TWIN EARTH

Former Belsize Park Fire Station

Light Spillage Modelling Report

Prepared for: Old House Developments

March 2018

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Twin and Earth Limited

Tel. +44 (0)203 713 9538
info@twinearth.co.uk
Registered in England and Wales 08780908

CONTENTS

1. Introduction

This report is intended to illustrate the potential light spillage from external luminaires which will be installed as part of the refurbishment of the former Belsize Park Fire Station, at 36 Lancaster Grove, NW3 4PB. The development consists of the part change of use of a former fire station to provide 11 self-contained residential units (Class C3).

Externally there will be hard and soft landscaping, car parking spaces and cycle storage provision (Figure 1 – Appendix A).

Planning permission for the development has been granted by the London Borough of Camden, subject to a number of conditions including a requirement to assess the light spillage from external illumination.

Condition 9:

'Prior to commencement of development, full details of a lighting strategy (both temporary and permanent) shall be submitted to and agreed in writing by the Local Planning Authority., This shall include information about potential light spill on to buildings, trees, lines of vegetation and bat boxes, plus a lux level contour plan which should extend outwards to incremental levels to zero lux. The lighting strategy should ensure no light spill outside of the site boundaries and should demonstrate how it seeks to minimise impact on bats'.

The proposed external light fittings that sit within the site boundary have been simulated to determine the illuminance levels and light spill. The simulation has been conducted using manufacture provided photometric data for each luminaire and using specialised lighting design software 'ReluxPro'.

2. Guidance on limits

It should be stated that Condition 9 does not specify an upper illuminance or luminance limit. For the purpose of the study, reference has been made to the design guidance contained in the ILP Guidance Notes for the Reduction of Obtrusive Light GN01:2011. According to the guidance note, and more specifically Table 2: *Obtrusive light limitations* for *exterior lighting installations (luminaire intensity) – pre and post curfew* – luminance output should not exceed 1000 candelas post curfew.

The limits are based on the assumption that the site is classified as an Environmental Zone E3 (Suburban, medium district brightness) which includes small town centres and suburban locations.

3. Theoretical Background

In this section the main terms such as illuminance, luminance as well as units such as lux, candela, lumens and post curfew are explained.

Illuminance

The formal definition of illuminance [1] is:

Illuminance (at a point of a surface) (E): Quotient of the luminous flux, incident on an element of the surface containing the point, by the area of that element. It is the amount of light falling onto a surface. The unit of illuminance is the lux which is equivalent to one lumen per square metre.

Lumen

The lumen is the unit of luminous flux, a measure of the total quantity of visible light emitted by a source, Lumens are used to compare the total amount of light output from a light emitter and it doesn't take into account the area.

Luminance

The formal definition of luminance [1] is:

The luminous intensity of the light emitted or reflected in a given direction from an element of the surface, divided by the area of the element projected in the same direction. The unit of luminance is candelas per square metre.

Candela

Candela is the base unit of luminous intensity (Luminance). A typical candle emits light with a luminous intensity of roughly one candela.

Curfew

Curfew is the time[2] 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.

[1] Daylight and window design, Lighting Guide LG10: 1999

[2] Guidance Notes for the Reduction of Obstructive Light GN01:2011

4. Software

For the purpose of this study, a 3D model of the development with all the proposed luminaries as well as the planting (trees) and hardstanding's (Figure 1) has been developed within the simulation software 'ReluxPro'.

ReluxPro is an industry recognised software package for undertaking lighting calculations. Based on this software the predicted illuminance and luminance levels produced by external lighting within the site boundary have been calculated.

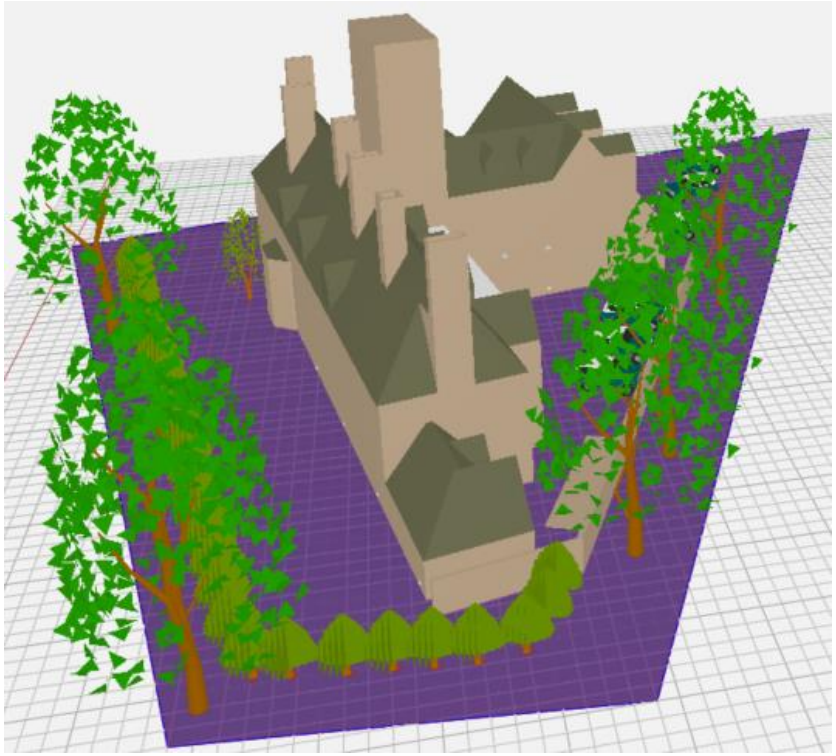


Figure 1 View of the 3D model of the development in Relux lighting software.

4.1 Software Inputs

The proposed external lighting has been chosen for its durability and its control of light spill from the horizontal plane. Consequently, four different types of fittings have been specifically specified for use at the site. These are presented below:

- Two different types of wall mounted luminaires - located on the building facades
- Bollard light - located adjacent to car parking area
- LED recessed light – located in the cycle store and the car parking area.

Further details of each luminaire are presented in the following Table 1 as well as in Appendix A (Site Plan, elevation drawings) and Appendix B.

