

Lighting Calculations

TM75Z012-CDP-00-ZZ-CA-E-12050
External Lighting Calculations

July 2022

Rev: P01

**MORGAN
SINDALL**
CONSTRUCTION

Morgan Sindall Construction
Albany Park
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Electrical Technical Schedules

Quality Management

Project No	369-J186		
Title	Lighting Calculations - HIWFR Live Fire External Lighting		
Location	HIWFRS HQ, Leigh Road, Eastleigh S050 9SJ		
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Date	July 2022		
Prepared by	Colin Griffiths	Signature (for file)	<i>C. Griffiths</i>
Checked by	Colin Griffiths	Signature (for file)	<i>C. Griffiths</i>

Change Record Table

Section			Verified		
Ref	Title	Prepared by	Checked by	Date	Approved by Signed
1	Initial Issue	CG	CG	Jul 2022	CG

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1 Lighting Calculations

Electrical Technical Schedules

1.1 Overview

This document outlines the concepts for the external lighting design submittal on behalf of Morgan Sindall for the proposed Hampshire & Isle of Wight Fire & Rescue Live Fire Building at Leigh Road Eastleigh.

The purpose of this is to provide detailed information to assist the Planners.

The area is a new live fire training facility for Hampshire County Council and the Fire Brigade training.

A combination of column mounted and wall mounted luminaires are proposed. These enable a good spread of light for the general area with the wall lights being fixed to the outside of the live fire building which are to illuminate the external staircases and local area.

The scheme indicated shows the general concepts put forward.

Relux software has been used for the external lighting calculations.

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1.2 Design Criteria

The following forms the design criteria proposed for this lighting scheme along with our interpretation of the requirements. The building does not comply with specific norms and it has therefore been necessary to form an opinion of what is best for the external areas.

We understand that the Fire Brigade work under standard street lighting when attending fires. However, for the open areas there are also tasks to carry out and Fire Brigade fire tenders in operation.

- BS EN 12464-2:2014 Lighting and lighting – Lighting of Work Places. Part 2: Outdoor work places

1.2.1 Illuminance Levels

Below is an extract from BS EN 12464-2:2014 showing the potential general illuminance levels which the Fire Brigade would come across in general parking areas:

Table 5.9 — Parking areas

Ref. no.	Type of area, task or activity	$\overline{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.9.1	Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	0.25	55	20	
5.9.2	Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	0,25	50	20	
5.9.3	Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose building complexes	20	0,25	50	20	

The Schedule below from BS EN 12464-2: 2014 shows what could apply to the operation of fire hydrants. This could equally apply to the external staircases:

Table 5.15 — Water and sewage plants

Ref. no.	Type of area, task or activity	$\overline{E}_m$ lx	U_o –	R_{GL} –	R_a –	Specific requirements
5.15.1	Handling of service tools, utilization of manually operated valves, starting and stopping of motors, piping packing and raking plants	50	0,40	45	20	
5.15.2	Handling of chemicals, inspection of leakage, changing of pumps, general servicing work, reading of instruments	100	0,40	45	40	
5.15.3	Repair of motors and electric devices	200	0,50	45	60	

The criteria selected are:

- Open area/yard:
 - E_m 20 lux
 - U_o 0.25
- External walkways to Live Fire Building:
 - E_m 50 lux
 - U_o 0.40
- Fire Hydrants:
 - E_m 50 lux
 - U_o 0.40

Electrical Technical Schedules

1.2.2 Equipment Selections

The proposals are based upon equipment selected by Contractors Design Partner Ltd for this project. DW Windsor Lighting are a UK company with a long standing reputation for good quality external lighting products.

The colour of the columns and fittings proposed is RAL 7035 light grey.

1.2.3 Maintenance Factor Calculation

This calculation shows the build-up for the maintenance factor.

