of the site (points 11 to 25). Further measurements were taken at areas where residents are most likely to be affected within a 500m radius of the Stadium. This primarily focuses on the residential buildings North of Viaduct Road (points 5 to 8) and South of Philips Park (points 26 to 29) as indicated above. Also, measurements along the pedestrian route next to the Ashton canal were recorded as the canal is an identified bat corridor (points 18-23 and 26,27).

Where measurement points are located local to residential properties, the readings are taken as close to the residential boundary as possible whilst keeping within the public realm.

3.2 Test Apparatus

Instrument: Konica Minolta illuminance meter
Model: T-10
Serial Number: 61731077-41721019

3.3 Field Results

The following observations are made for the baseline spill light levels taken at key point areas around the site.

Readings are intended to establish existing conditions for future comparison and are not intended to be a random sampling that would be required in order to determine a statistical average for the given area and street.

It shall be noted that the survey carried out is an initial study to obtain the base-line spill lighting conditions within immediate surrounding of the proposed development. Pictures of key location areas are included in Appendix A.

To obtain the base-line spill lighting conditions within the immediate surrounding of the proposed works area, a survey was carried out on 12th of September 2019. The survey was carried out during low-light hours (21.30-00.00). The measurements, reflect the present lighting conditions. Any light generated by other external sources (e.g. floodlighting during a match day) that were not on at the time of the survey would alter the readings.

Table 3.1 Measurement coordinates and illuminance values

Point	GPS Coordinates	Illuminance		
		Horizontal	Vertical	
			Towards the Site	Away from the Site
1	53°28'54"N 2°12'12"W	30.12	11.71	5.06
2	53°29'02"N 2°12'20"W	4.50	0.32	2.37
3	53°29'04"N 2°12'21"W	14.61	1.61	-
4	53°29'08"N 2°12'22"W	10.43	0.33	-
5	53°29'18"N 2°12'18"W	4.52	7.92	0.31
6	53°29'20"N 2°12'21"W	4.43	6.06	-
7	53°29'22"N 2°12'18"W	4.05	26.05	-
8	53°29'25"N 2°12'11"W	13.72	10.63	6.56
9	53°29'21"N 2°12'03"W	30.21	10.56	11.01
10	53°29'23"N 2°12'03"W	10.08	6.41	-
11	53°29'14"N 2°11'55"W	17.93	3.66	-
12	53°29'13"N 2°11'57"W	2.34	0.38	2.22
13	53°29'13"N 2°12'00"W	12.58	0.51	8.79
14	53°29'13"N 2°12'02"W	36.53	1.21	22.02
15	53°29'12"N 2°12'05"W	51.35	0.90	21.51
16	53°29'11"N 2°12'05"W	12.24	0.32	2.93
17	53°29'10"N 2°12'04"W	32.62	0.85	8.45
18	53°29'08"N 2°12'04"W	11.99	3.42	4.47
19	53°29'08"N 2°12'01"W	4.02	1.00	0.22
20	53°29'08"N 2°11'58"W	4.32	0.98	0.54
21	53°29'08"N 2°11'58"W	9.01	25.41	0.28
22	53°29'08"N 2°11'55"W	3.43	7.23	0.67
23	53°29'09"N 2°11'53"W	5.36	2.51	2.45
24	53°29'11"N 2°11'54"W	1.23	1.61	0.19
25	53°29'12"N 2°11'55"W	2.42	0.07	1.6
26	53°29'09"N 2°11'51"W	3.92	0.26	2.65
27	53°29'09"N 2°11'51"W	3.43	1.17	0.23
28	53°29'13"N 2°11'43"W	10.81	0.28	0.15
29	53°29'13"N 2°11'30"W	11.80	16.04	6.67
30	53°28'54"N 2°11'41"W	13.57	2.73	8.35

3.4 **Comments**

The proposed site is surrounded by areas that could be sensitive to light such as parks, residential blocks and the canal.

The Etihad Campus on the south of the site obstructs direct view from the residencies located south of Ashton New Road and potential light spill to them (points 1 and 2).

Areas within 500m west of the New Viaduct Street are not subject to glare or ambient light spill from the site as they are obstructed by the foliage of trees next to the trainline (points 3 to 7). Also, they are at lower level than the site. The road is lit by street lighting and it slopes down towards the north where views to the site are obstructed by a rail bridge (point 8).

On the west the main contribution of ambient illumination is by the street lights illuminating Alan Turing Way (points 9 to 11, 23 to 25 and 30). The light levels are quite high as this is a traffic route for motorized vehicles of medium to high driving speeds with conflict areas e.g. intersections and pedestrian passages.

The residential area south of Philips park is at lower level than the site. There is a direct line of sight from the buildings adjacent to Alan Turing Way (points 26 and 27) but not from other location in this area. The horizontal light levels next to the park are quite high (points 28 and 29). These streets are well lit by post top luminaires.

Figure 3.2 Residential buildings with direct line of sight to the Site



In a radius within 150m of the ground the only sensitive area is the canal which is currently lit by LED lighting columns (points 18 to 23 and 26). The vertical light levels are high with light spilling onto the surface and the area above the canal, due to the contribution of light from the street columns. During the site survey we recorded bats flying above the canal.

Figure 3.3 Light columns by the canal West of Allan Turing Way



The part of the canal which is east of Alan Turing Way is lit mainly by bollards.

Figure 3.4 Lighting bollards east of Allan Turing Way



Areas further than 500m from the site are very unlikely to suffer from light spill (due to distance) or direct glare from a façade installation.

4 PROPOSED LIGHTING SCHEME

4.1 Recommended Lighting Values

The lighting levels have been designed in accordance with the site requirements and to mitigate as much as possible the site's impact on its surroundings and on local wildlife.

Amenity lighting aims to provide a safe and secure environment for pedestrian circulation. The recommended light levels for walkways exclusively for pedestrians is 5 lux according to SLL Code of lighting- General Areas in Outdoor Work Places

Recommended Luminance levels for signs/screens are provided in the ILP Guidance note PLG 05 – The Brightness of Illuminated Advertisements. The luminance limits are expressed in cd/sqm and are dependent on the size of the proposed signage.

Measurements for the external illumination of the signs is provided for both the illumination level and as a measurement of the building Luminance at the signage positions.

4.2 Minimising obtrusive Light, effect on bats and reducing Visual impact

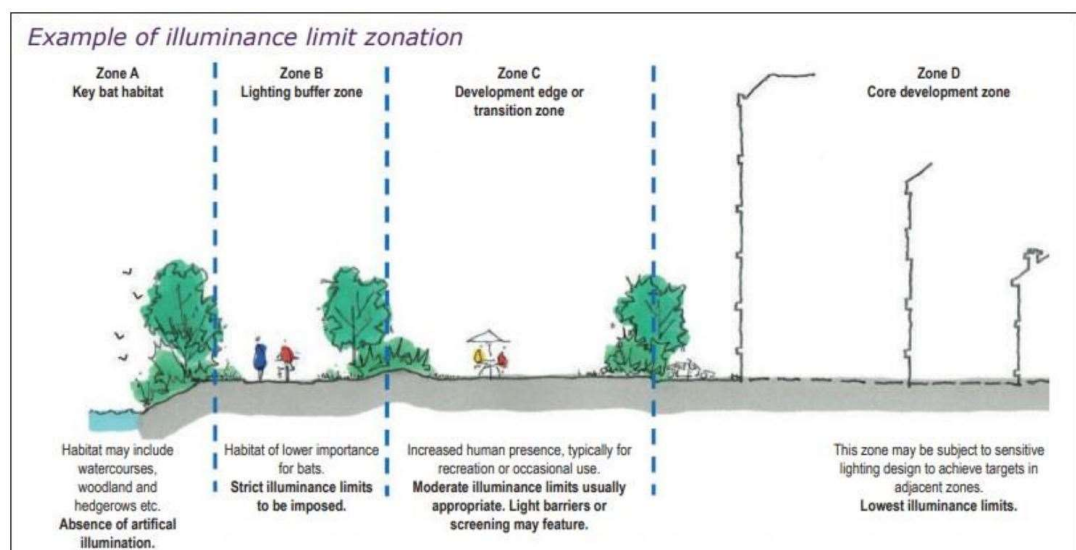
Careful consideration has been given to reduce the visual impact of the lighting installation during the day, whilst maintaining an adequate level of illuminance on the site. The perimeter of the building will be illuminated by luminaires recessed on the underside of the soffit. Amenity lighting will be supplemented by lighting columns. The aim is for the columns to have a simple design that blends with the architecture. Additional illumination will be provided by low level lighting incorporated in landscape elements.

