



LDL LIGHTING

Wardel Academy Extension - External

LIGHTING CALCULATIONS



External - Rev.1

Installation : Wardle Acaedmy Extension - External

Project number :

Customer :

Processed by : DPW

Date : 24.10.2023

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.

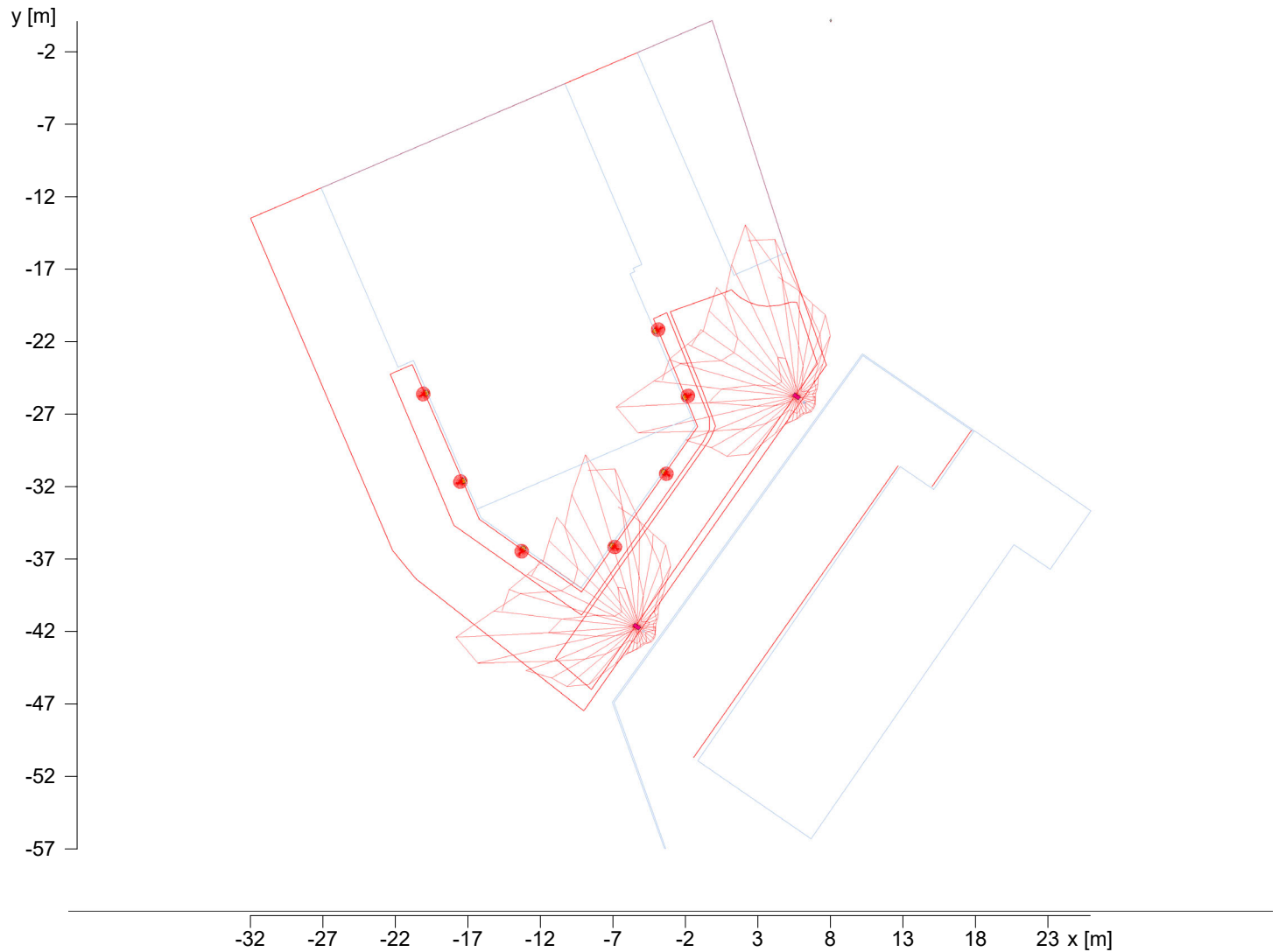
This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.

Object : External - Rev.1
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Description, EXTERNAL