Maintenance Factor

As derived from BS 5489-1:2020 clause 5.1.6

$$f_M = f_{LF} \times f_S \times f_{LM}$$

$$\text{or: MF} = \text{LLMF} \times \text{LSF} \times \text{LMF}$$

f_M / MF = Overall Maintenance Factor

f_{LF} / LLMF = Luminous flux factor. Lumen maintenance factor at end of rated life

f_S / LSF = Survival factor. Failure fraction of the light source at the end of rated life

f_{LM} / LMF = Luminaire maintenance factor. Reduction of output due to the accumulation of dirt on light emitting parts

f_{LF} / LLMF

The manufacturer of the selected fitting has not able to provide this information. We have therefore assumed a value of 0.8 for the purposes of these workings.

f_S / LSF

It is assumed that a spot replacement program will be used for the project and defective fittings replaced when found. A value of 1 is therefore used.

f_{LM} / LMF

For the location of the project an Environment Zone is taken as E2, based upon BS EN 12464-2:2014 table 2:

Table 2 — Maximum obtrusive light permitted for exterior lighting installations

Environmental zone	Light on properties		Luminaire intensity		Upward light ratio	Luminance	
	E_v lx		I cd		R_{UL} %	L_b cd·m ⁻²	L_s cd·m ⁻²
	Pre-curfew ^a	Post-curfew	Pre-curfew	Post-curfew		Building facade	Signs
E1	2	0	2 500	0	0	0	50
E2	5	1	7 500	500	5	5	400
E3	10	2	10 000	1 000	15	10	800
E4	25	5	25 000	2 500	25	25	1 000

where

E1 represents intrinsically dark areas, such as national parks or protected sites;
 E2 represents low district brightness areas, such as industrial or residential rural areas;
 E3 represents medium district brightness areas, such as industrial or residential suburbs;
 E4 represents high district brightness areas, such as town centres and commercial areas;
 E_v is the maximum value of vertical illuminance on properties in lx;
 I is the light intensity of each source in the potentially obtrusive direction in cd;
 R_{UL} is the proportion of the flux of the luminaire(s) that is emitted above the horizontal, when the luminaire(s) is (are) mounted in its (their) installed position and attitude, and given in %;
 L_b is the maximum average luminance of the facade of a building in cd·m⁻²;
 L_s is the maximum average luminance of signs in cd·m⁻².

^a In case no curfew regulations are available, the higher values shall not be exceeded and the lower values should be taken as preferable limits.

Luminaire Maintenance Factors (from BS 5489-1:2020)

Electrical Technical Schedules

Table C.1 — *Luminaire maintenance factors*

Environmental zone	Mounting height	Maintenance factor					
		Cleaning frequency					
		12 months	24 months	36 months	48 months	60 months	72 months
E1/E2	≤ 6 m	0.96	0.96	0.95	0.94	0.93	0.92
E1/E2	> 6 m	0.96	0.96	0.95	0.94	0.93	0.92
E3/E4	≤ 6 m	0.94	0.92	0.90	0.88	0.86	0.84
E3/E4	> 6 m	0.96	0.96	0.95	0.94	0.93	0.92

NOTE 1 This table is not valid if cleaning is not undertaken within the maximum 6 year scope of the table.

NOTE 2 Each site experiences different levels of pollution, so it is advisable to assess local conditions through measurement in accordance with ILP document TR28 [47].

NOTE 3 The relevant value from this table is combined with the luminous flux factor to provide a combined maintenance factor (see 5.1.6).

Column heights are ≤6m

Cleaning frequency is assumed at 72 months

Therefore Calculated

$$LLMF \times LSF \times LMF = MF$$

LLMF	x	LSF	x	LMF	=	MF
0.8	x	1.0	x	0.84	=	0.67

Electrical Technical Schedules

1.3 Schedule 01 – External Lighting

Manufacturer: DW Windsor
Pindar Road
Hoddesdon
Hertfordshire
EN11 0DX

Telephone: +44 (0)1992 474600
Website: info@dw Windsor.com

Electrical Technical Schedules

External Lighting

Reference				
	X1	X2	X1 Column	X1 Cut out
Area of use:	Open Area	Fire Hydrants & External Walkways	Carpark	Within column
Manufacturer:	DW Windsor	DW Windsor	DW Windsor	Any
Luminaire range:	Kirium Pro1 16 LED	Kirium Wall	Circular	n/a
Cat No:				
Lamp Type:	35W LED + C2 Optic	27W LED + Frosted Medium Optic	n/a	
Lumen Output (lm):	5362	2844	n/a	
Lamp Colour (°K):	4000	4000	n/a	
Dimmable?:	No	No	n/a	
Type of Fitting:	Column mounted	High Output Bulkhead	5m Column	Cut out
Mounting Arrangement :	Post top. 5m.	Wall Mounted	Flange Plate	Within column base
Dimensions (mm):	610L x 350 W x 140H	340W x 235H x 182D	Ø139/76 x 5m	
Colour/Finish :	RAL 7035 Light Grey	RAL 7035 Light Grey	RAL 7035 Light Grey	
Weight (kg):	7.1	3.5		
Cut-out size (mm):	n/a	n/a	n/a	
Drivers:	Integral	Integral	n/a	
EMG Integral/Remote:	n/a	n/a	n/a	
Lumens/Circuit Watt:			n/a	
Notes				20A rated. Fused at 6A. For single phase double pole. Loop-in, loop-out.