Manufacturer	Ref. Number	Type of fitting	Number of fittings	Distance from base of luminaire to the ground
Whitecroft Lighting	Spectre WR	Wall mounted luminaire	5	2 - 3800 mm 2 – 4450 mm 1 - 3000 mm
Orlight	Orllungo-300	Wall recessed LED lamp	9	600 mm
BEGA	33 530 K4	Wall mounted luminaire	26	22 - 600 mm 2 – 3750 mm 2 – 6000 mm
EATON Lighting	CHAF17144ZBA	Bollard light	5	870 mm

Table 1 Proposed external luminaires.

5. Results

5.1 3D luminance images

The following visuals represent the computer generated external light distribution for the development. The images, generated by ReluxPro software, provide an indication of the indicative luminance levels that will be achieved by the design and an indication of the level of light spill to surrounding areas.

Figure 2 External light distribution for Belsize Park (Side views).

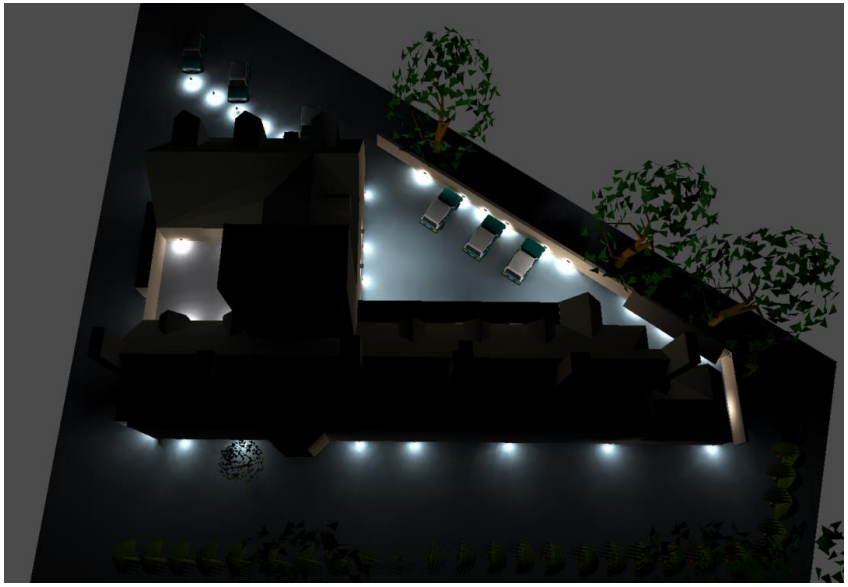


Figure 3 External light distribution Belsize Park (Top view).

5.2 Illuminance (Lux) levels

The following visuals have also been generated using ReluxPro Software. It shows false colour plots based on the illuminance levels in order to illustrate the light spill.

The lighting has been modelled using the proposed fittings (Section 4.1) to provide an indication of light spill across the development and the surrounding environment.

According to ReluxPro calculations the maximum illuminance value across the whole site is equal to 287 lx, while the average illuminance is equal to 7 lx. A table showing all the illuminance values for the whole site is included in Appendix C.

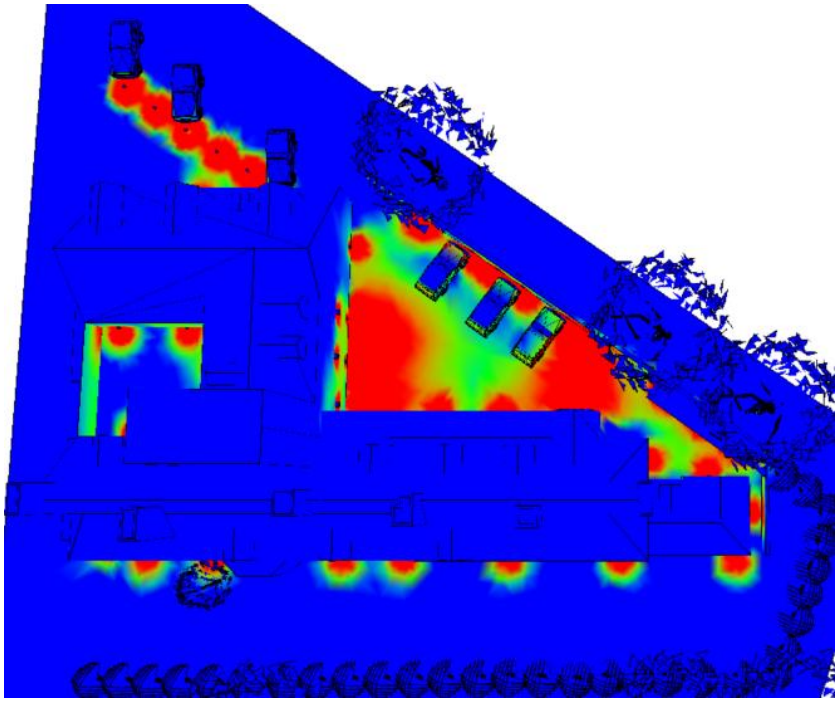


Figure 4 Illuminance distribution based on the proposed light fittings (Top view). Scale in the figure varies between 0 lx (Blue) – more than 35 lx (Red).

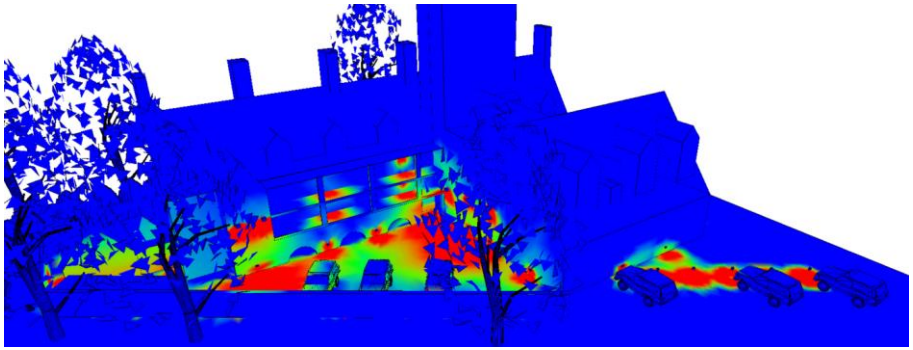


Figure 5 Illuminance distribution based on the proposed light fittings (Side view). Scale in the figure varies between 0 lx (Blue) – more than 35 lx (Red).