Floor plan

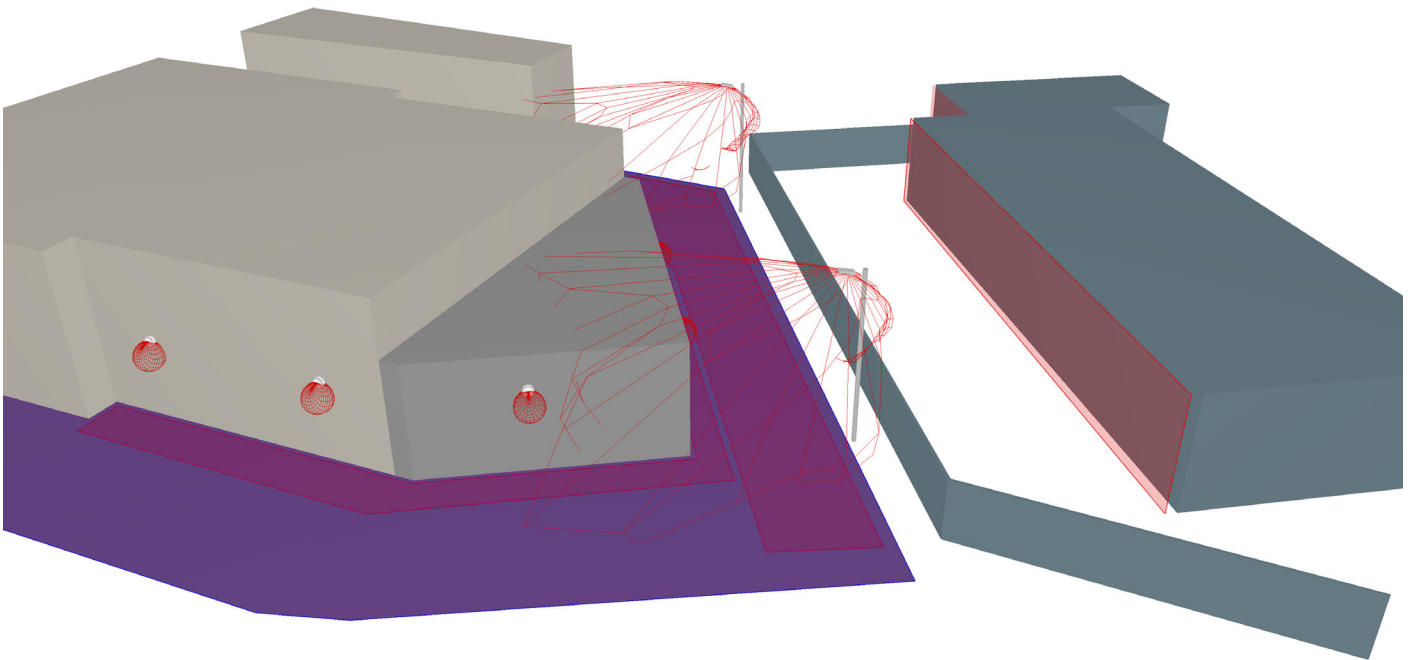


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Description, EXTERNAL

3D view, View 1



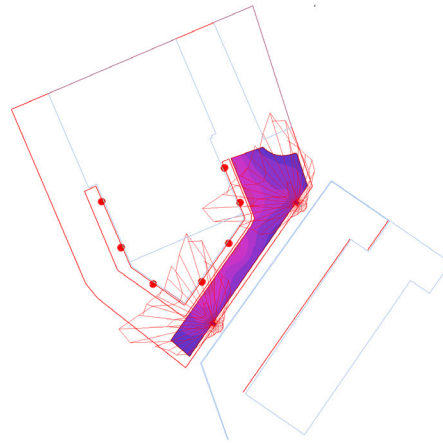
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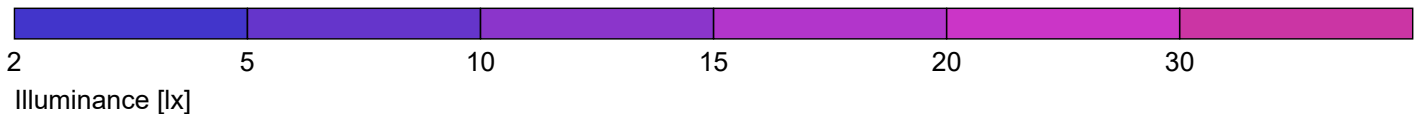
EXTERNAL

Summary, EXTERNAL

Result overview, Measuring area 2



-32 -22 -12 -2 3 8 13 18 23 x [m]



General

Calculation algorithm used	Average indirect fraction
Height of evaluation surface	0.00 m
Maintenance factor	0.80
Total luminous flux	14984 lm
Total power	135.8 W
Total power per area (1087.93 m²)	0.12 W/m²
Upward light ratio (ULR)	0.02

Illuminance

Average illuminance	E_m	16.1 lx
Minimum illuminance	E_{min}	4.9 lx
Maximum illuminance	E_{max}	38.1 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:3.28 (0.3)
Diversity U_d	E_{min}/E_{max}	1:7.77 (0.13)

Type No.\Make

3	7 x	LDL	
		Order No.	: LD7016/1220/4
		Luminaire name	: LD7016 1216lm 11w 840 250mA
		Equipment	: 1 x LED Backlight 10.59 W / 1216 lm



4	2 x	Order No.	: ST/M/L2/3200/74
		Luminaire name	: STREET Medium L2optic 3236lm 31w 740 300mA
		Equipment	: 1 x LED Backlight 30.82 W / 3236 lm

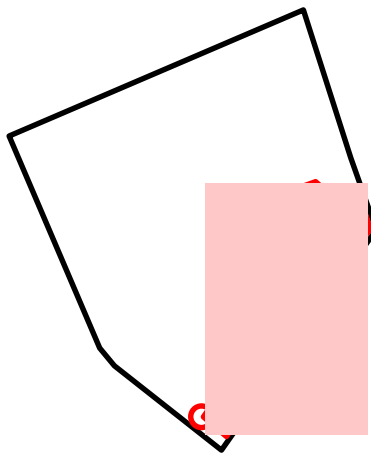
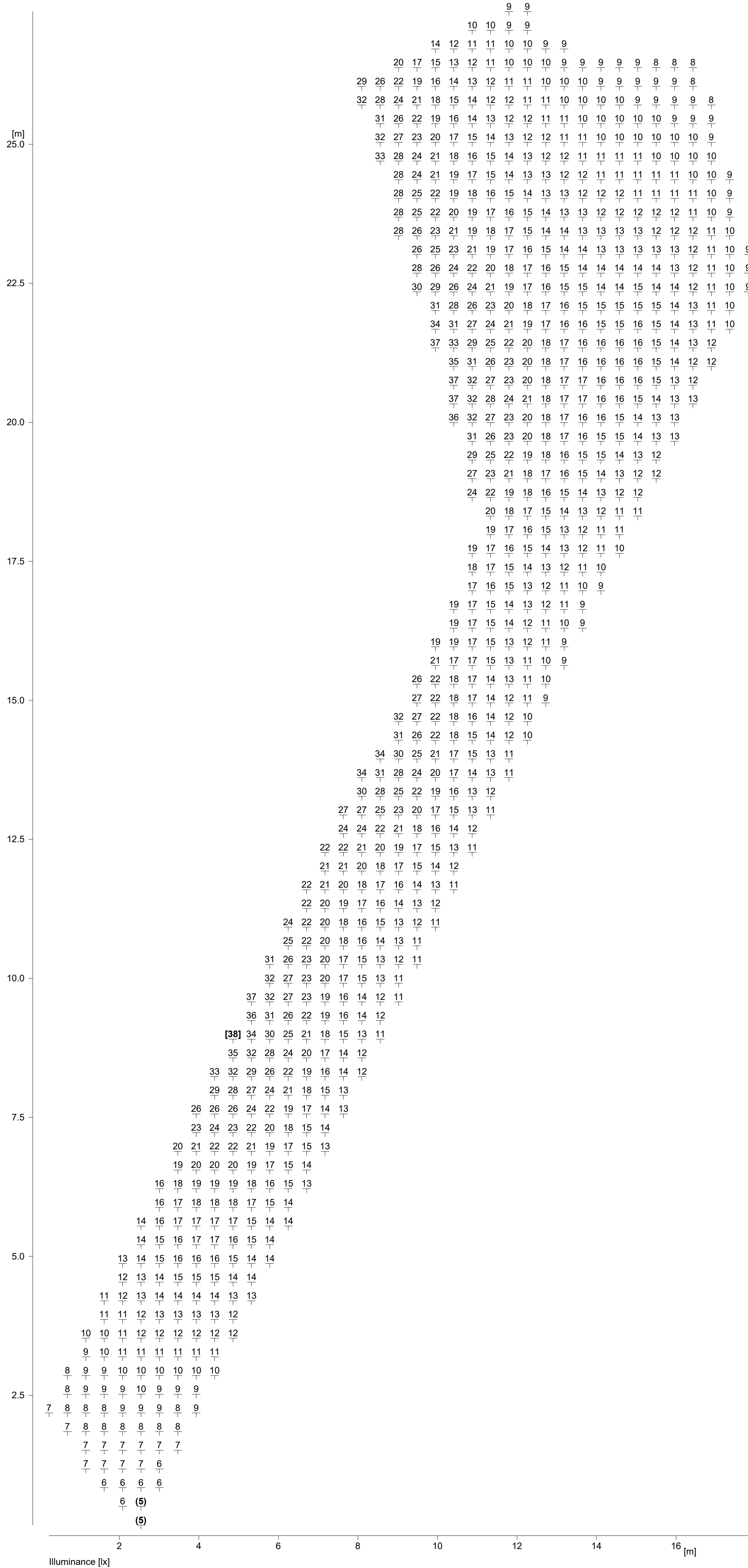


The ULR value has been calculated without obstruction by other objects.