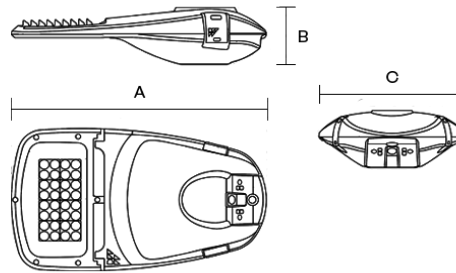
Electrical Technical Schedules

Notes:

- Any part numbers are to be fully checked by the contractors and manufacturer prior to placing any orders.
- Any changes to luminaires will require the calculations to be amended.
- The cut-out is required to be purchased additionally to the column. There is a board mounted with the column base for the installation of the cut-out.

Electrical Technical Schedules

1.4 Data Sheets – DW Windsor



Dimensions (mm):

A 610 **B** 140 **C** 350

Weight (kg):

8.5

Windage (m²):

**0.054 (CxS =
0.029)**

Sample Specification Text

Kirium Pro 1 street luminaire with 32 LED light engine. Constant light output enabled fully programmable DALI driver operating up to 1000mA. 3,000K colour temperature using Diamond+ A1 optic technology. LM6 high pressure die-cast aluminium body in RAL 7046 mid grey with a polyester powder coat finish and flat toughened glass glazing. With lift-off head, automatic electrical disconnection block and toolless entry for easy maintenance. Cool Zone™ thermal technology for improved performance. IP66 and IK10 protection. 100,000 hour (L90 B10) lifetime. For -45 °C to +50 °C ambient operating temperatures. Class I.

Performance

Output (luminaire flux)	13,800lm (max)
Power	93W (max)
Efficacy	187lm/W (max)
Number of LEDs	8 / 16 / 24 / 32
Colour Temperatures	2,700K 3,000K 4,000K
Colour Rendering Index (CRI)	70 / 80
Distributions	Diamond+ optic system
Certifications	UKCA, CE, ENEC

Mechanical

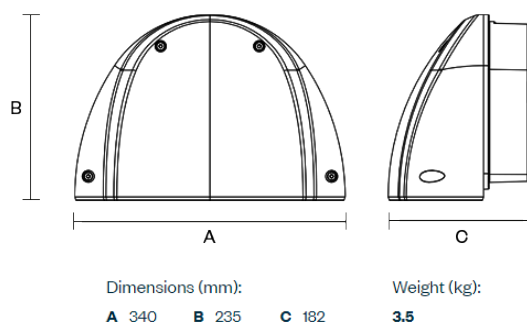
Mounting Options	Side Entry: Ø34mm - Ø42mm / Ø60mm Direct Post: Ø60mm / Ø60-76mm
Tilt Adjustment	-15° to +15° (5° increments)
Glazing	Toughened glass IK08 / Polycarbonate for IK10
Housing	Die-cast aluminium
Colours	Mid Grey RAL 7046 Light Grey RAL 7035 Black RAL 9005 (Other RAL colours on request)
Finish	Polyester powder coat
IP Rating	IP66
IK Rating	IK10
Weight	8.5kg

Electrical

Driver Options	DALI (fully programmable with Constant Light Output enabled)
Drive Current Range	200mA to 1,050mA
Operating Voltage	220-240V
Electrical Class	Class I Class II (on request)
Operating Temperature Limit	-45 °C to +50 °C
Rated Lifetime	100,000 hours (L90 B10)

Controls

Control Options	Photocell Part-night switching Pre-programmed dimming NEMA Zhaga Integral CMS Sensor ready
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Sample Specification Text

Kirium Wall surface luminaire with 16 LED light engine. Constant light output enabled fully programmable DALI driver operating up to 700mA. 3,000K colour temperature using Diamond+ A1 optic technology. LM6 high pressure die-cast aluminium body in RAL 7046 mid grey with a polyester powder coat finish and flat toughened glass glazing. With toolless entry for easy maintenance. Cool Zone™ thermal technology for improved performance. IP66 and IK10 protection. 100,000 hour (L80 B10) lifetime. For -25 °C to +40 °C ambient operating temperatures. Class I.