Particular attention has been paid to minimise any obtrusive light, glare or sky glow produced by the artificial lighting installation. Wherever possible luminaires are orientated towards the site or mounted on the underside of the building soffit. The luminaire types with good light beam control have been chosen to reduce light spillage.

The facade is lit by luminaires located in an enclosed metal perforated panel. Light spill from the architectural lighting will be minimal as the lit effect is a result of the contrast between the dark exterior panel and the illuminated back surface.

Best practice guidance from the Institute of Lighting Professionals, in conjunction with the Bat Conservation Trust, is to avoid lighting on key habitats such as the canal corridor altogether with implementation of buffer zones between the development and the corridor. This means that any increase above existing light levels should be minimal. Therefore, light levels are kept to a minimum adjacent to the canal corridor.

Figure 4.1 Guidance Notes for the Reduction of Obtrusive Light by the Institute of Lighting Engineers



4.3 Lighting Controls

The luminaires will be controlled via a photocell to ensure that they are only switched on when required. The lighting should be switched on for dusk and off for dawn. The controls should be integrated to the BMS system to ensure that lights switch on and off together.

To minimise the light impact on surrounding areas as much as possible, a part-lighting strategy will be adopted where only part of the exterior lighting will be switched on at times when the venue is not in use.

The light output of the media screens should be adjustable and respond to daylight availability. During low light hours the luminance should not be higher than the suggested values.

5 PROPOSED LIGHTING INSTALLATION THE LIGHTING SCHEME

5.1 Façade Lighting

In order to accentuate the architectural features of the building by night, a façade lighting installation has been proposed. The desired effect is illustrated in Figure 5.1.

Figure 5.1 Illustrative visual of the façade lighting



It is suggested that the perforated panels of the top level of the building are backlit by linear LED luminaires as shown in Figures 5.2 and 5.3.

Figure 5.3 Section showing the luminaire locations

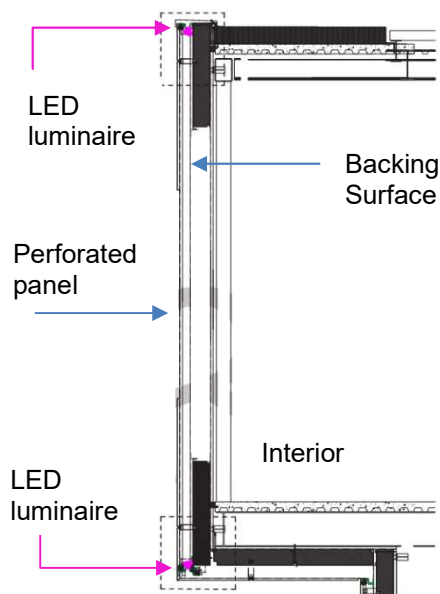
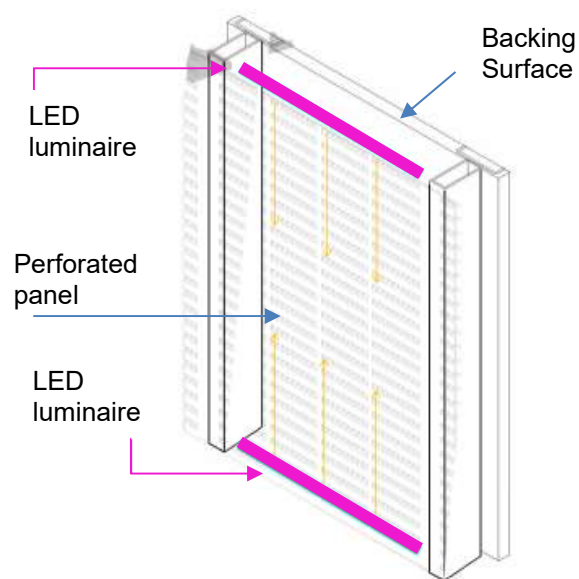


Figure 5.2 Axonometric view of a facade section



The light fittings will be installed between the perforated cladding panels and the backing surface behind these panels, Figure 5.2. Luminaires installed on the bottom of the panels will be aiming upwards and luminaires on the top of the panel will be aiming downwards. The illuminated backing panel will be visible through the perforations as shown in Figure 5.4.

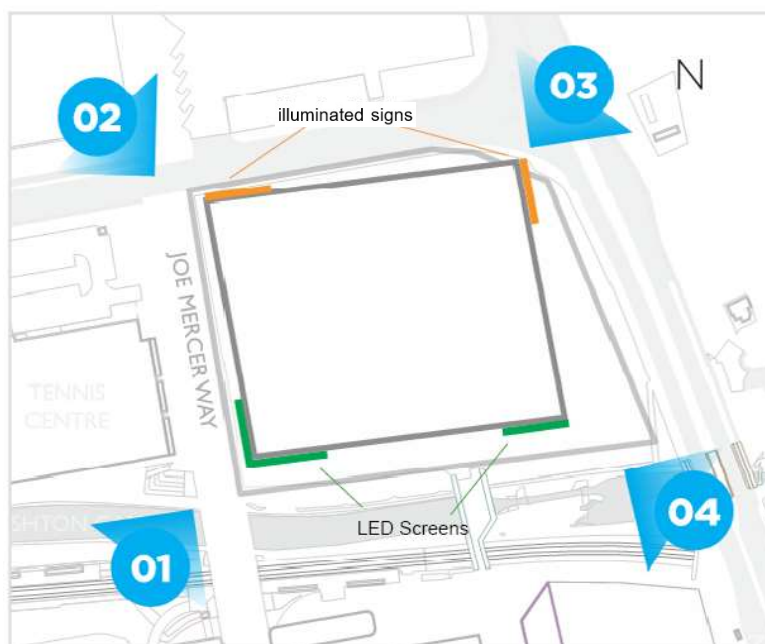
Figure 5.4 Full scale mock up showing the lit effect through the perforated panel



5.2 LED Screens

It is suggested that three LED screens and two illuminated signs are installed on the fifth level of the building as shown on Figure 5.5.