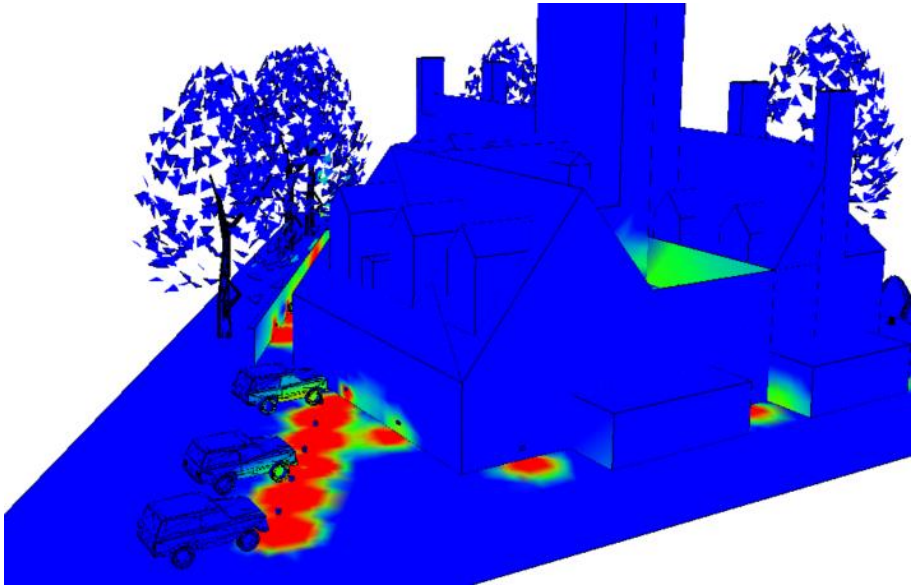


Figure 6 Illuminance distribution based on the proposed light fittings (Front view). Scale in the figure varies between 0 lx (Blue) – more than 35 lx (Red).

Figures 7 and 8 below, illustrates the illuminance distribution as isolines. It can be observed that the light spill is restricted within the boundaries of the development.

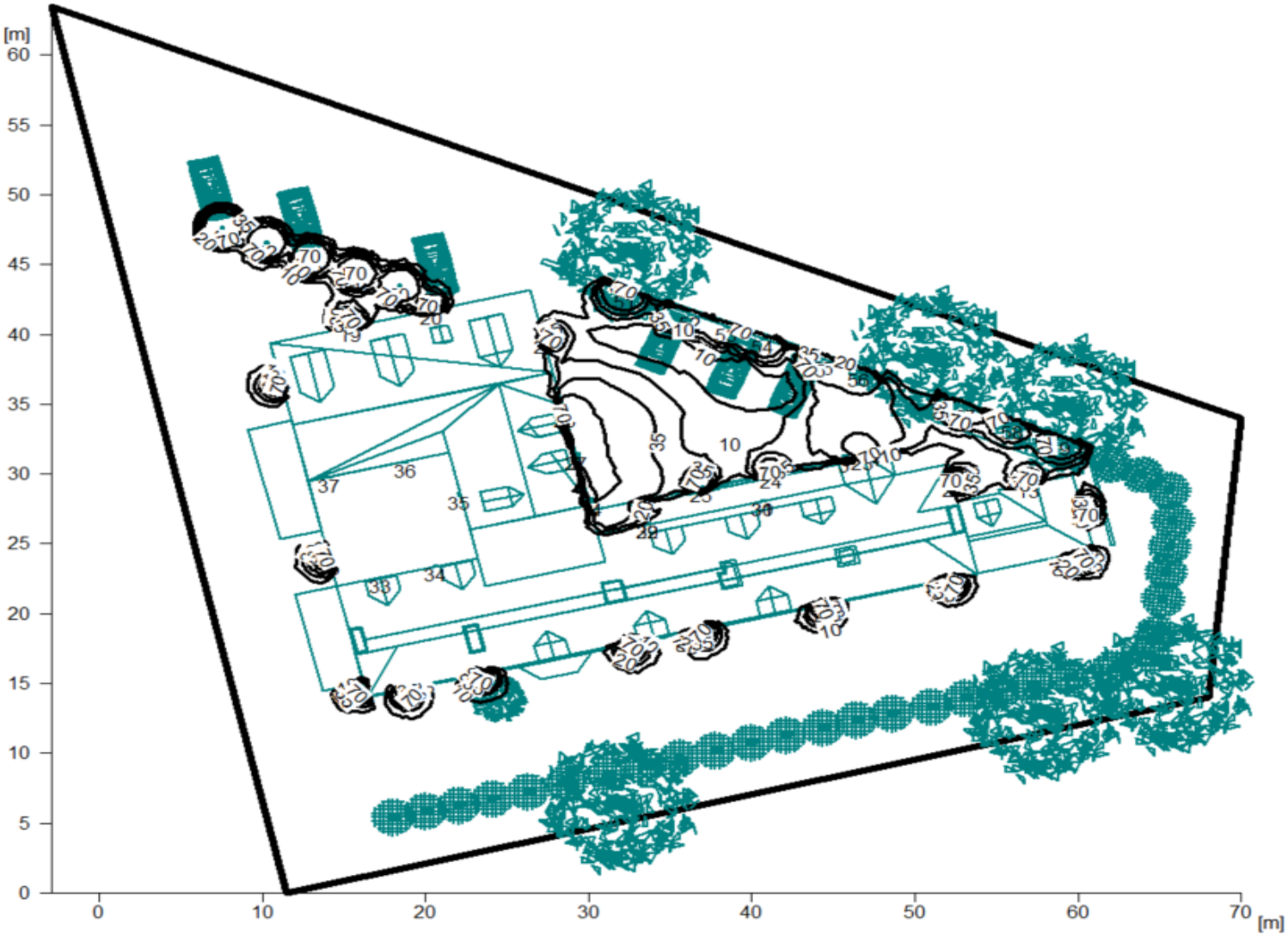


Figure 7 Isolines showing illuminance distribution without elements / luminaires in the output.