Performance

Output (luminaire flux)	3,989lm (max)
Power	37W (max)
Efficacy	172lm/W (max)
Number of LEDs	8 / 16
Colour Temperatures	2,700K 3,000K 4,000K 4,000K (SUNLIKE)
Colour Rendering Index (CRI)	70 / 80 / 95
Distributions	Narrow (Diamond+A1) Medium (Diamond+A5) Wide (Diamond+ C2)
Certifications	UKCA, CE

Mechanical

Mounting Options	Wall mount (option to mount over BESA box available)
Glazing	Clear / frosted polycarbonate
Housing	Die-cast aluminium
Colours	Mid Grey RAL 7046 Light Grey RAL 7035 Black RAL 9005 White RAL 9016 Aluminium 9006 Metallic Grey 9007 Metallic Dark Grey DB703 Corten Brown (Other RAL colours on request)
Finish	Polyester powder coat
IP Rating	IP66
IK Rating	IK10
Weight	3.5kg

Electrical

Driver Options	DALI / 1-10V (fully Programmable with Constant Light Output Enabled)
Drive Current Range	300mA to 700mA
Operating Voltage	220-240V
Electrical Class	Class I / Class II
Operating Temperature Limit	-25 °C to +40 °C
Rated Lifetime	100,000 hours (L80 B10)

Controls

Control Options	Photocell Part night switching Pre-programmed dimming Integral CMS Presence detector Integral 3-hour emergency
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Electrical Technical Schedules

1.5 Lighting Calculations

External Lighting Calculations

Installation : HIWFR

Project number : 369-J186

Customer :

Processed by : C Griffiths

Date : 13.07.2022

Project description:

Rev1 - 13/07/2022 Initial Issue

The following values are based on precise calculations performed on calibrated lamps and luminaires, and their configurations, whereby gradual, unavoidable deviations can occur in practice. All guarantee claims are excluded for the specified data.

This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.

Object : External Lighting Calculations
Installation : HIWFR
Project number : 369-J186
Date : 13.07.2022

1 Luminaire data

1.1 DW Windsor, Kirium Bulkhead-4k-Med... (!Kirium Bulkhea...)

1.1.1 Data sheet

Manufacturer: DW Windsor

!Kirium Bulkhead -16LED-4k-500mA-27W-Frosted-Medium

Kirium Bulkhead-4k-Medium

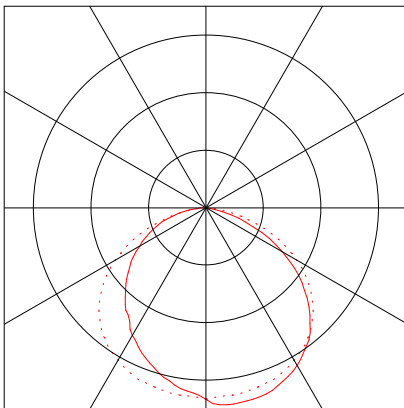
Luminaire data

Luminaire efficiency : 100%
Luminaire efficacy : 105.33 lm/W
Classification : A40 ↓100.0% ↑0.0%
CIE Flux Codes : 47 80 97 100 100
UGR 4H 8H : 63.6 / 65.3
Power : 27 W
Luminous flux : 2844 lm

Dimensions : 340 mm x 182 mm x 235 mm

Equipped with

Quantity : 1
Designation : 16 x 4k LED
Colour :
Luminous flux : 2844 lm



Object : External Lighting Calculations
Installation : HIWFR
Project number : 369-J186
Date : 13.07.2022