Figure 5.5 Illuminated signs and Commercial Activation LED Screens

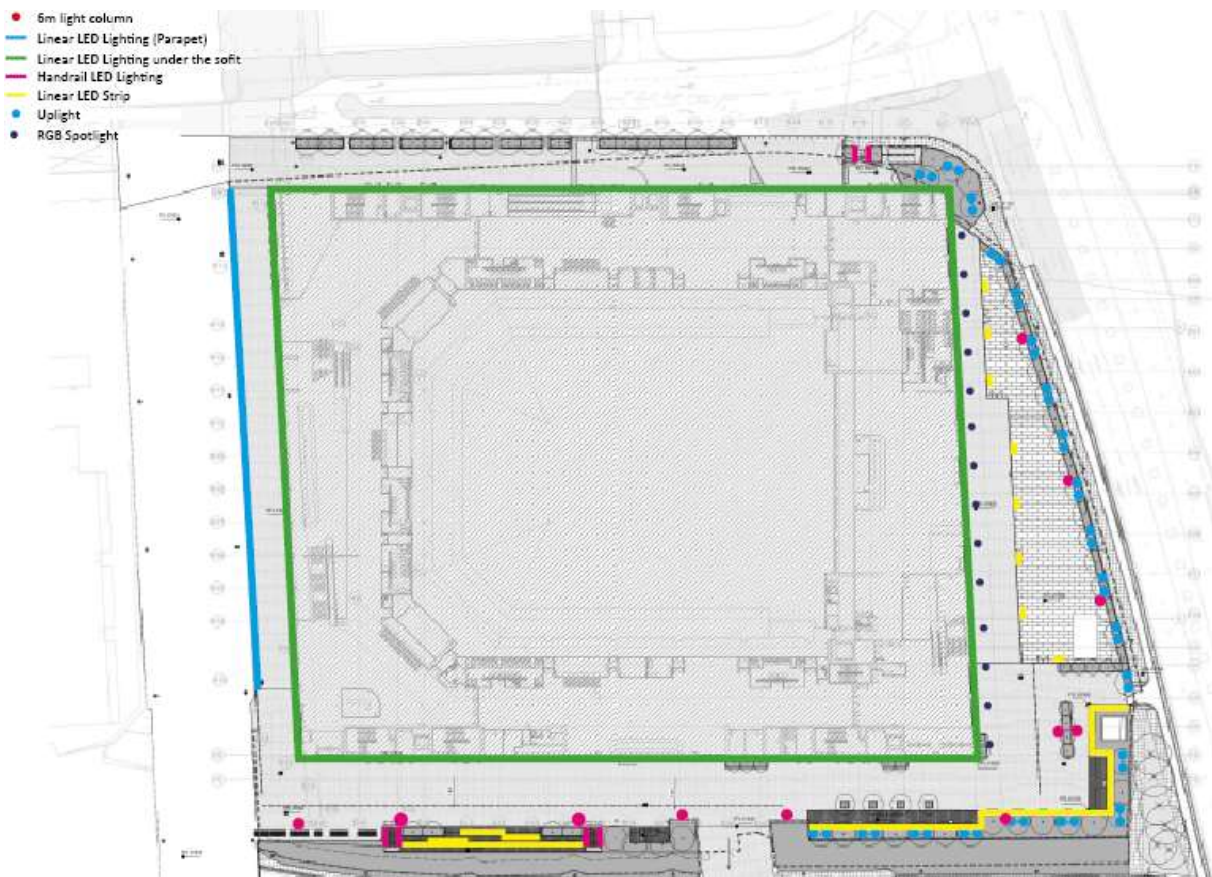


The LED video design approach intends to maintain the transparency of the perforated facade to allow the architectural backlighting to be visible when the video is not in use.

5.3 Amenity Lighting

The amenity lighting consists of LED columns, Linear LED Lighting under the soffit and along the parapet as well as handrail lighting. LED strips incorporated in street furniture and a few uplights are considered to provide areas of interest to the visitors. Figure 5.6 shows the landscape lighting layout (Appendix C)

Figure 5.6 Lighting Layout



The typology of luminaires was chosen, based on the recommendations of ILP's 'Guidance Notes for the Reduction of Obtrusive Light GN01:2011'. All luminaires are utilising LED sources sensitively positioned into the body of the luminaire to avoid glare while suitable optics provide directional light to illuminate the task area and minimise spill light to the surrounding area. All general lighting luminaires use full-cut optics (no upward light component). There are a few uplights considered for the illumination of trees around the site. These fittings should have narrow optics and gimbal that allows for the light to concentrate onto the tree trunk. A brief description of the luminaires can be found in Table 5.1.

Table 5.1 Luminaire Schedule

Symbol	Example Image	Indicative Manufacturer/ Product Code	Indicative Description
		Technilum Micado PM	6m LED lighting column
		Tryka Continuity	Linear LED integrated in the parapet
		Optelma Quad 100	Recessed LED luminaire under the soffit
		Footfall Lighting Spot	LED integrated within the handrail
		Tryka Continuity	Linear LED integrated under benches/ furniture
		GVA Lira RGBW	Colour changing LED spotlight recessed under the soffit
		Targetti Keplero Gimbal	LED uplight with narrow beam distribution
		Ligman Leeds 6	Wall mounted LED luminaire

Assessment Methodology

An appropriate lighting scheme for the site has been assessed using the industry software, Dialux.

Dialux is a computer lighting simulation tool which utilizes 3D modelling to model the output of chosen light fittings.

The following factors and assumptions have been used in the calculation:

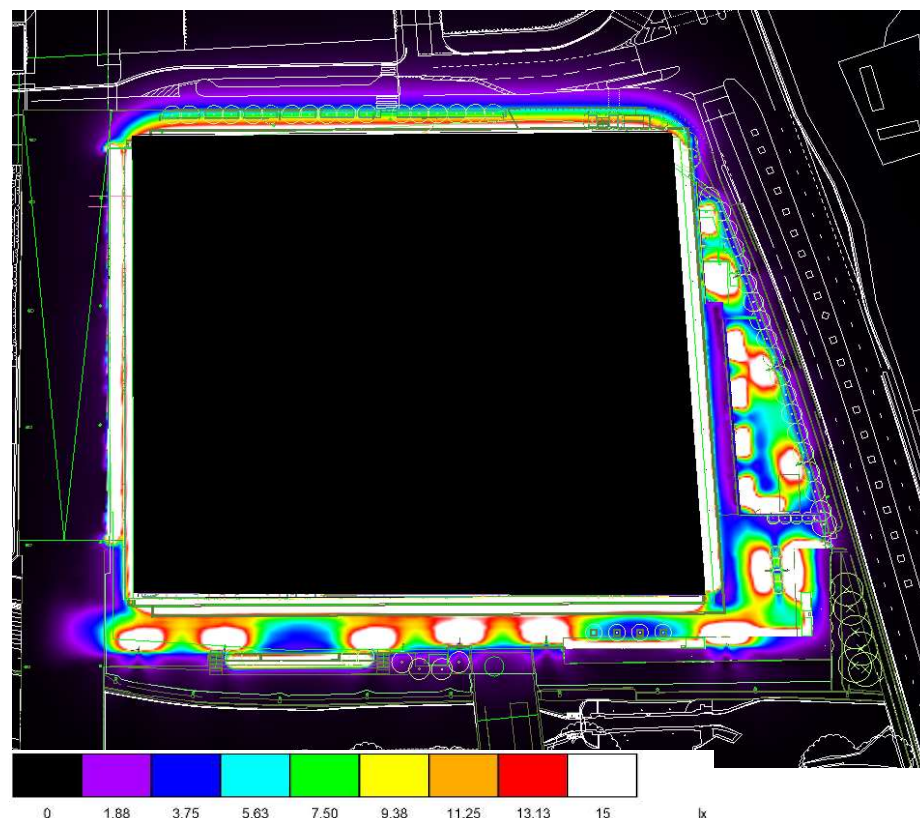
- Ground reflectance set at 10% and external surfaces in general set at 20%;
- Surrounding trees have not been included in the calculation as the various species and shapes cannot be accurately modelled. It is assumed most will be deciduous and the amount of cover offered will be reduced during the winter season. However, it should be noted that the old and new trees in this area will provide further reduction to any spill light and visual impact of the brightness to the Site;
- This assessment technique simulates and calculates the proposed combined total lighting lumen output (worst case scenario) of the new development. The assessment takes not into account the existing lighting installation. All lighting has been assessed at 100% output;

The rendering of the results has been shown in 'pseudo colour' format in Figure 5.7. This figure demonstrates visually where the lighting (illuminance) will potentially be distributed on the horizontal plane and the quantity of light (lux) on this level.

Areas with illuminance above 15lx appear white. Red illustrates areas with illuminance levels between 13.13lx and 15lx. Orange illustrates areas with illuminance levels between 11.25lx and 13.13lx etc. Finally, areas with illuminance less than 1.88lx appear black.