Calculation results, EXTERNAL

Table, Measuring area 2 (E)



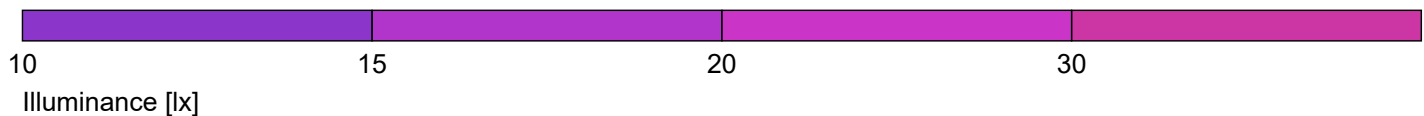
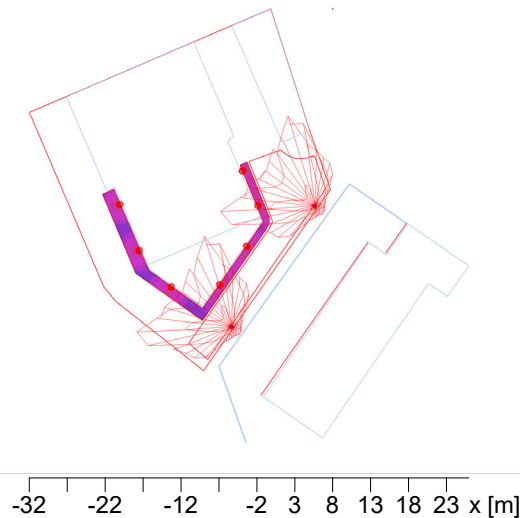
Height reference plane	: 0.00 m
Average illuminance	E_m : 16.1 lx
Minimum illuminance	E_{min} : 4.9 lx
Maximum illuminance	E_{max} : 38.1 lx
Uniformity U_0	E_{min}/E_m : 1 : 3.28 (0.30)
Diversity U_d	E_{min}/E_{max} : 1 : 7.77 (0.13)

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Summary, EXTERNAL

Result overview, Measuring area 3



General

Calculation algorithm used	Average indirect fraction
Height of evaluation surface	0.00 m
Maintenance factor	0.80
Total luminous flux	14984 lm
Total power	135.8 W
Total power per area (1087.93 m²)	0.12 W/m²
Upward light ratio (ULR)	0.02

Illuminance

Average illuminance	E_m	25.6 lx
Minimum illuminance	E_{min}	10.2 lx
Maximum illuminance	E_{max}	45 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:2.51 (0.4)
Diversity U_d	E_{min}/E_{max}	1:4.42 (0.23)

Type No.\Make

3	7 x	LDL
	Order No.	: LD7016/1220/4
	Luminaire name	: LD7016 1216lm 11w 840 250mA
	Equipment	: 1 x LED Backlight 10.59 W / 1216 lm

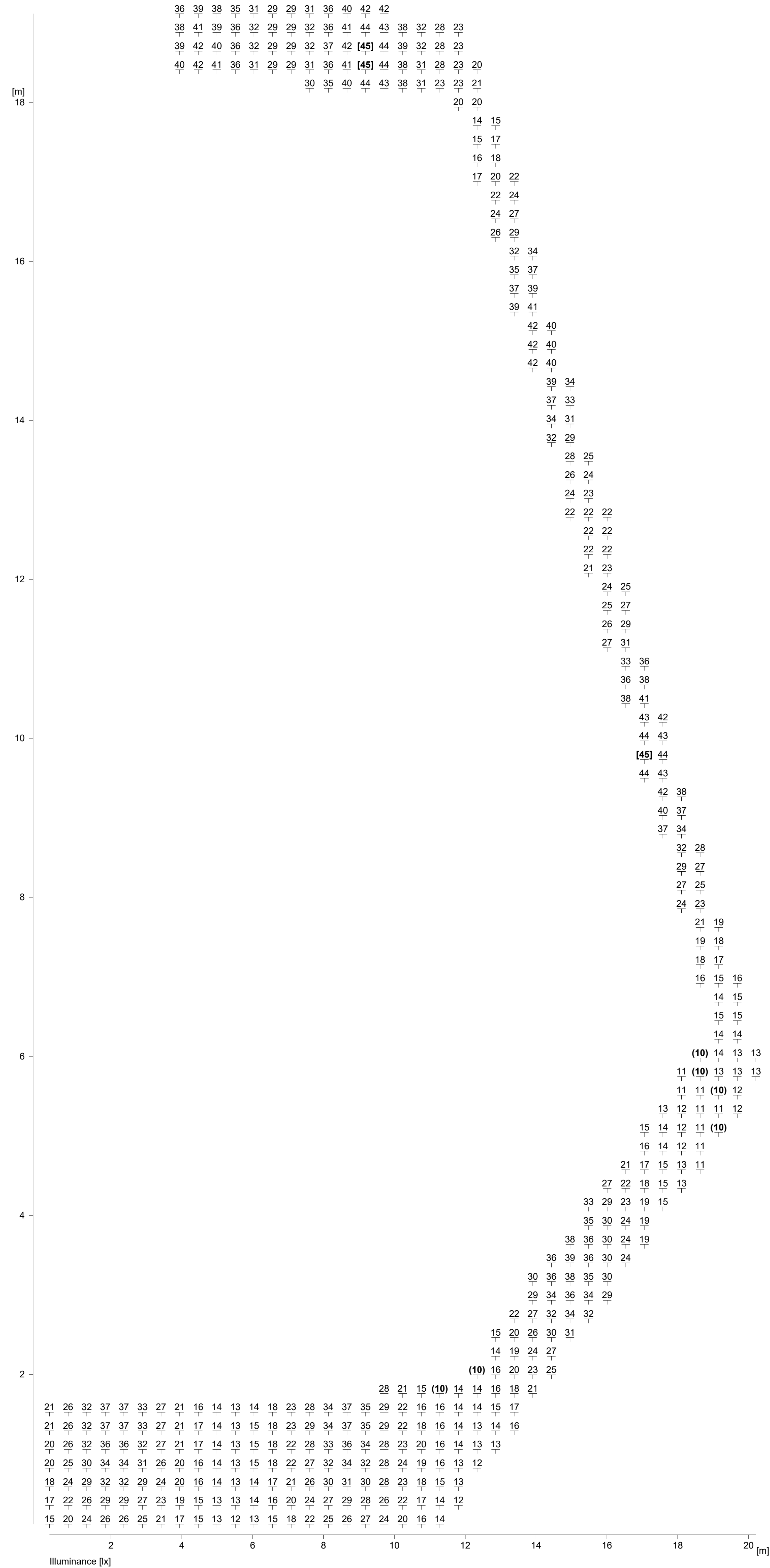
4	2 x	Order No.	: ST/M/L2/3200/74
		Luminaire name	: STREET Medium L2optic 3236lm 31w 740 300mA
		Equipment	: 1 x LED Backlight 30.82 W / 3236 lm

The ULR value has been calculated without obstruction by other objects.