As it has already been mentioned, ILP Guidance Notes for the Reduction of Obtrusive Light GN01:2011 and more specifically Table 2: *Obtrusive light limitations for exterior lighting installations (luminaire intensity) – pre and post curfew suggest that the* luminance output should not exceed 1000 candelas, post curfew.

Table 2 below summarizes the candelas for each luminaire based on the Luminous Flux and Peak Luminous Intensity.

Manufacturer	Ref. Number	Luminous Flux [Lumen]	Peak Luminous Intensity [Candelas/1000lm]	Luminous Intensity [Candelas]
Whitecroft Lighting	Spectre WR	2620	558	1461
Orlight	Orllungo-300	3000	326	978
BEGA	33 530 K4	711	300	213
EATON Lighting	CHAF17144ZBA	1320	383	505

Table 2 Luminous Intensity (Candela) for each light fitting

It can be concluded that a majority of the lighting fittings will have a luminous Intensity within the acceptable limits (<1000 candelas). There will be only one luminaire (Whitecroft Lighting Spectre WR), which will have a luminous intensity of 1461 candela which is slightly above the limit of 1000 candelas suggested by the ILP guidance. However, the ILP guidance note should only be used as a guide and the impact of surrounding structures (buildings / trees / hedging) should be taken into account in assessing the impact of lighting on light spillage – as previously detailed .

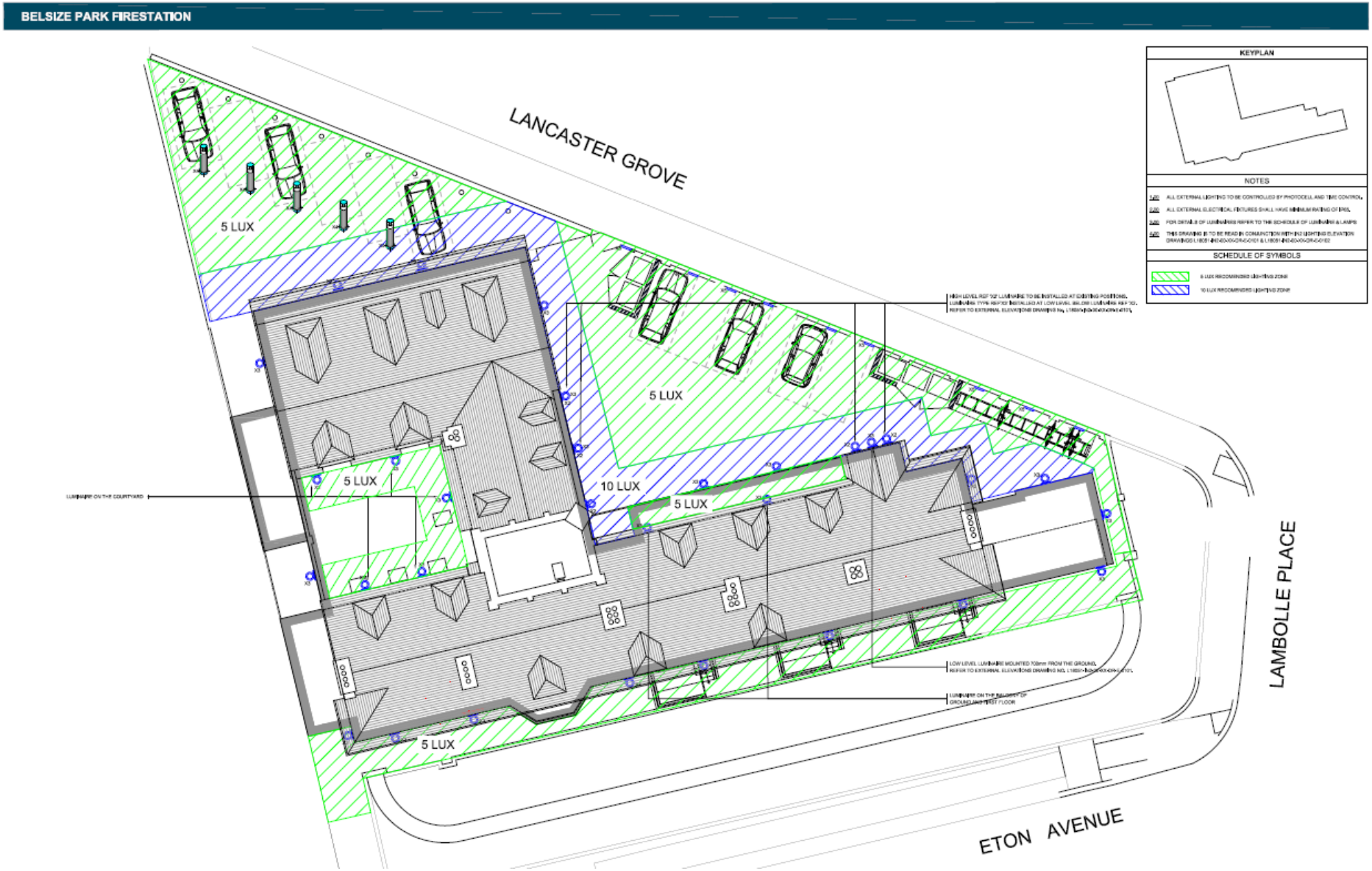
6. Conclusions

Four different types of external luminaire are proposed for the development.

To keep the light spill and light source to a minimum, bollard style lighting and brick lights on the parking and cycle storage areas have been specified. In addition, wall mounted luminaires - located on the building facades (no light in a horizontal plane) have been specified.

Based on Relux Lighting Calculations it can be concluded that the anticipated spill light into the surrounding area is negligible and confined to the site boundary.