From Figure 5.7 we can see that most of the light is concentrated within the site boundary. The illuminance fades gradually to zero in the close vicinity to the new development.

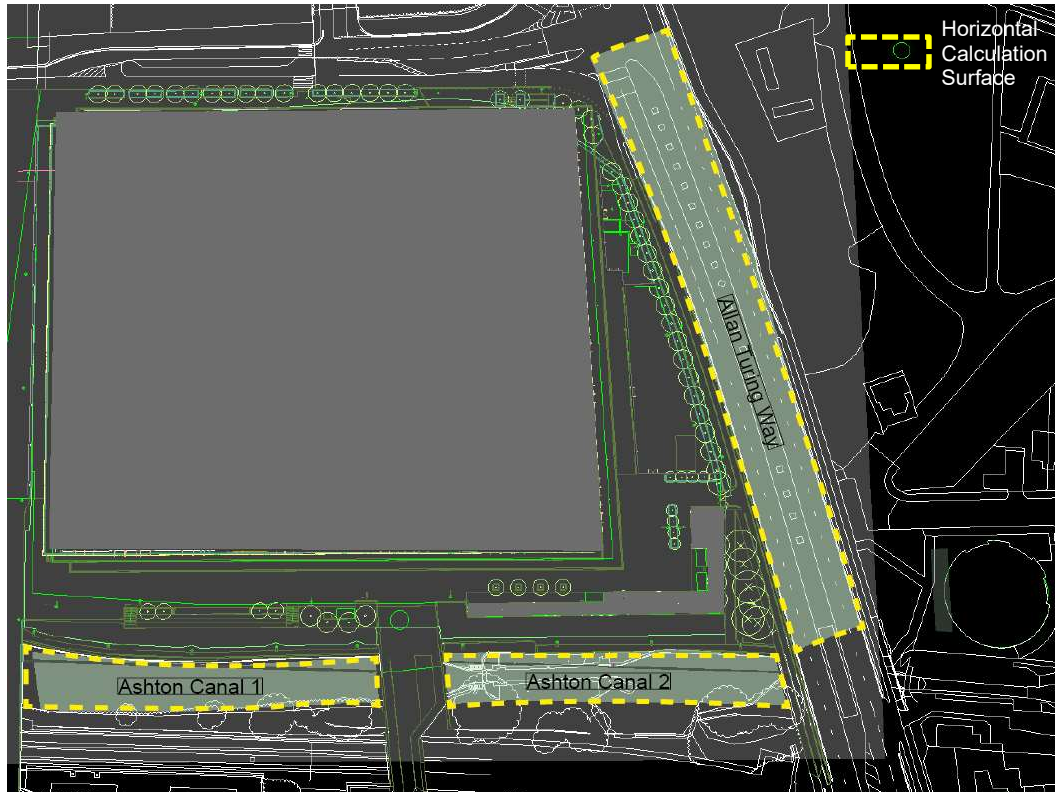
Figure 5.7 Visual Extract from lighting calculation model with lighting effect shown in pseudo colour



Calculation results measured on calculation grids in the model are shown for identified receptors.

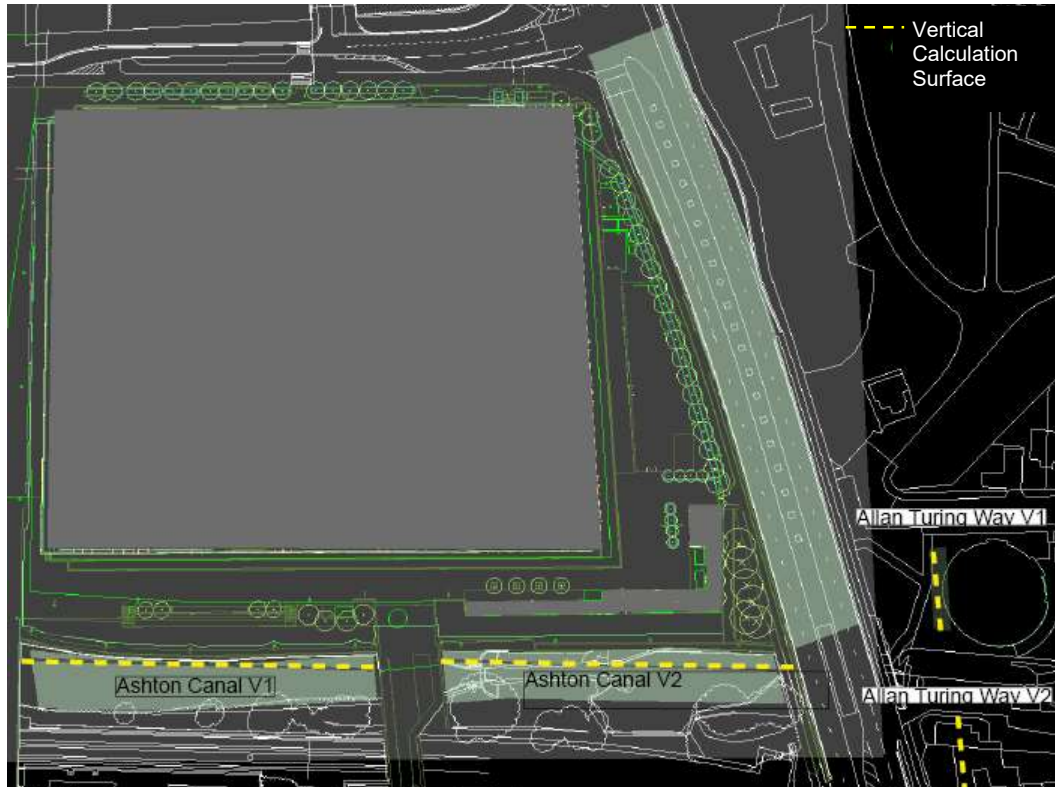
The yellow dashed areas in Figure 5.8 illustrate the three horizontal calculation grids. Two calculation grids are placed along Ashton Canal (Ashton Canal 1 and Ashton Canal 2) and one is along Allan Turing Way.

Figure 5.8 Horizontal Spill light Calculation surfaces



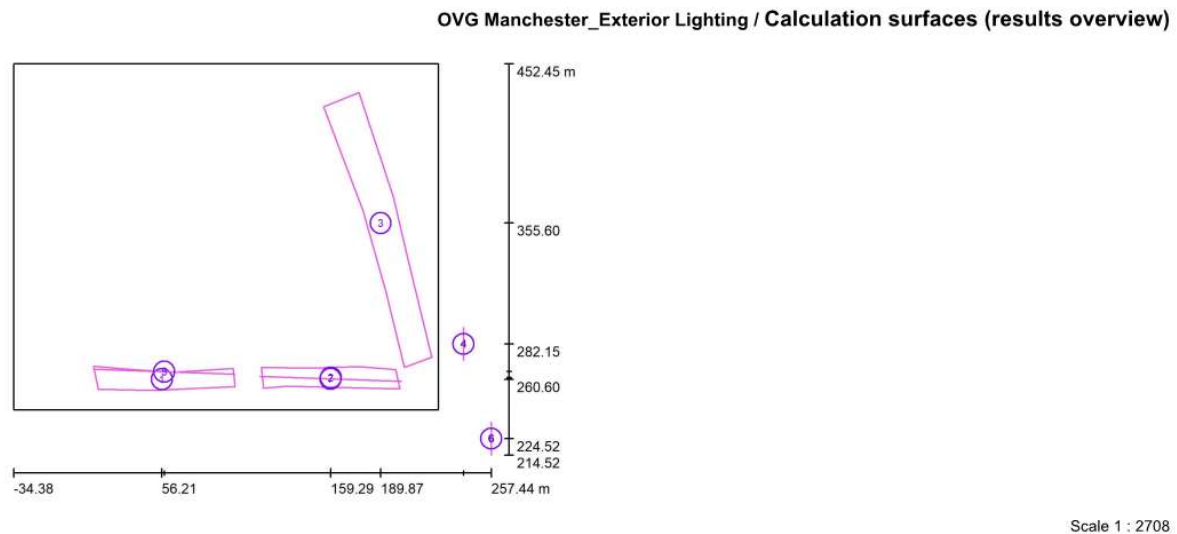
Additionally, illuminance levels were measured on four vertical grids. The location of each grid is identified with a yellow dashed line in Figure 5.9. Two grids are placed along Ashton Canal (Ashton Canal V1 and Ashton Canal V2) and two in front of properties east of Allan Turing Way (Allan Turing Way V1 and Allan Turing Way V2).