Calculation results, EXTERNAL

Table, Measuring area 3 (E)



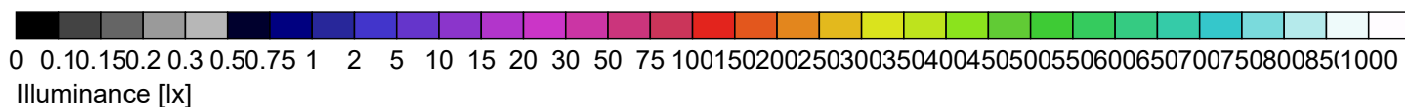
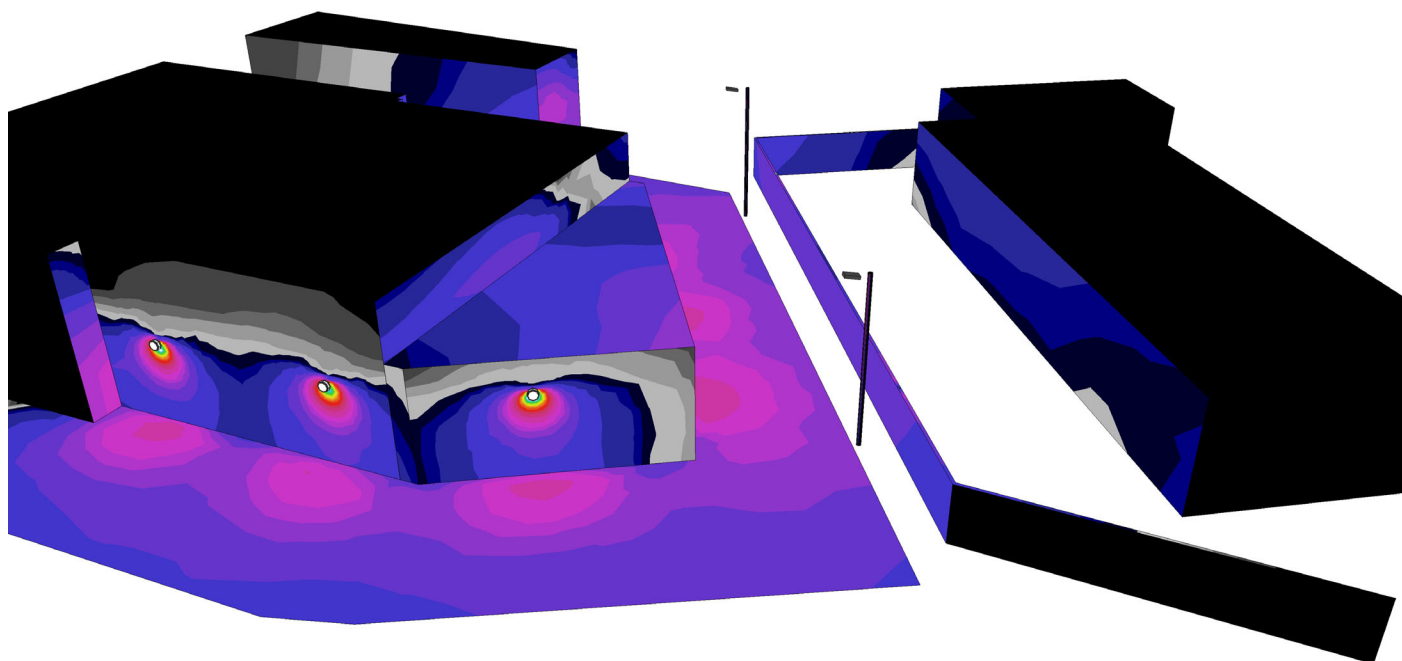
Height reference plane	: 0.00 m
Average illuminance	: 25.6 lx
Minimum illuminance	: 10.2 lx
Maximum illuminance	: 45 lx
Uniformity U ₀	: 1 : 2.51 (0.40)
Diversity U _a	: 1 : 4.42 (0.23)

Object : External - Rev.1
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Calculation results, EXTERNAL

3D pseudo colours, View 1 (E)

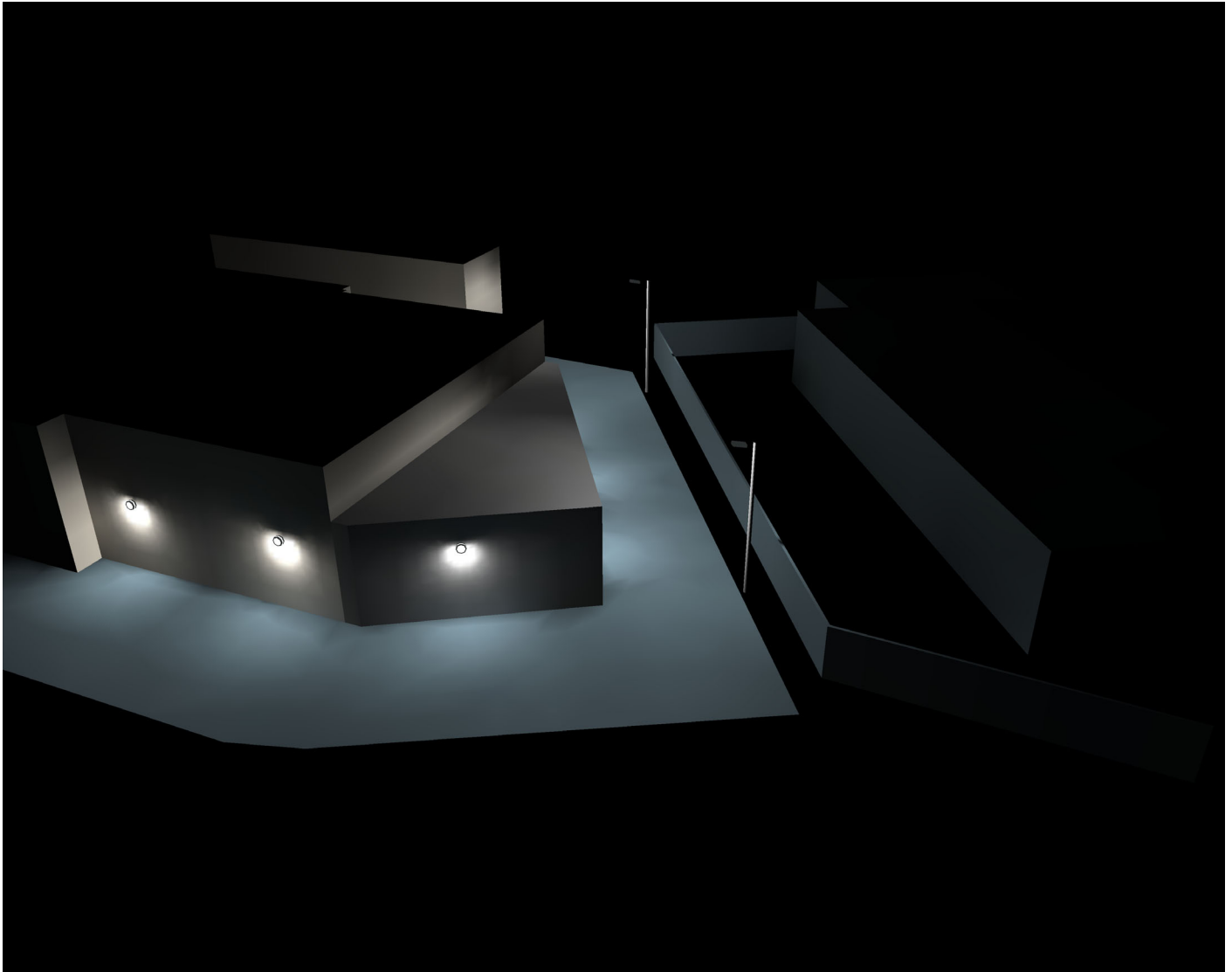


Object : External - Rev.1
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Calculation results, EXTERNAL