1 Luminaire data

1.2 DW Windsor, KIRIUM PRO1 16LED C2... (KIRIUM PRO1 16LED...)

1.2.1 Data sheet

Manufacturer: DW Windsor

KIRIUM PRO1 16LED 4k C2 750mA UMSUG 42 0035 0000 100

KIRIUM PRO1 16LED C2

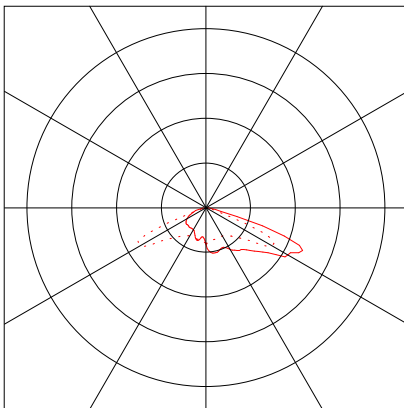
Luminaire data

Luminaire efficiency : 100%
Luminaire efficacy : 153.2 lm/W
Classification : A20 ↓100.0% ↑0.0%
CIE Flux Codes : 26 59 97 100 100
UGR 4H 8H : 30.8 / 26.4
Power : 35 W
Luminous flux : 5362 lm

Equipped with

Quantity : 1
Designation : 16 x 4k LED
Colour :
Luminous flux : 5362 lm

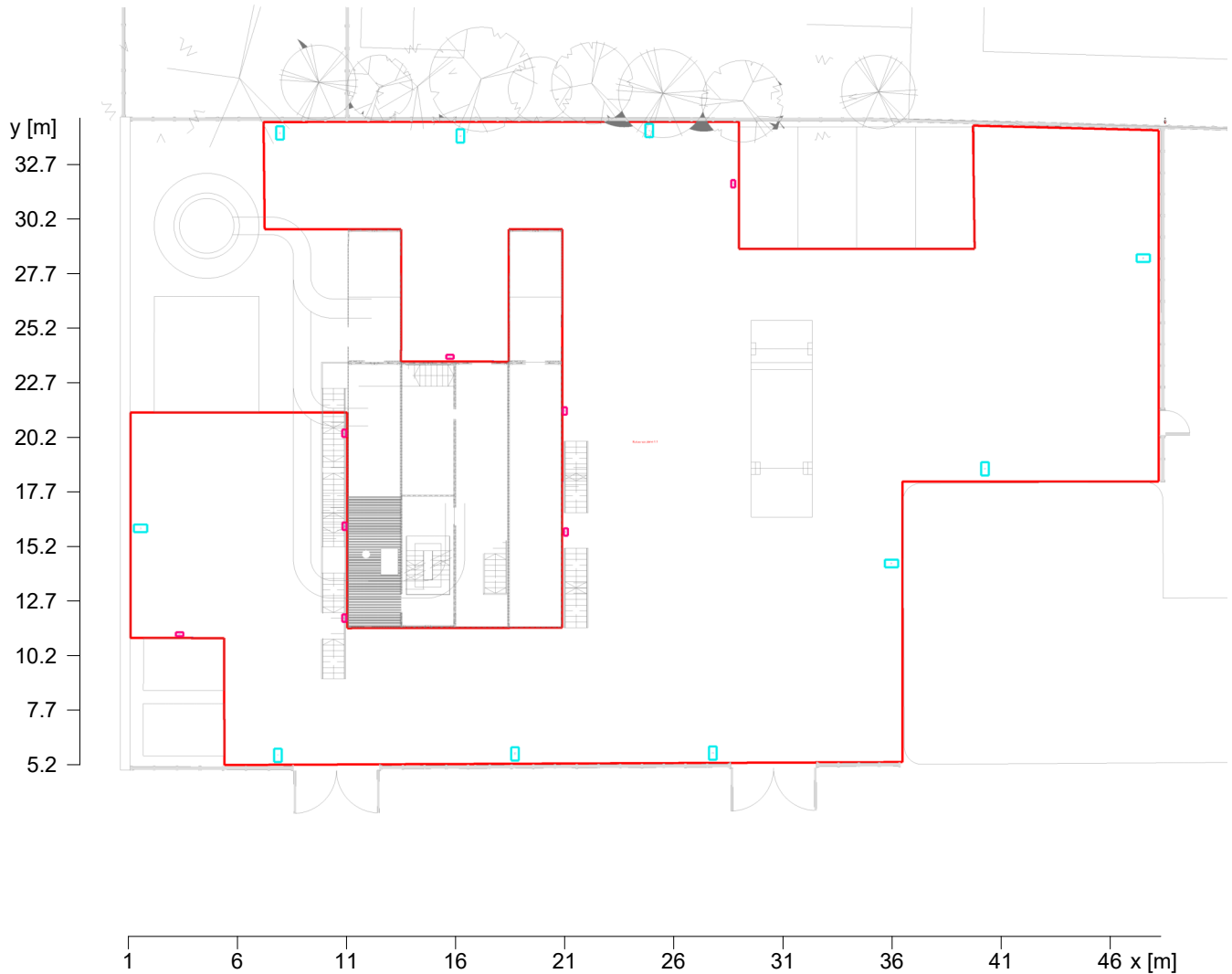
Dimensions : 350 mm x 610 mm x 140 mm



2 Exterior 1