Figure 5.9 Vertical Spill light Calculation surfaces



The calculation results for each one of these grids is shown in Figure 5.10.

Figure 5.10 Lighting simulation- calculation results



Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
1	Ashton Canal 1	perpendicular	87 x 14	0.11	0.05	0.22	0.449	0.226
2	Ashton Canal 2	perpendicular	85 x 13	0.08	0.03	0.20	0.300	0.125
3	Allan Turing Way	perpendicular	168 x 24	0.11	0.02	0.68	0.157	0.024
4	Allan Turing Way V1	perpendicular	30 x 20	0.16	0.13	0.20	0.784	0.635
5	Ashton Canal V1	perpendicular	20 x 57	0.73	0.44	1.21	0.600	0.364
6	Allan Turing Way V2	perpendicular	30 x 20	0.06	0.05	0.08	0.808	0.660
7	Ashton Canal V2	perpendicular	57 x 20	0.66	0.23	0.95	0.348	0.244

From the results on the calculation surfaces 1 to 3 we can conclude that the spill light on horizontal surfaces is minimal. The maximum illuminance (E_{max}) value is 0.68lx on Allan Turing Way and 0.22lx on the canal. There are no maximum target values that the development needs to achieve.

The average illuminance (E_{av}) on the vertical surfaces along the canal is 0.73lx at the Ashton Canal V1 surface and 0.66lx at the Ashton Canal V2 surface. The maximum value is 1.21lx. These illuminance levels are relatively low. As a reference the vertical values of the existing baseline condition measured along the canal path vary from 0.98lx to 25.41lx (Table 3.1 points 19 to 22).

Both residencies east of Allan Turing Way receive very low illuminance from the site. The maximum illuminance value (E_{max}) is 0.20lx. The light intrusion into windows as shown in Table 2.1 is 10lx.

The calculations have been included in Appendix B.

6 CONCLUSIONS

6.1 Comments

The light spill onto sensitive areas from the Site will be very limited.

At full output and without accounting for obstructions (e.g. trees) the light contribution of the proposed exterior lighting installation to the surrounding area is very low. The highest values are identified on the vertical surface along the Ashton Canal, but it has to be noted that the calculations do not take into account obstructions (e.g. trees) which will minimise further the light spill from the site.

According to the Highway Safety Report prepared by Curtins the façade lighting would be visible from the roads surrounding the Site but there are no underlying road safety issues and it would present a low risk to road safety (074369-CUR-00-XX-RP-TP-001-V02 paragraph reference 7.2.1)

6.2 Summary

The exterior illumination of the landscape and the façade of the Proposed Development could have an impact on the surrounding areas.

The areas most likely to be affected by the lighting installation at the Proposed Development are the canal, Allan Turing Way and the buildings east of Alan Turing Way.

As the canal is a bat corridor, light levels should be kept to a minimum. A new installation of exterior lighting might add to the existing light levels. The proposed design demonstrates that it is possible to provide a solution that does not contribute significantly to the illuminance of this area.

Light spill on Allan Turing Way should also be controlled. The proposed lighting installation contributes minimum light levels to this area as well.

The residential buildings east of Allan Turing Way have a direct line of sight to the site. The installation of an illuminated facade on the top level of the building and media screens on the south elevation could create high contrast with the night time sky and would be visible from these buildings. The contrast can be minimised with the installation of a lighting control system which will allow the lighting to be dimmed according with the daylight availability.

The façade illumination imposes no underlying road safety issues and would present a low risk to road safety.

In conclusion the new development could affect some surrounding residencies as well as the bat corridor. The proposed design showcases that with careful design and luminaire selection it is possible to illuminate the Site while limiting the light spill to the surrounding areas.

APPENDIX A: SURVEY PHOTOS

	Calculation Point: 1 (View towards the site) Subject: Etihad Stadium and Manchester Regional arena High illuminance levels due to the street lighting. Additional flood lighting during match days
	Calculation Point: 1 (View away from the site) Subject: Properties South of Ashton New Road The Etihad Campus obstructs direct view of the site from these properties
	Calculation Point: 4 Subject: View up New Viaduct Street Subsidiary road lit by LED lighting columns. Foliage next to the rail lines
	Calculation Point: 5 Subject: View down New Viaduct Street Subsidiary road lit by LED lighting columns. Foliage next to the rail lines obstructs direct view of the site



Calculation Point: 3
Subject: View up New Viaduct Street

Subsidiary road lit by LED lighting columns. Foliage next to the rail lines obstructs direct view of the site



Calculation Point: 6
Subject: View up Barking Street

Subsidiary road lit by LED lighting columns



Calculation Point: 7
Subject: View down Broxton Street

Residential road lit by LED lighting columns. Road at lower level than the site. Properties subjected to no light spill or glare from the site as they sit at lower level. Also, the rail bridge provides an obstruction



Calculation Point: 8
Subject: View up Alan Turing Way

Highway illuminated by LED lighting columns



Calculation Point: 8
Subject: View down Alan Turing Way

Highway illuminated by LED lighting columns



Calculation Point: 10
Subject: View down Alan Turing Way

Highway illuminated by LED lighting columns



Calculation Point: 15
Subject: View down Joe Mercer Way

Street illuminated by LED lighting columns



Calculation Point: 15
Subject: View from Joe Mercer Way to the site

Highway illuminated by LED lighting columns



Calculation Point: 18
Subject: View east on the canal

Canal path illuminated by LED lighting columns



Calculation Point: 23
Subject: View west on the canal

Canal path illuminated by LED lighting columns



Calculation Point: 24
Subject: View southeast to residential building

Highway illuminated by LED lighting columns. Building has direct line of sight to the site



Calculation Point: 23
Subject: View southeast to residential building

Highway illuminated by LED lighting columns. Building has direct line of sight to the site



Calculation Point: 25
Subject: View down Alan Turing Way

Highway illuminated by LED lighting columns



Calculation Point: 25
Subject: View up Alan Turing Way

Highway illuminated by LED lighting columns



Calculation Point: 26
Subject: View east to the canal

Canal illuminated by bollards. Illuminance contribution from Alan Turing Street lighting



Calculation Point: 28
Subject: View down Wesham Road

Street illuminated by LED lighting columns



Calculation Point: 28

Subject: View up Wesham Road to the park

Street illuminated by LED lighting columns



Calculation Point: 30

Subject: View up Alan Turing Way

The Etihad Campus obstructs direct view to the site

APPENDIX B: LIGHTING CALCULATIONS

OVG Manchester_Exterior Lighting / Planning data

Maintenance factor: 0.80, ULR (Upward Light Ratio): 0.5%

Scale 1:2206

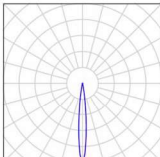
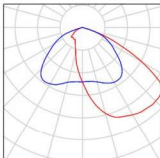
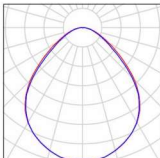
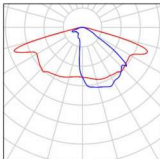
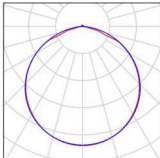
Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	45	GVA Lighting Inc. LIRA2-CM-10W-RGBW65K-CA-10-DMX-24VDC-ALL ON (1.000)	384	384	7.8
2	7	LIGMAN LEE-30021-T4-W30 Leeds 6 Surface wall luminaires (1.000)	2044	2044	19.6
3	587	Optelma Architectural Lighting 11583-40 Quad 100 (Type 1)* (1.000)	371	500	12.6
4	11	Technilum_Dizeo 24W_simulated Technilum_Dizeo 24W_simulated_3000K (1.000)	3487	3660	24.0
5	189	TRYKA L.E.D. LTD 1210 TRY-FLEX120-WWH-30-1M-12V (Type 1)* (1.000)	720	720	8.8