3D luminance, View 1



Object : External - Rev.1
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Luminaire data

LDL, STREET Medium L2optic 32... (ST/M/L2/3200/74)

Data sheet

Manufacturer: LDL

ST/M/L2/3200/74

STREET Medium L2optic 3236lm 31w 740 300mA

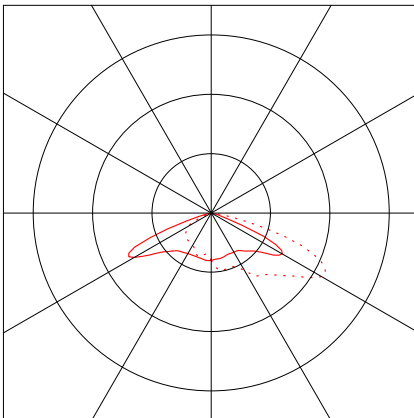
Luminaire data

Absolute Photometry
Luminaire efficacy : 105 lm/W
Classification : A20 ↓100.0% ↑0.0%
CIE Flux Codes : 27 61 96 100 100
UGR 4H 8H : 30.4 / 21.9
Power : 30.82 W
Luminous flux : 3236 lm

Equipped with

Quantity : 1
Designation : LED Backlight
Colour : 4000
Colour reproduction : 71

Dimensions : 500 mm x 250 mm x 100 mm



Each Street Medium
Luminaire mounted atop 6m
Column with a 10 Degree
upwards tilt (Towards the
Academy and away from
Residential Properties)

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Luminaire data

LDL, LD7016 1216lm 11w 840 250mA (LD7016/1220/4)

Data sheet

Manufacturer: LDL

LD7016/1220/4

LD7016 1216lm 11w 840 250mA

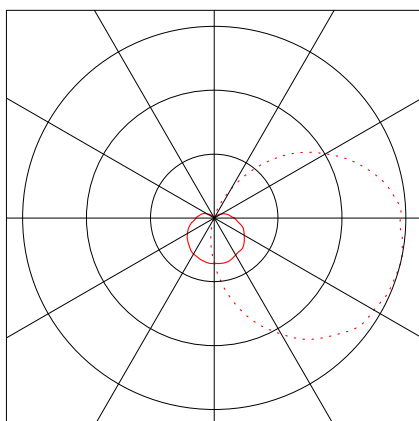
Luminaire data

Absolute Photometry :
Luminaire efficacy : 107.91 lm/W
Classification : B21 ↓63.7% ↑36.3%
CIE Flux Codes : 22 48 75 64 94
UGR 4H 8H : 18.8 / <10.0
Power : 10.59 W
Luminous flux : 1142.7 lm

Equipped with

Quantity : 1
Designation : LED Backlight
Colour : 4000
Colour reproduction : 80

Dimensions : Ø360 mm x 150 mm



Each LD7016 luminiare is
wall mounted at 3m AFFL.



External - Rev.1 - Obtrusive Lighting

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Description, EXTERNAL

3D view, View 1

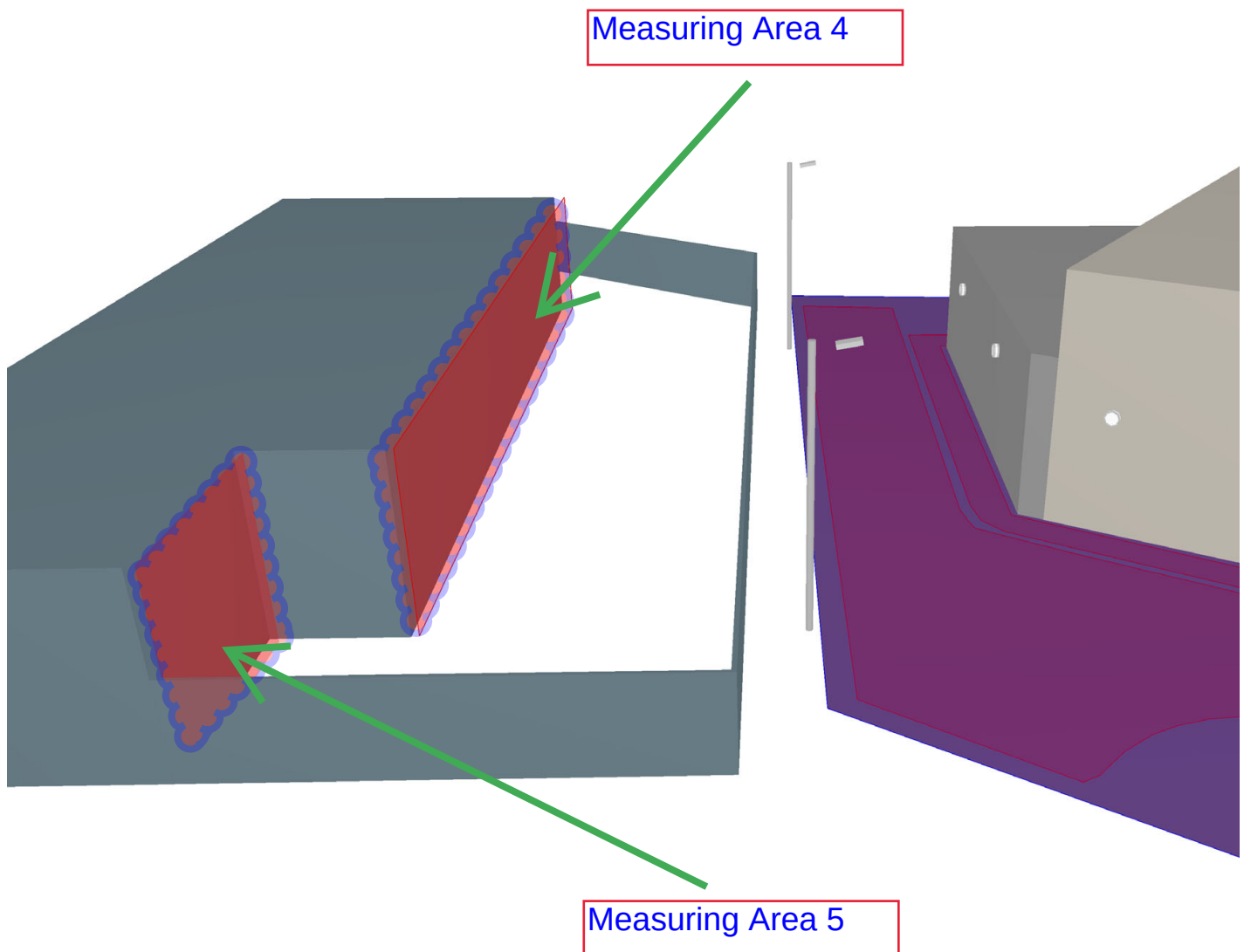


FIGURE 1 : Enviromental Zones

Table 2.1 Environmental zones

Zone	Surroundings	Lighting environment	Examples
E0	Protected	Dark	IDA Dark Sky Parks, UNESCO Starlight Reserves
E1	Natural	Intrinsically dark	Areas of Outstanding Natural Beauty, relatively uninhabited rural areas
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 and city centres, commercial areas

Source: CIE 150: 2003.