2.1 Description, Exterior 1

2.1.1 Floor plan

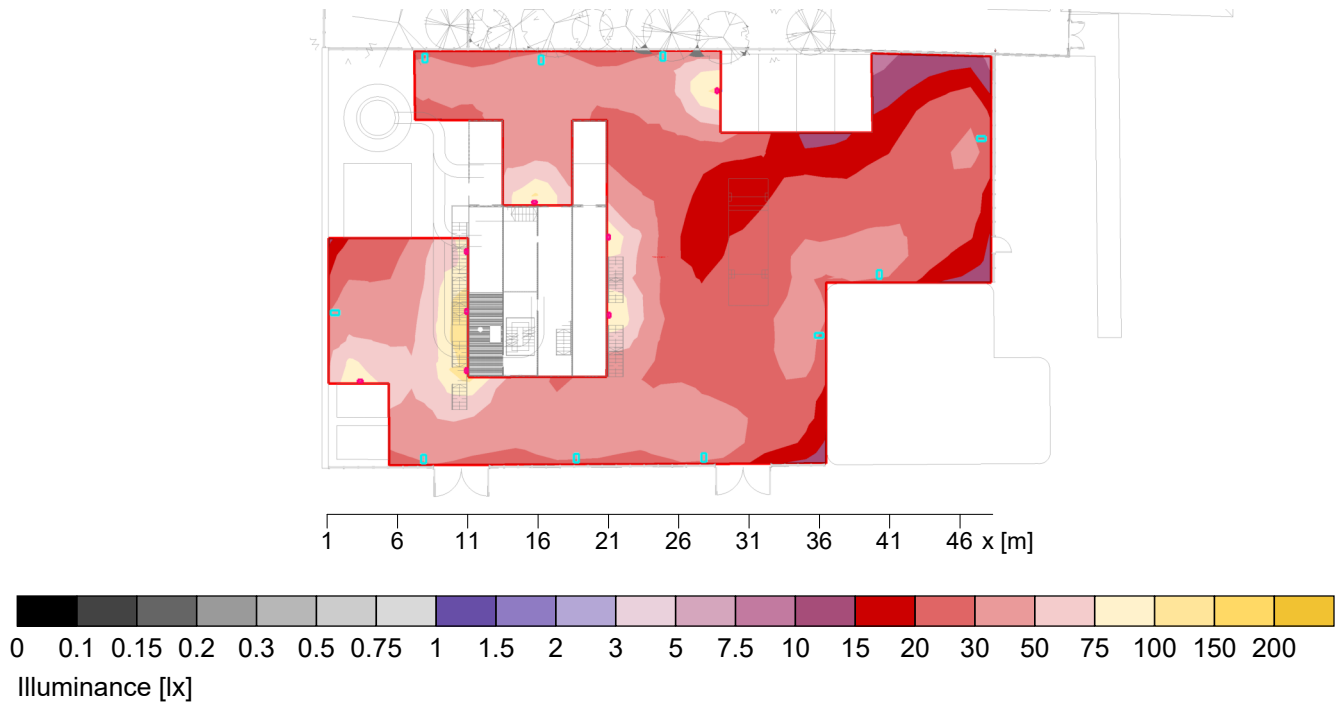


Object : External Lighting Calculations
 Installation : HIWFR
 Project number : 369-J186
 Date : 13.07.2022

2 Exterior 1

2.2 Summary, Exterior 1

2.2.1 Result overview, Evaluation area 1



General

Calculation algorithm used
 Maintenance factor

Average indirect fraction
 0.67

Total luminous flux

76372.00 lm

Total power

566.0 W

Total power per area (879.17 m²)

0.64 W/m² (2.06 W/m²/100lx)

Evaluation area 1

Reference plane 1.1

Horizontal
 Em 31.3 lx
 Emin 9.7 lx
 Emin/Em (Uo) 0.31
 Emin/Emax (Ud) 0.13
 Position 0.00 m