OVG Manchester_Exterior Lighting / Planning data**Luminaire Parts List**

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
6	30	TRYKA L.E.D. LTD 1210 TRY-FLEX120-WWH-30-1M-12V (Type 2)* (1.000)	450	450	8.8
*Modified Technical Specifications			Total: 437186	Total: 514931	10079.5

OVG Manchester_Exterior Lighting / Luminaire parts list

45 Pieces	GVA Lighting Inc. LIRA2-CM-10W-RGBW65K-CA-10-DMX-24VDC-ALL ON Article No.: Luminous flux (Luminaire): 384 lm Luminous flux (Lamps): 384 lm Luminaire Wattage: 7.8 W Luminaire classification according to CIE: 95 CIE flux code: 93 95 98 95 100 Fitting: 1 x User defined (Correction Factor 1.000).	See our luminaire catalog for an image of the luminaire.	
7 Pieces	LIGMAN LEE-30021-T4-W30 Leeds 6 Surface wall luminaires Article No.: LEE-30021-T4-W30 Luminous flux (Luminaire): 2044 lm Luminous flux (Lamps): 2044 lm Luminaire Wattage: 19.6 W Luminaire classification according to CIE: 100 CIE flux code: 41 79 98 100 100 Fitting: 1 x 12 LED 3000K (Correction Factor 1.000).	See our luminaire catalog for an image of the luminaire.	
587 Pieces	Optelma Architectural Lighting 11583-40 Quad 100 (Type 1) Article No.: 11583-40 Luminous flux (Luminaire): 371 lm Luminous flux (Lamps): 500 lm Luminaire Wattage: 12.6 W Luminaire classification according to CIE: 100 CIE flux code: 60 88 97 100 74 Fitting: 1 x User defined (Correction Factor 1.000).	See our luminaire catalog for an image of the luminaire.	
11 Pieces	Technilum_Dizeo 24W_simulated Technilum_Dizeo 24W_simulated_3000K Article No.: Luminous flux (Luminaire): 3487 lm Luminous flux (Lamps): 3660 lm Luminaire Wattage: 24.0 W Luminaire classification according to CIE: 99 CIE flux code: 36 70 94 99 95 Fitting: 1 x Osram_Oslon_Square_Gen3_2x6_ (Correction Factor 1.000).	See our luminaire catalog for an image of the luminaire.	
189 Pieces	TRYKA L.E.D. LTD 1210 TRY-FLEX120-WWH-30-1M-12V (Type 1) Article No.: 1210 Luminous flux (Luminaire): 720 lm Luminous flux (Lamps): 720 lm Luminaire Wattage: 8.8 W Luminaire classification according to CIE: 99 CIE flux code: 48 81 98 99 100 Fitting: 1 x User defined (Correction Factor 1.000).	See our luminaire catalog for an image of the luminaire.	

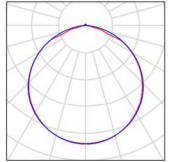


Operator
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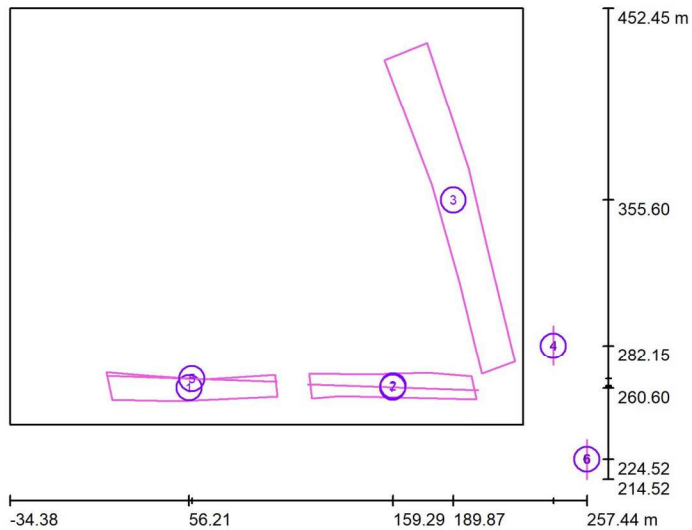
OVG Manchester_Exterior Lighting / Luminaire parts list

30 Pieces TRYKA L.E.D. LTD 1210 TRY-FLEX120-WWH-30-1M-12V (Type 2)
Article No.: 1210
Luminous flux (Luminaire): 450 lm
Luminous flux (Lamps): 450 lm
Luminaire Wattage: 8.8 W
Luminaire classification according to CIE: 99
CIE flux code: 48 81 98 99 100
Fitting: 1 x User defined (Correction Factor 1.000).

See our luminaire catalog for an
image of the luminaire.



OVG Manchester_Exterior Lighting / Calculation surfaces (results overview)



Scale 1 : 2708

Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1	Ashton Canal 1	perpendicular	87 x 14	0.11	0.05	0.22	0.449	0.226
2	Ashton Canal 2	perpendicular	85 x 13	0.08	0.03	0.20	0.300	0.125
3	Allan Turing Way	perpendicular	168 x 24	0.11	0.02	0.68	0.157	0.024
4	Allan Turing Way V1	perpendicular	30 x 20	0.16	0.13	0.20	0.784	0.635
5	Ashton Canal V1	perpendicular	20 x 57	0.73	0.44	1.21	0.600	0.364
6	Allan Turing Way V2	perpendicular	30 x 20	0.06	0.05	0.08	0.808	0.660
7	Ashton Canal V2	perpendicular	57 x 20	0.66	0.23	0.95	0.348	0.244

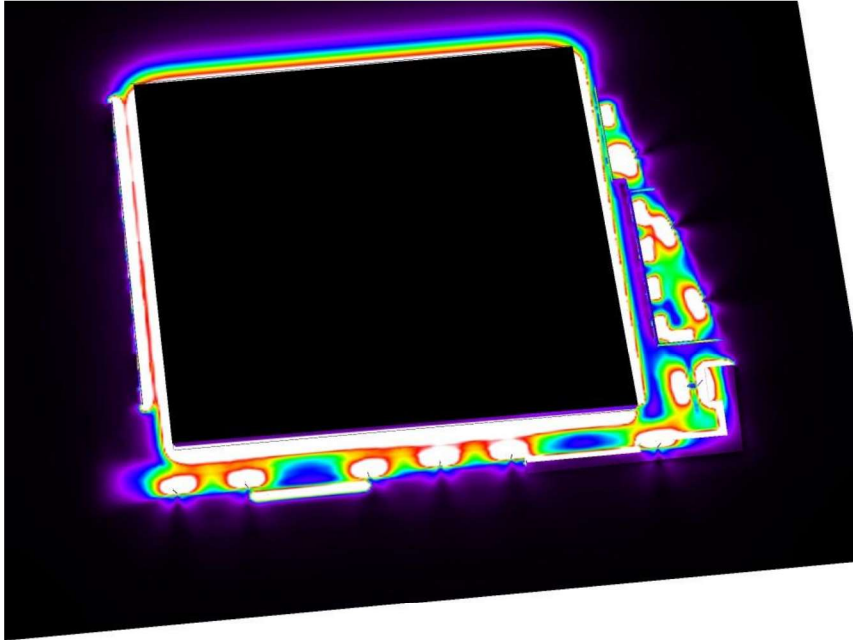
Summary of Results

Type	Quantity	Average [lx]	Min [lx]	Max [lx]	u0	E_{min} / E_{max}
perpendicular	7	0.37	0.02	1.21	0.04	0.01