Source: LG6: The exterior Enviroment

FIGURE 2 : Obtrusive Lighting Levels

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.

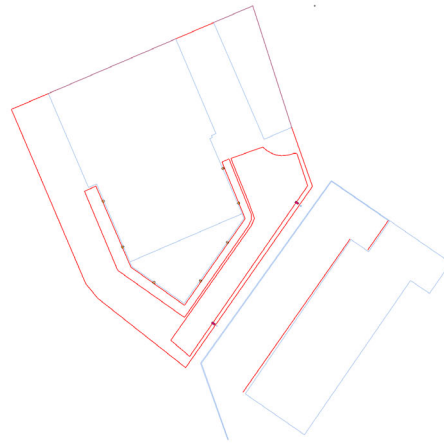
Source: BS EN 12464-2:2014

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Summary, EXTERNAL

Result overview, Measuring area 4



-32 -22 -12 -2 3 8 13 18 23 x [m]



General

Calculation algorithm used
 Maintenance factor

Average indirect fraction
 0.80

Total luminous flux
 Total power
 Total power per area (1087.93 m²)
 Upward light ratio (ULR)

14984 lm
 135.8 W
 0.12 W/m²
 0.02

(2%) as of
 Fig.2 Rug

Illuminance

Average illuminance $\bar{E}_m$ 1.35 lx
 Minimum illuminance E_{min} 0.7 lx
 Maximum illuminance E_{max} 1.92 lx
 Uniformity U_o $E_{min}/\bar{E}_m$ 1:1.93 (0.52)
 Diversity U_d E_{min}/E_{max} 1:2.74 (0.36)

Type No.\Make

LDL

3 7 x
 Order No. : LD7016/1220/4
 Luminaire name : LD7016 1216lm 11w 840 250mA
 Equipment : 1 x LED Backlight 10.59 W / 1216 lm

4 2 x
 Order No. : ST/M/L2/3200/74
 Luminaire name : STREET Medium L2optic 3236lm 31w 740 300mA
 Equipment : 1 x LED Backlight 30.82 W / 3236 lm

The ULR value has been calculated without obstruction by other objects.



Calculation results, EXTERNAL

Table, Measuring area 4 (E)



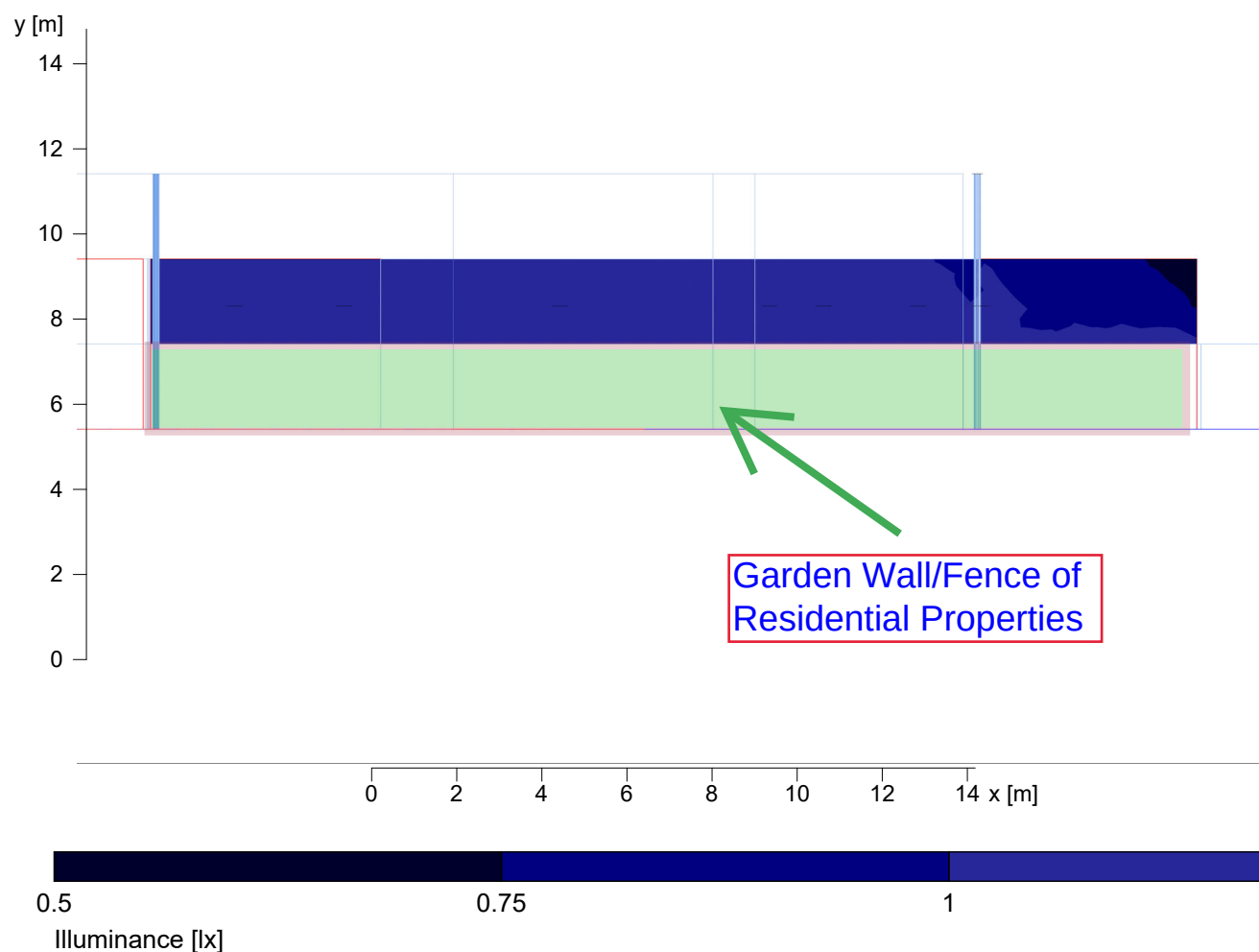
Average illuminance	$\bar{E}_m$	: 1.35 lx
Minimum illuminance	E_{min}	: 0.7 lx
Maximum illuminance	E_{max}	: 1.92 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	: 1 : 1.93 (0.52)
Diversity U_d	E_{min}/E_{max}	: 1 : 2.74 (0.36)

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Calculation results, EXTERNAL

Pseudo colours, Measuring area 4 (E)



Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

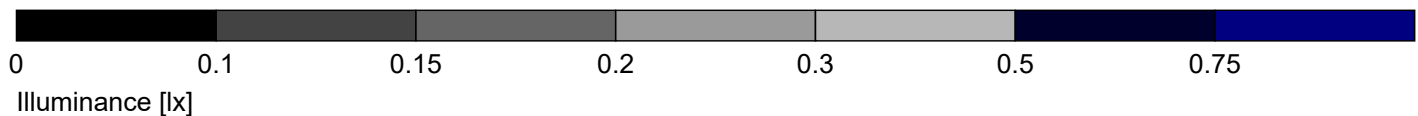
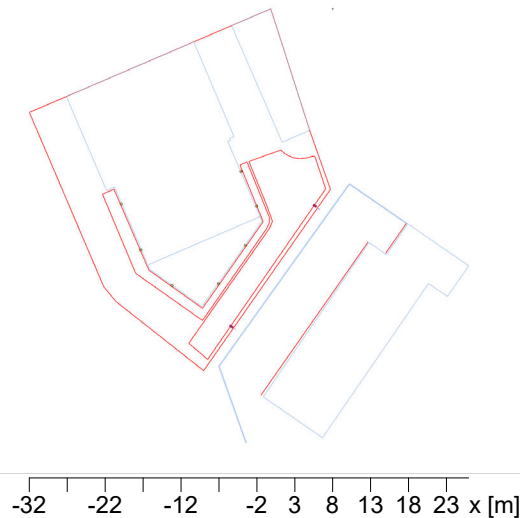
$\bar{E}_m$: 1.35 lx
 E_{min} : 0.7 lx
 E_{max} : 1.92 lx
 $E_{min}/\bar{E}_m$: 1 : 1.93 (0.52)
 E_{min}/E_{max} : 1 : 2.74 (0.36)

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Summary, EXTERNAL

Result overview, Measuring area 5



General

Calculation algorithm used	Average indirect fraction
Maintenance factor	0.80
Total luminous flux	14984 lm
Total power	135.8 W
Total power per area (1087.93 m²)	0.12 W/m²
Upward light ratio (ULR)	0.02

Illuminance

Average illuminance	$\bar{E}_m$	0.56 lx
Minimum illuminance	E_{min}	0.08 lx
Maximum illuminance	E_{max}	0.94 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	1:7.15 (0.14)
Diversity U_d	E_{min}/E_{max}	1:11.9 (0.08)

Type No.\Make

LDL	
3	7 x
	Order No. : LD7016/1220/4
	Luminaire name : LD7016 1216lm 11w 840 250mA
	Equipment : 1 x LED Backlight 10.59 W / 1216 lm
4	2 x
	Order No. : ST/M/L2/3200/74
	Luminaire name : STREET Medium L2optic 3236lm 31w 740 300mA
	Equipment : 1 x LED Backlight 30.82 W / 3236 lm

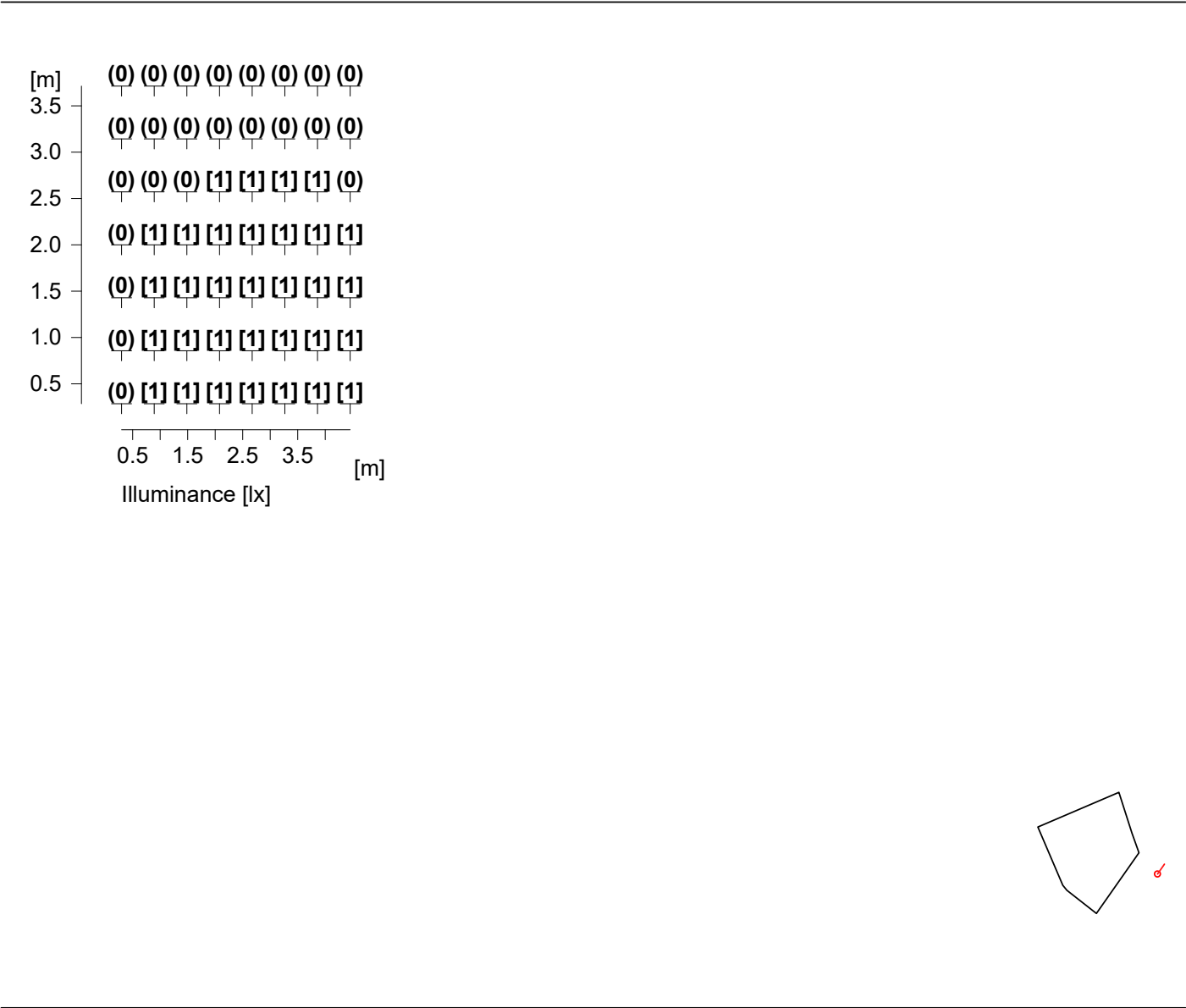
The ULR value has been calculated without obstruction by other objects.

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Calculation results, EXTERNAL

Table, Measuring area 5 (E)



Average illuminance	$\bar{E}_m$	: 0.56 lx
Minimum illuminance	E_{min}	: 0.08 lx
Maximum illuminance	E_{max}	: 0.94 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	: 1 : 7.15 (0.14)
Diversity U_d	E_{min}/E_{max}	: 1 : 11.90 (0.08)