APPENDIX A – Site Plan



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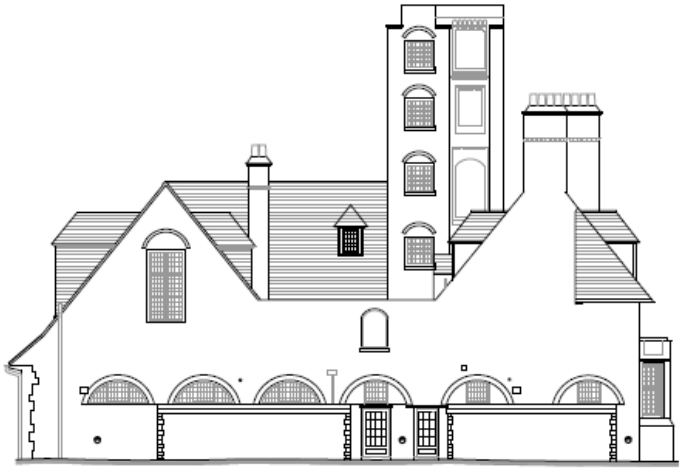
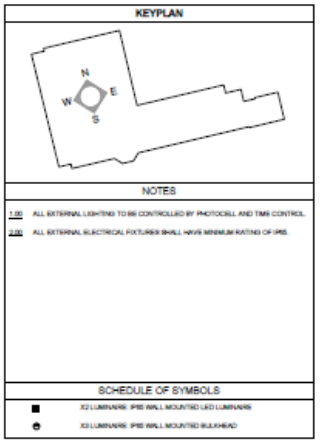
South / West Elevation Plans

BELSIZE PARK FIRESTATION

SOUTH ELEVATION



WEST ELEVATION



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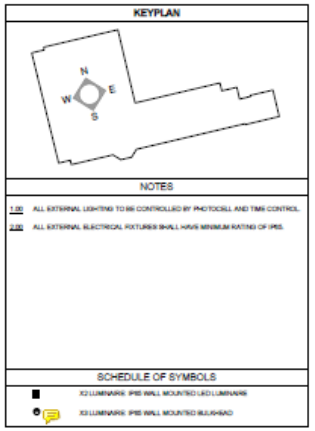
North / East Elevation Plans

BELSIZE PARK FIRESTATION

NORTH ELEVATION

EAST ELEVATION



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APPENDIX B - Light Fittings Datasheets

White Croft Lighting – Spectre WR

Manufacturer: Whitecroft Lighting

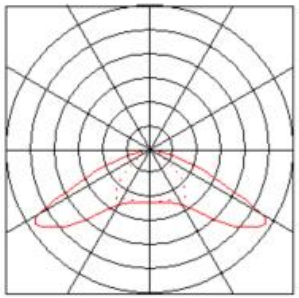
SPRAH14K wall-mounted luminaire SPECTRE WR

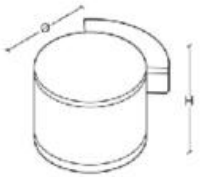
SPECTRE WR IP65 wall mounted LED cylindrical luminaire with symmetrical sideways distribution for illuminating building perimeter. Die cast aluminium body with thermal shock resistant clear tempered glass.

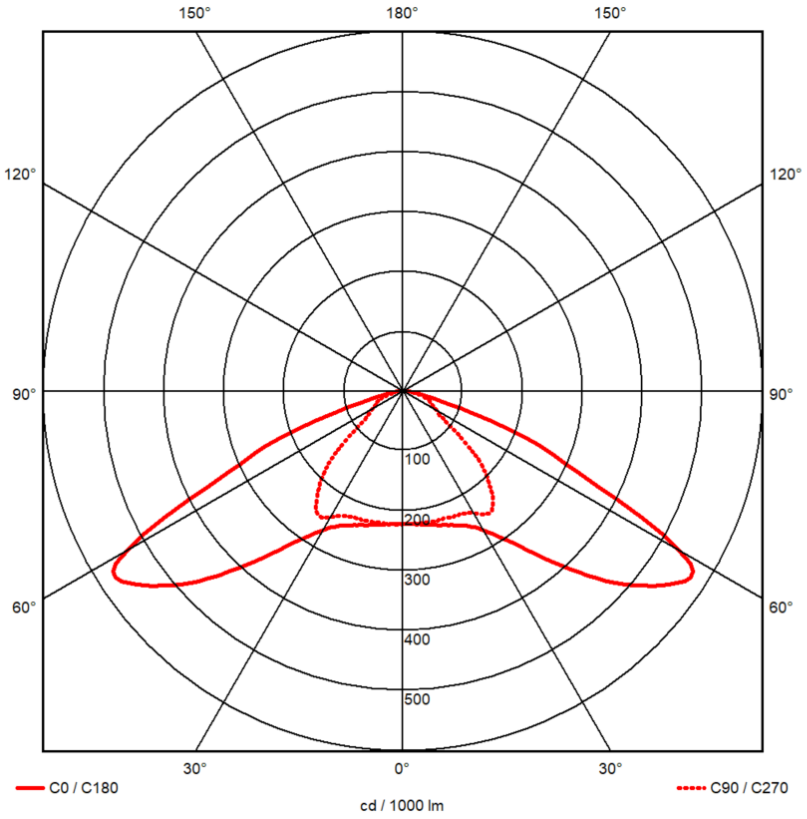
Luminaire data		
Luminaire efficiency	:	100%
Luminaire efficacy	:	97.04 lm/W
Classification	:	A30 ↓100.0% ↑0.0%
CIE Flux Codes	:	40 81 98 100 100
UGR 4H 8H	:	29.9 / 21.0
Control gear	:	Electronic ballast
Power	:	27 W
Luminous flux	:	2620 lm

Equipped with		
Quantity	:	1
Designation	:	LED
Power	:	27 W
Colour	:	4000K
Luminous flux	:	2620 lm
Colour reproduction	:	1B