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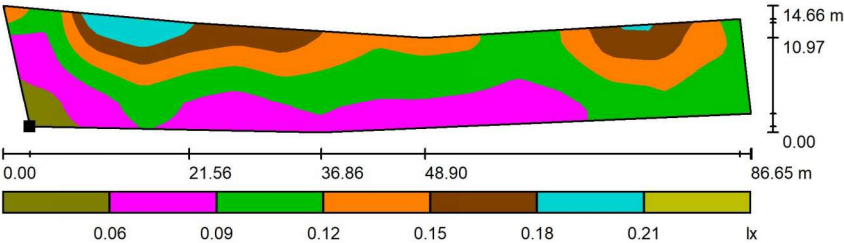
OVG Manchester_Exterior Lighting / False Colour Rendering



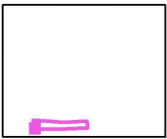


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OVG Manchester_Exterior Lighting / Ashton Canal 1 / Greyscale (E, Perpendicular)



Position of surface in external scene:
Marked point:
(17.456 m, 254.631 m, 0.000 m)



Scale 1 : 620

Grid: 87 x 14 Points

E_{av} [lx]
0.11

E_{min} [lx]
0.05

E_{max} [lx]
0.22

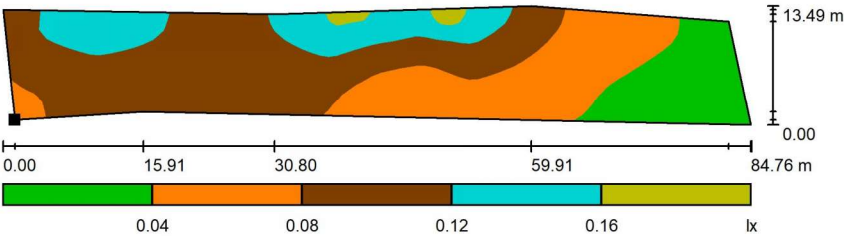
u_0
0.449

E_{min} / E_{max}
0.226



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OVG Manchester_Exterior Lighting / Ashton Canal 2 / Greyscale (E, Perpendicular)



Position of surface in external scene:
Marked point:
(118.220 m, 255.392 m, 0.000 m)



Scale 1 : 606

Grid: 85 x 13 Points

E_{av} [lx]
0.08

E_{min} [lx]
0.03

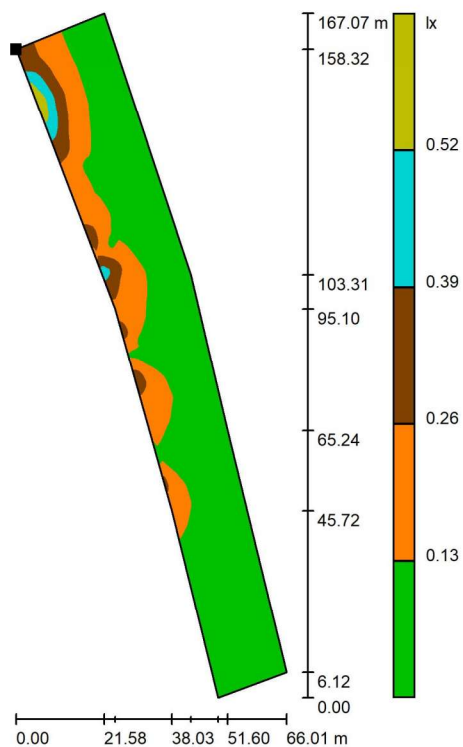
E_{max} [lx]
0.20

u_0
0.300

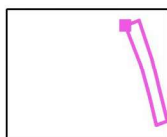
E_{min} / E_{max}
0.125

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OVG Manchester_Exterior Lighting / Allan Turing Way / Greyscale (E, Perpendicular)



Position of surface in external scene:
Marked point:
(154.969 m, 426.265 m, 0.000 m)



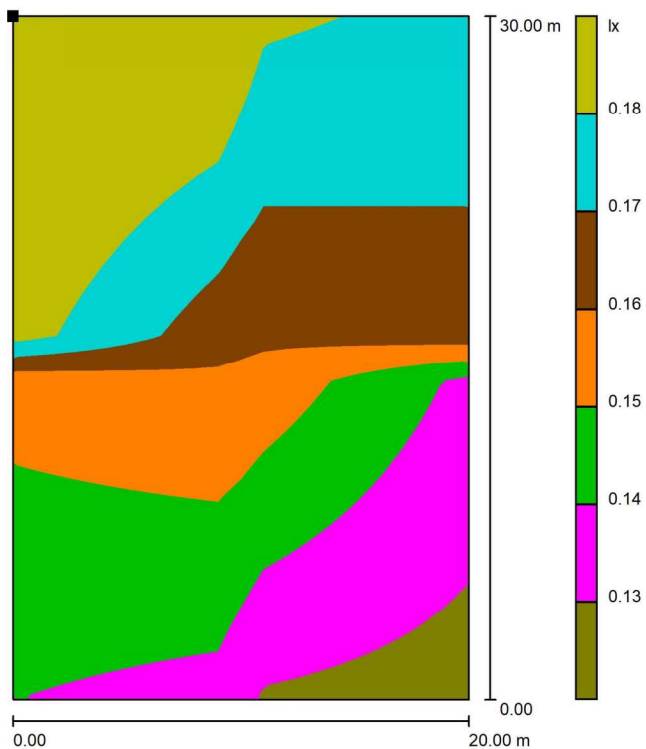
Scale 1 : 1307

Grid: 168 x 24 Points

 E_{av} [lx]
0.11 E_{min} [lx]
0.02 E_{max} [lx]
0.68u0
0.157 E_{min} / E_{max}
0.024

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OVG Manchester_Exterior Lighting / Allan Turing Way V1 / Greyscale (E, Perpendicular)



Position of surface in external scene:
Marked point:
(240.471 m, 292.153 m, 30.000 m)



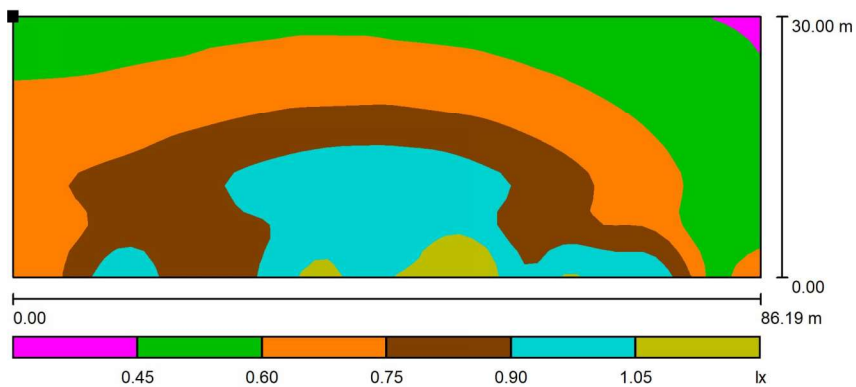
Scale 1 : 235

Grid: 30 x 20 Points

 E_{av} [lx]
0.16 E_{min} [lx]
0.13 E_{max} [lx]
0.20 $u0$
0.784 E_{min} / E_{max}
0.635

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Telephone
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OVG Manchester_Exterior Lighting / Ashton Canal V1 / Greyscale (E, Perpendicular)



Position of surface in external scene:
Marked point:
(100.701 m, 263.753 m, 30.000 m)