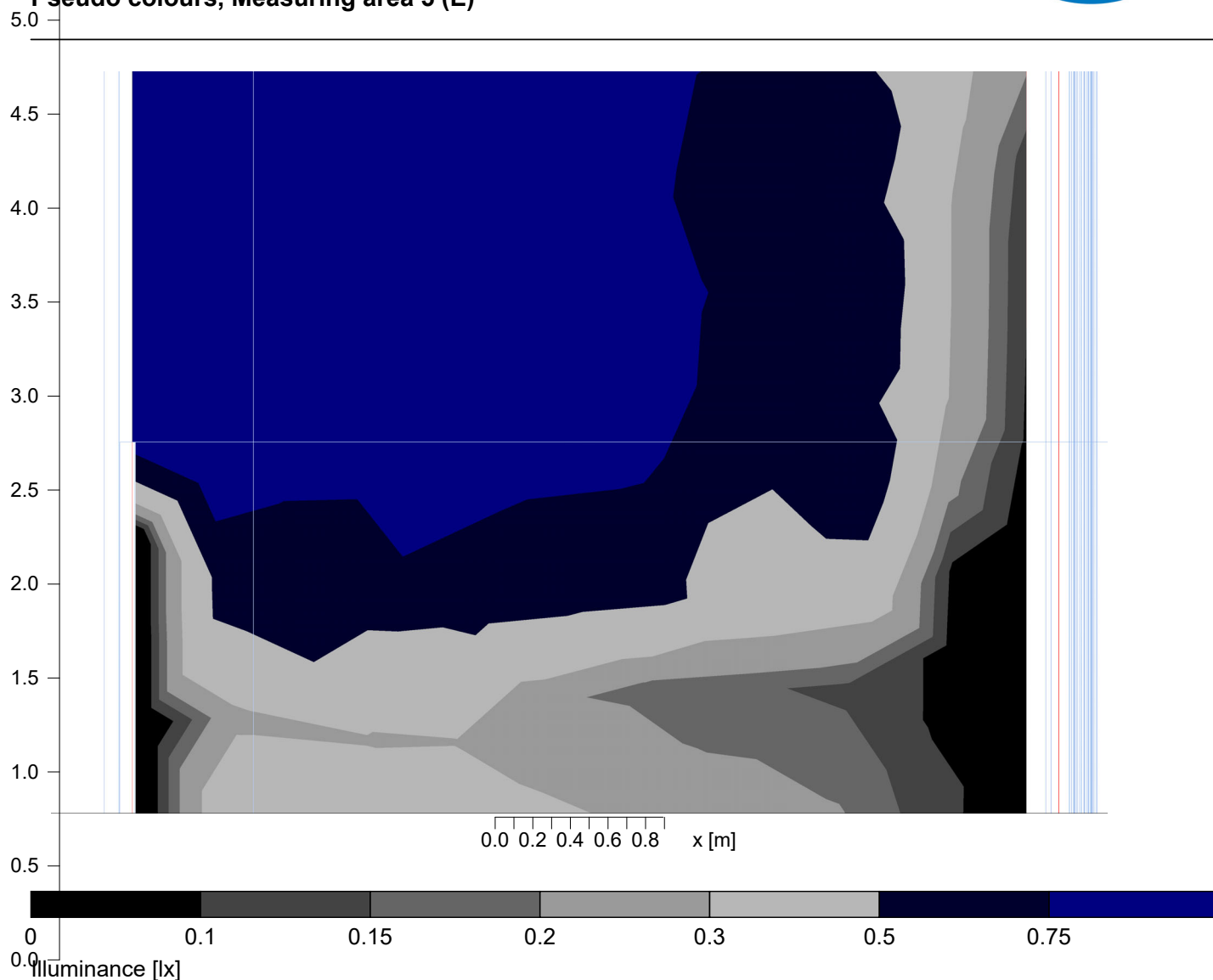
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y [m]

Calculation results, EXTERNAL

Pseudo colours, Measuring area 5 (E)



Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

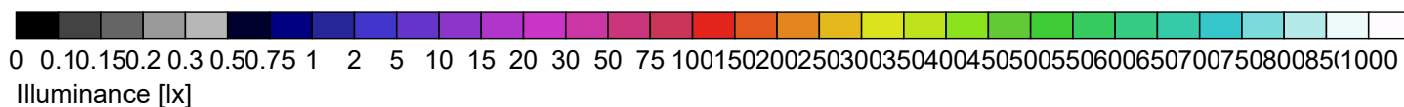
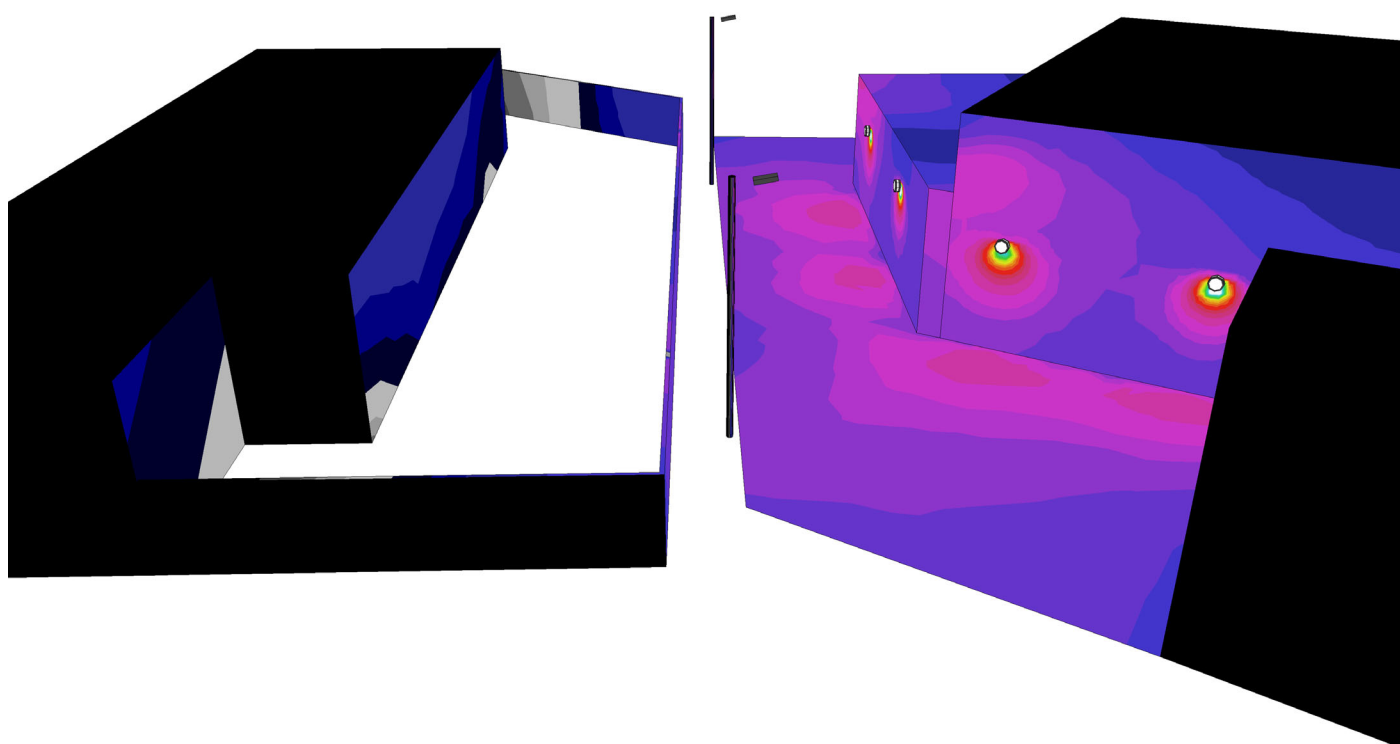
$\bar{E}_m$	: 0.56 lx
E_{min}	: 0.08 lx
E_{max}	: 0.94 lx
$E_{min}/\bar{E}_m$	: 1 : 7.15 (0.14)
E_{min}/E_{max}	: 1 : 11.90 (0.08)

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Calculation results, EXTERNAL

3D pseudo colours, View 1 (E)



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Calculation results, EXTERNAL

3D luminance, View 1