Type No.\Make

1	8 x	DW Windsor	
		Order No.	: !Kirium Bulkhead -16LED-4k-500mA-27W-Frosted-Medium
		Luminaire name	: Kirium Bulkhead-4k-Medium
		Equipment	: 1 x 16 x 4k LED 27 W / 2844 lm
2	10 x		
		Order No.	: KIRIUM PRO1 16LED 4k C2 750mA UMSUG 42 0035 0000 100
		Luminaire name	: KIRIUM PRO1 16LED C2
		Equipment	: 1 x 16 x 4k LED 35 W / 5362 lm

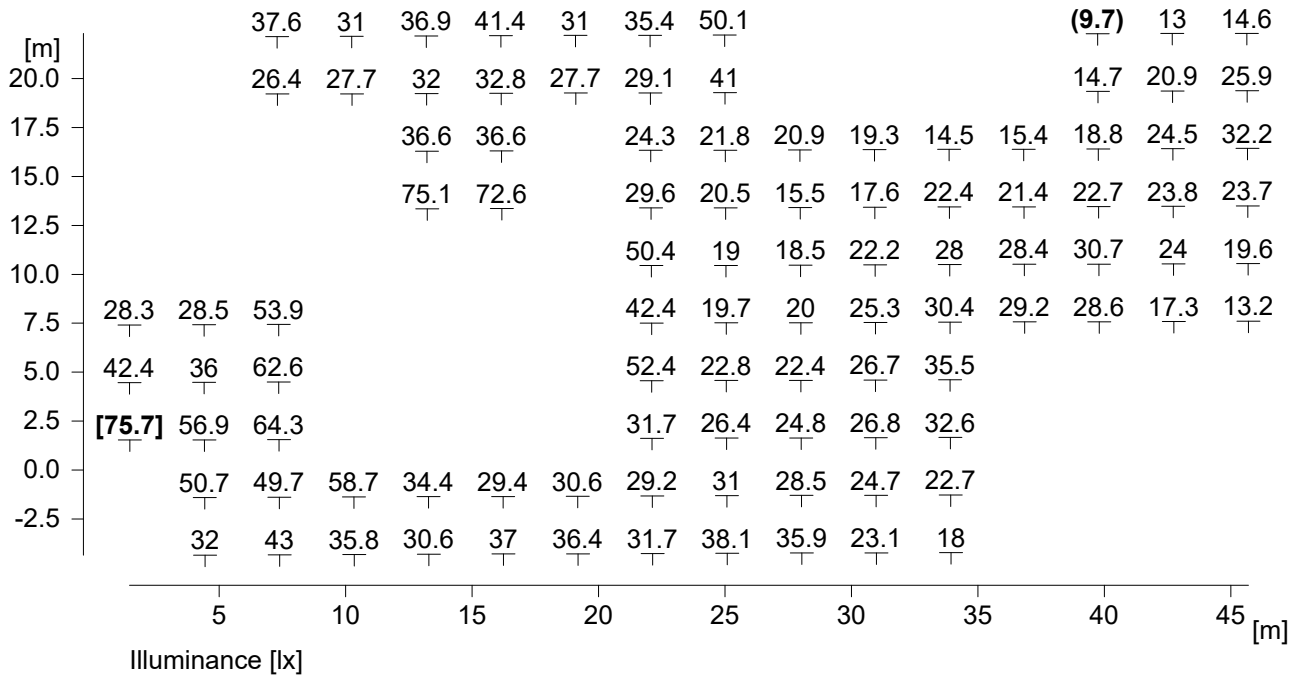
Object : External Lighting Calculations
 Installation : HIWFR
 Project number : 369-J186
 Date : 13.07.2022