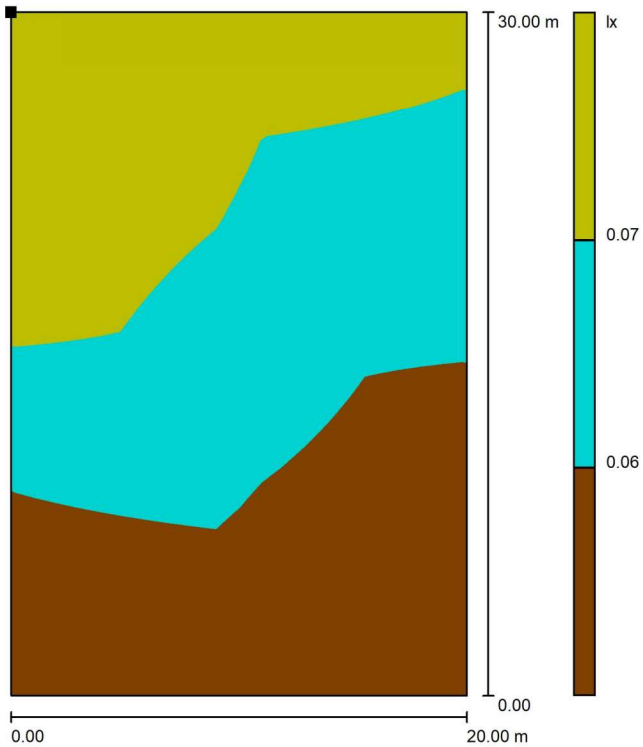
Scale 1 : 617

Grid: 20 x 57 Points

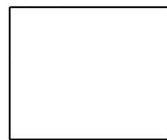
 E_{av} [lx]
0.73 E_{min} [lx]
0.44 E_{max} [lx]
1.21u0
0.600 E_{min} / E_{max}
0.364

Operator
Telephone
Fax
e-Mail

OVG Manchester_Exterior Lighting / Allan Turing Way V2 / Greyscale (E, Perpendicular)



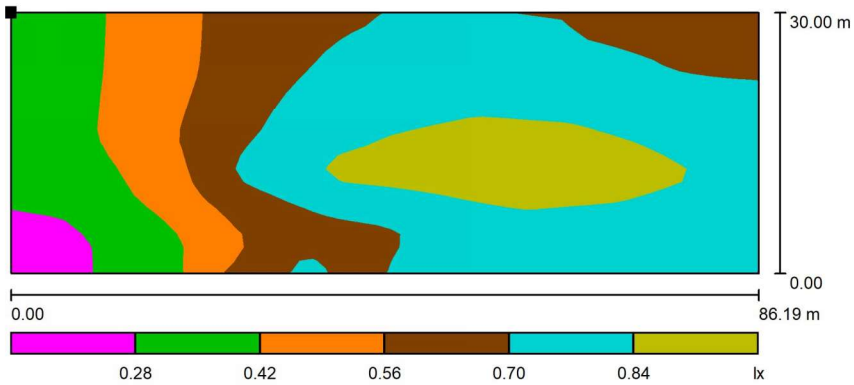
Position of surface in external scene:
Marked point:
(257.443 m, 234.520 m, 30.000 m)



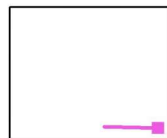
Scale 1 : 235

Grid: 30 x 20 Points

 E_{av} [lx]
0.06 E_{min} [lx]
0.05 E_{max} [lx]
0.08 u_0
0.808 E_{min} / E_{max}
0.660

Operator
Telephone
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Position of surface in external scene:
Marked point:
(202.358 m, 259.425 m, 30.000 m)



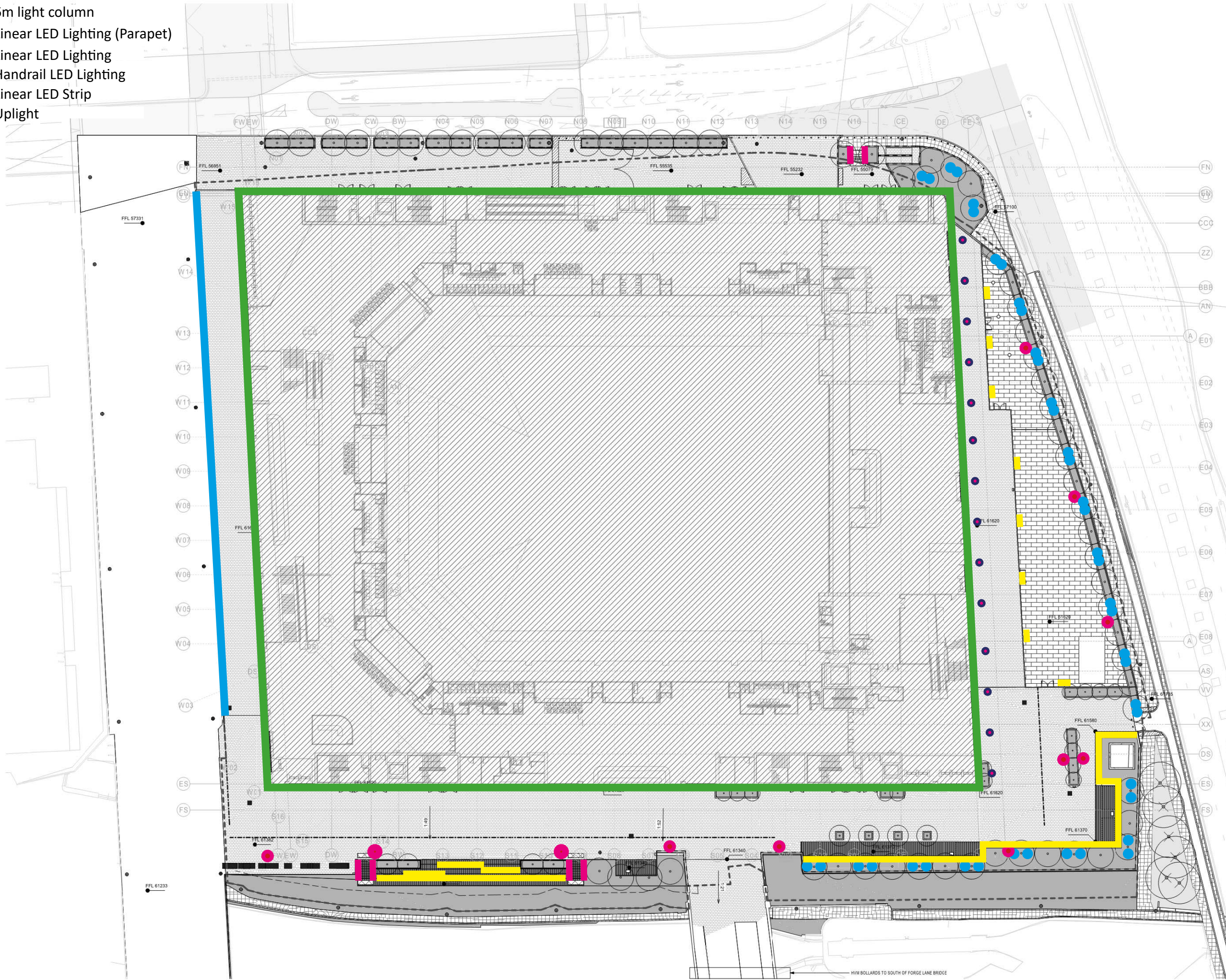
Scale 1 : 617

Grid: 57 x 20 Points

 E_{av} [lx]
0.66 E_{min} [lx]
0.23 E_{max} [lx]
0.95u0
0.348 E_{min} / E_{max}
0.244

APPENDIX C: LIGHTING LAYOUT

- 6m light column
- Linear LED Lighting (Parapet)
- Linear LED Lighting
- Handrail LED Lighting
- Linear LED Strip
- Uplight



HVM BOLLARDS TO SOUTH OF FORGE LANE BRIDGE