Dimensions : 300 mm x 256 mm x 225 mm







	C0	C90	C180
0°	222	222	222
5°	223	222	223
10°	227	223	227
15°	232	224	232
20°	238	225	238
25°	248	227	248
30°	268	235	268
35°	305	250	305
40°	362	233	362
45°	436	197	436
50°	504	141	504
55°	558	82	558
60°	531	65	531
65°	326	52	326
70°	189	47	189
75°	58	33	58
80°	23	16	23
85°	7	5	7
90°	0	0	0

cd / 1000 lm

BEGA 33 530 K4 IP65

BEGA **33 530**

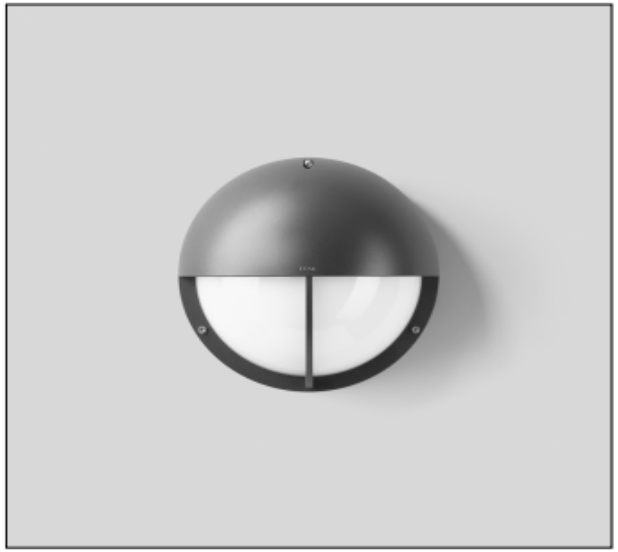
Wall luminaire

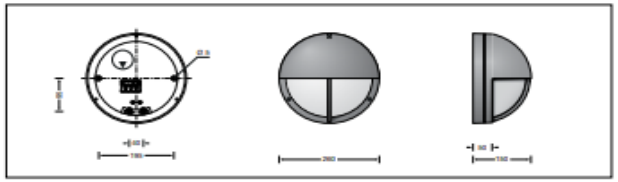
IP 65

Project · Reference number

Date

Product data sheet





Application
Shielded LED wall luminaire with high protection class for a variety of lighting tasks. A luminaire made of die cast aluminium and impact resistant crystal glass.
The used LED technique offers durability and optimal light output with low power consumption at the same time.

Product description
Luminaire made of aluminium alloy, aluminium and stainless steel
Crystal glass with optical structure
Silicone gasket
2 fixing holes ø 5 mm
195 mm spacing
Two cable entries for through-wiring power connecting cable up to 10.5 mm in diameter, max. 5 x 1.5 qmm.
Connecting terminal 2.5□
Earth conductor connection
LED power supply unit
220-240 V ⎓ 0/50-60 Hz
DC 176-280 V
DALI controllable
A basic isolation exists between power cable and control line
Safety class I
Protection class IP 65
Dust-tight and protection against water jets
Impact strength IK06
Protection against mechanical impacts < 1 joule
– Safety mark
CE – Conformity mark
Weight: 2.8 kg

Inrush current
Inrush current: 5 A / 50 µs
Maximum number of luminaires of this type per miniature circuit breaker:
B 10 A: 30 luminaires
B 16 A: 50 luminaires
C 10 A: 52 luminaires
C 16 A: 80 luminaires

Lamp

Module connected wattage	11.8 W
Luminaire connected wattage	14.4 W
Rated temperature	t_a = 25 °C
Ambient temperature	$t_{a\,max}$ = 30 °C

33 530

Module designation	LED-0283/830
Colour temperature	3000 K
Colour rendering index	R_a > 80
Module luminous flux	2140 lm
Luminaire luminous flux *	695 lm
Luminaire luminous efficiency *	48,3 lm/W

33 530 K4

Module designation	LED-0283/840
Colour temperature	4000 K
Colour rendering index	R_a > 80
Module luminous flux	2190 lm
Luminaire luminous flux *	711 lm
Luminaire luminous efficiency *	49,4 lm/W

* preliminary data

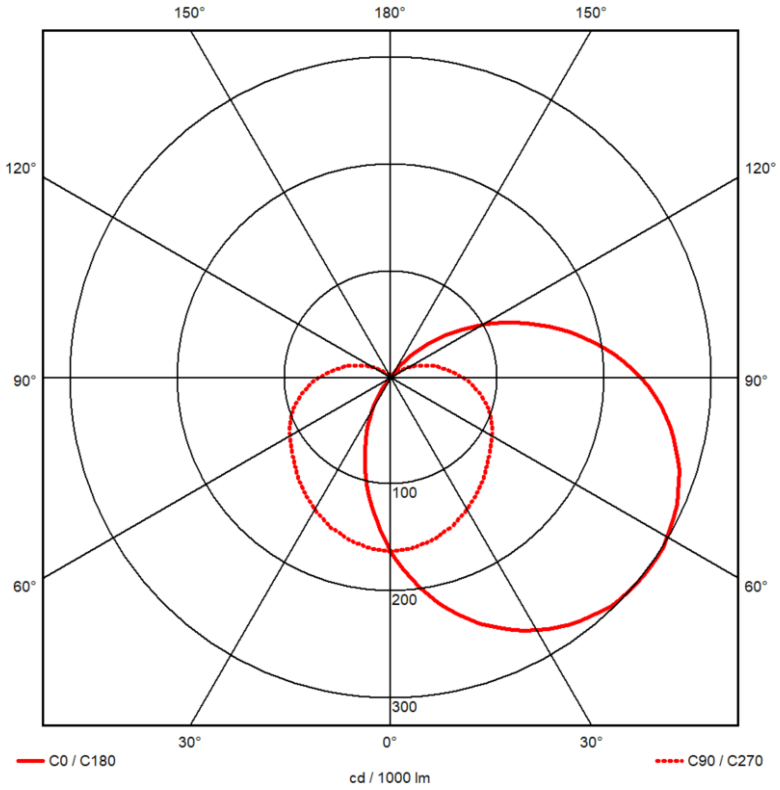
Lifetime of the LED
Ambient temperature t_a = 15 °C
– at 50,000h: L90B10
– at > 500,000h: L70B50

Ambient temperature t_a = 25 °C
– at 50,000h: L90B10
– at > 500,000h: L70B50

max. ambient temperature t_a = 30 °C
– at 50,000h: L90B10
– at 381,000h: L70B50

Article No. 33 530
LED colour temperature optionally 3000 K or 4000 K
3000 K – Article number
4000 K – Article number + **K4**

Colour optionally graphite, white or silver
Graphite – Article number
White – Article number + **W**
Silver – Article number + **A**