2 Exterior 1

2.3 Calculation results, Exterior 1

2.3.1 Table, Reference plane 1.1 (E)

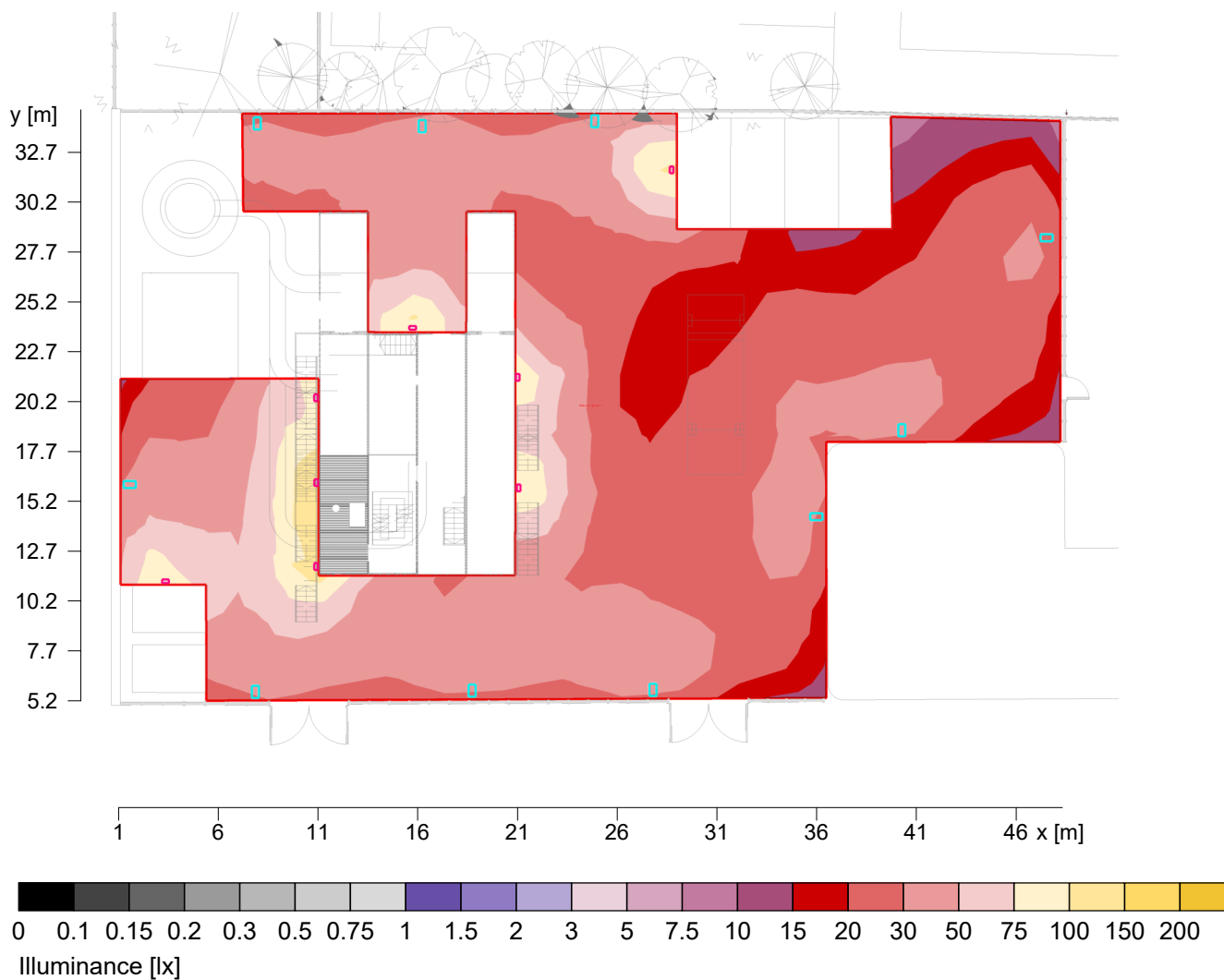


Height reference plane	: 0.00 m
Average illuminance	Em : 31.3 lx
Minimum illuminance	Emin : 9.7 lx
Maximum illuminance	Emax : 75.7 lx
Uniformity Uo	Emin/Em : 1 : 3.21 (0.31)
Diversity Ud	Emin/Emax : 1 : 7.78 (0.13)

Object : External Lighting Calculations
Installation : HIWFR
Project number : 369-J186
Date : 13.07.2022

2.3 Calculation results, Exterior 1

2.3.2 Pseudo colours, Reference plane 1.1 (E)



Height reference plane	:	0.00 m
Average illuminance	Em	: 31.3 lx
Minimum illuminance	Emin	: 9.7 lx
Maximum illuminance	Emax	: 75.7 lx
Uniformity Uo	Emin/Em	: 1 : 3.21 (0.31)
Diversity Ud	Emin/Emax	: 1 : 7.78 (0.13)

2 Drawings

The following drawings are included:

- TN75Z012-CDP-00-DR-E-9000



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