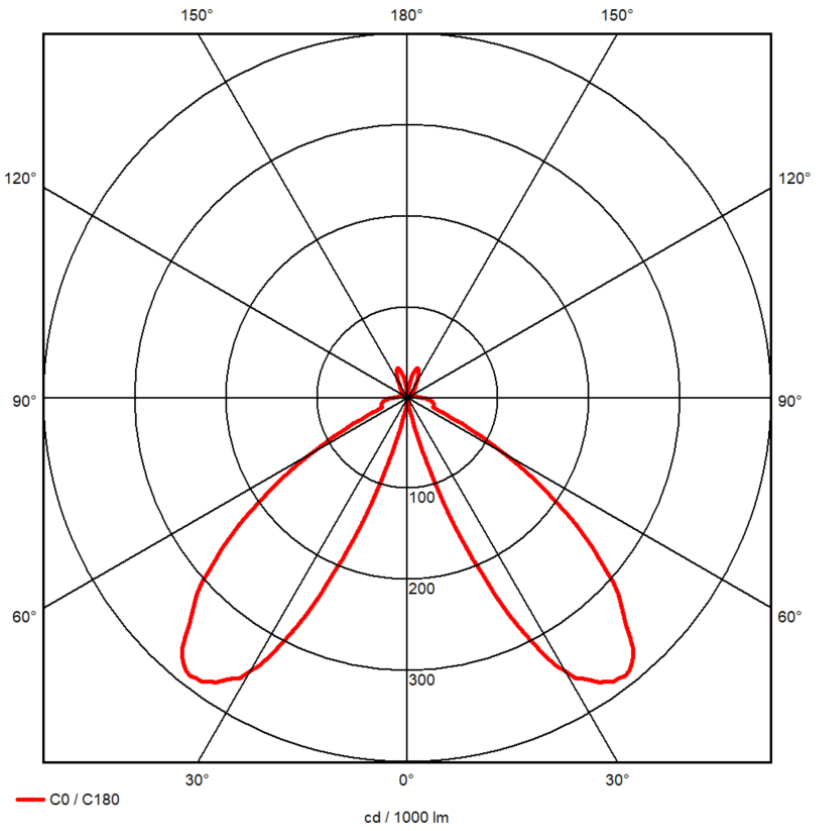
	C0	C90	C180
0°	163	163	163
10°	207	159	115
20°	245	153	72
30°	273	143	35
40°	292	131	9
50°	300	119	0
60°	299	109	0
70°	286	99	0
80°	265	84	0
90°	234	68	0
100°	193	50	0
110°	146	34	0
120°	99	20	0
130°	56	9	0
140°	21	3	0
150°	1	0	0
160°	0	0	0
170°	0	0	0
180°	0	0	0
	cd / 1000 lm		

TWIN EARTH

Chatham

Aluminium - Domed top

Stainless Steel – Domed top



	C0	C90	C180
0°	0	0	0
10°	8	8	8
20°	145	145	145
30°	347	347	347
40°	383	383	383
50°	276	276	276
60°	121	121	121
70°	31	31	31
80°	27	27	27
90°	17	17	17
100°	9	9	9
110°	5	5	5
120°	5	5	5
130°	6	6	6
140°	11	11	11
150°	22	22	22
160°	34	34	34
170°	15	15	15
180°	0	0	0
	cd / 1000 lm		

CHAF17144ZBA **CHATHAM BOLLARD**

Luminaire data

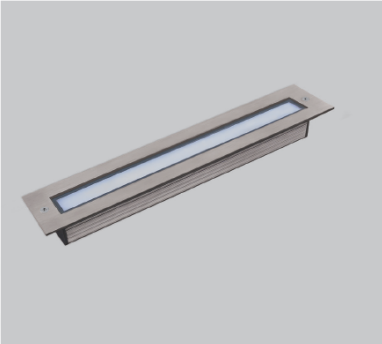
Luminaire efficiency	:	100%
Luminaire efficacy	:	73.33 lm/W
Classification	:	A42 ↓93.1% ↑6.9%
CIE Flux Codes	:	45 87 96 93 100
UGR 4H 8H	:	19.3 / 19.3
Power	:	18 W
Luminous flux	:	1320 lm
Dimensions	:	Ø187 mm x 175 mm

Equipped with

Quantity	:	1
Designation	:	LED
Colour	:	
Luminous flux	:	1320 lm

Orlight Orllungo 300 3000K

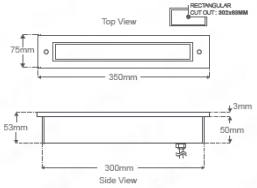
ORLLUNGO-300 - Robust Recessed Linear - 300MM



Description

Recessed linear fixture with IP67 Stainless Steel construction. Integrated CREE XPE LED chipset with Anti-Glare recess & 115 degree light distribution. Inline driver options include switched, 1-10V and DALI dimmable solutions.

Dimensions

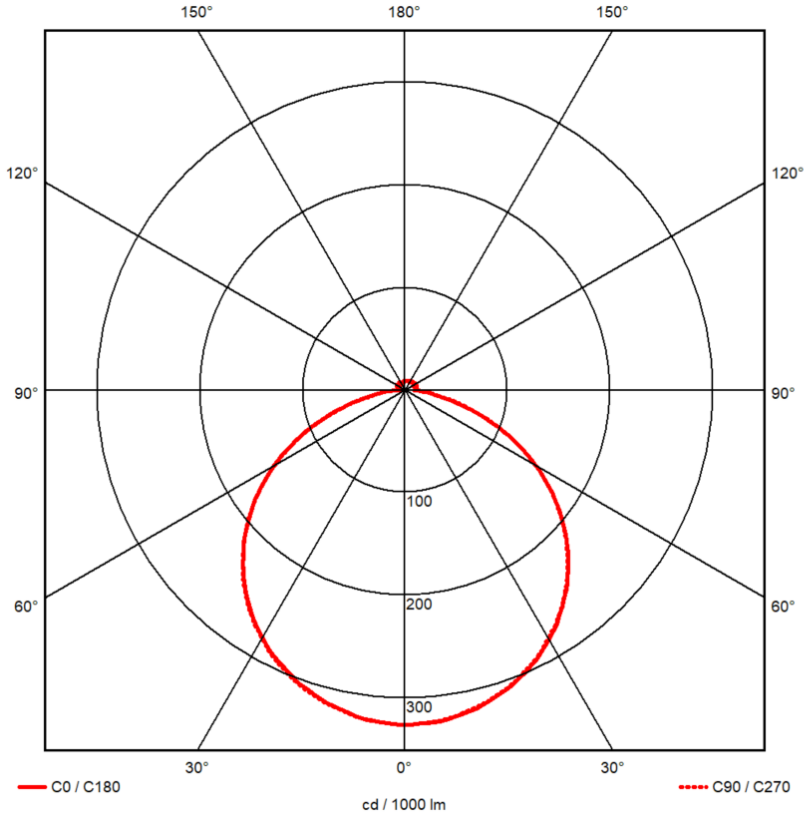


Standards

6W · 24V · IP67 · BEAM ANGLE 115° · 1-10V DIMMABLE · DALI COMPATIBLE · LED · LONG LIFE · CREE XPE · 4 STEP · CE · RoHS

Specifications

Chipset	CREE XPE	
Dimming Options	1-10V; DALI	
Power Consumption	6W	
Voltage	24V	
Colour Temperature	3000K	6000K
Light Output ~	270lm	322lm
lm Per Watt ~	45lm/W	53lm/W
CRI	>80	>75
Beam Angle	115°	
Binning	4 Step MacAdams Ellipse	
Chip Life TM-21	L70 > 60,500 hours	
IP Rating	67	
Weight	1100g	
Finish	316 Marine Grade Stainless Steel	



	C0	C90	C180
0°	326	326	326
10°	320	320	319
20°	306	304	303
30°	280	279	278
40°	246	245	244
50°	201	200	200
60°	147	147	147
70°	86	87	88
80°	30	31	31
90°	12	10	7
100°	12	9	6
110°	12	9	7
120°	12	10	7
130°	12	10	8
140°	11	10	8
150°	10	9	8
160°	10	9	8
170°	9	9	9
180°	9	9	9
	cd / 1000 lm		

TWIN EARTH

APPENDIX C – Illuminance values

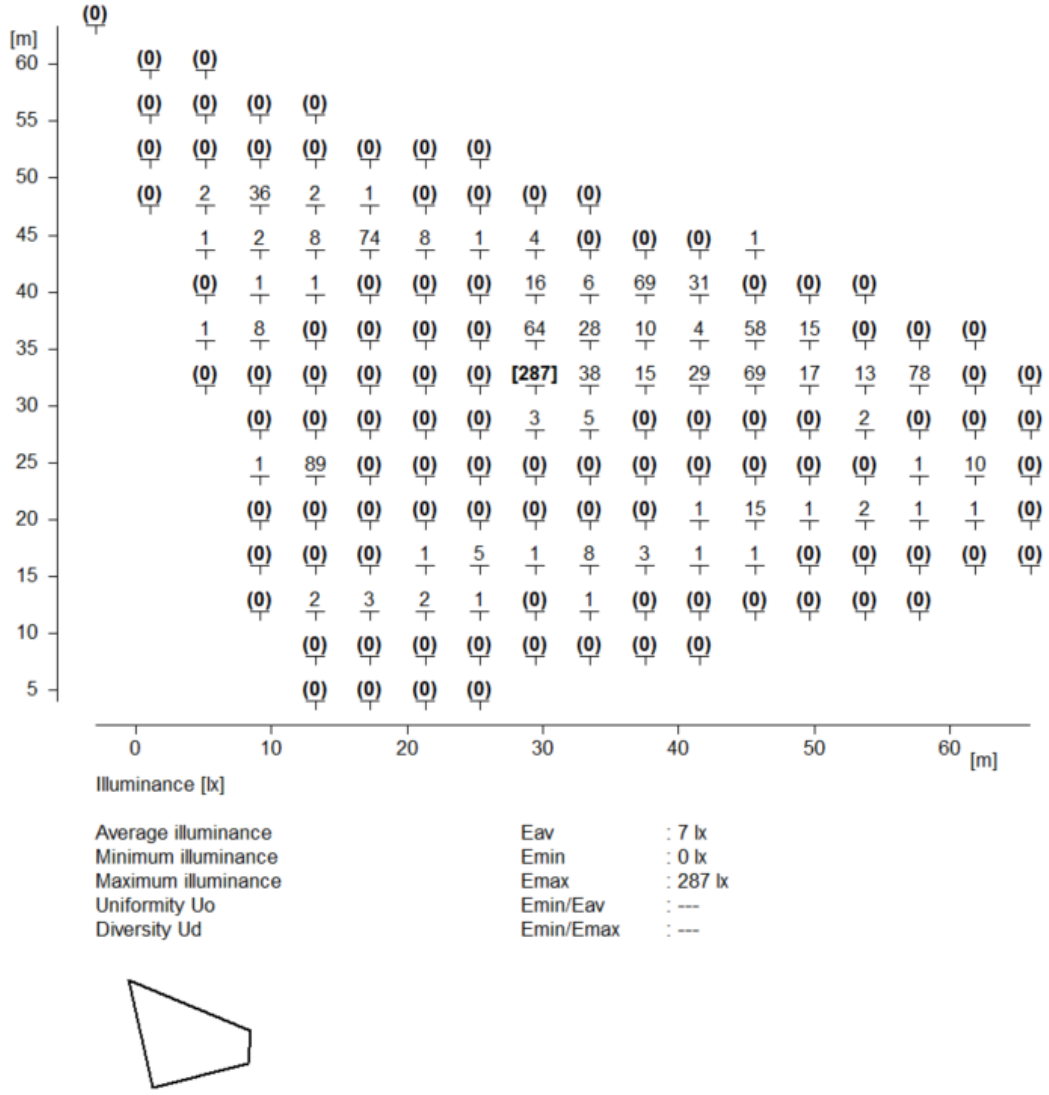


Figure 8hill Illuminance distribution values for the whole site based on ReluxPro calculations