EXTERNAL LIGHTING DESIGN REPORT

REV B

DECEMBER 2022

Document Information

Title and Number

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External Lighting Design Report	NA

Revision History

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B	NK	Author	12th Dec. 2022

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Name	Signature	Role	Date
CM		Electrical Engineer	12th Dec 2022
HC		Electrical Engineer	12th Dec 2022

Note: To jump to a page, hold down the Ctrl key and click the page number.

Contents

PART 1 - GENERAL

1.1 INTRODUCTION

This report outlines the design approach proposed for the external lighting installations at the alterations at Unit 1 M50 Business Park, Ballymount Avenue, Dublin 12, and takes into consideration the requirements, and standards as listed below.

The site totals 8,915 sqm in area and is currently vacant. The site is bound to the north-west by Calmount Road, to the north-east by an existing warehouse unit to the south-east by an internal estate road within the M50 Business Park and to the south-west by Ballymount Road Upper.

The proposed development will consist of:

- the change of use from warehouse to data repository facility,
- alterations to external facades provision of a new 1100 mm parapet, reclad roof, internal alterations, refurbishment of the existing office space, solar panels at roof level
- external plant and roof levels equipment to include 12 no. condenser modules, an emergency back-up generator and associated fuel storage tank, transformer,
- extension to the existing sub-station (c. 13 m2),
- 2 no. sprinkler tanks and pumphouse, bin store,
- 22 parking spaces including 2 electrical vehicle charging points, bicycle parking shelter, landscaping, planting, new security fence, external lighting, CCTV, altered vehicular gates, permeable hard surfaces,
- alterations to internal foul sewerage and water supply networks, provision of SuDS compliant surface water drainage system and
- all associated site works.

This document is to be read in conjunction with the Environmental Consultant's planning documentation, Architect's submission and relevant Civil/Structural submissions.

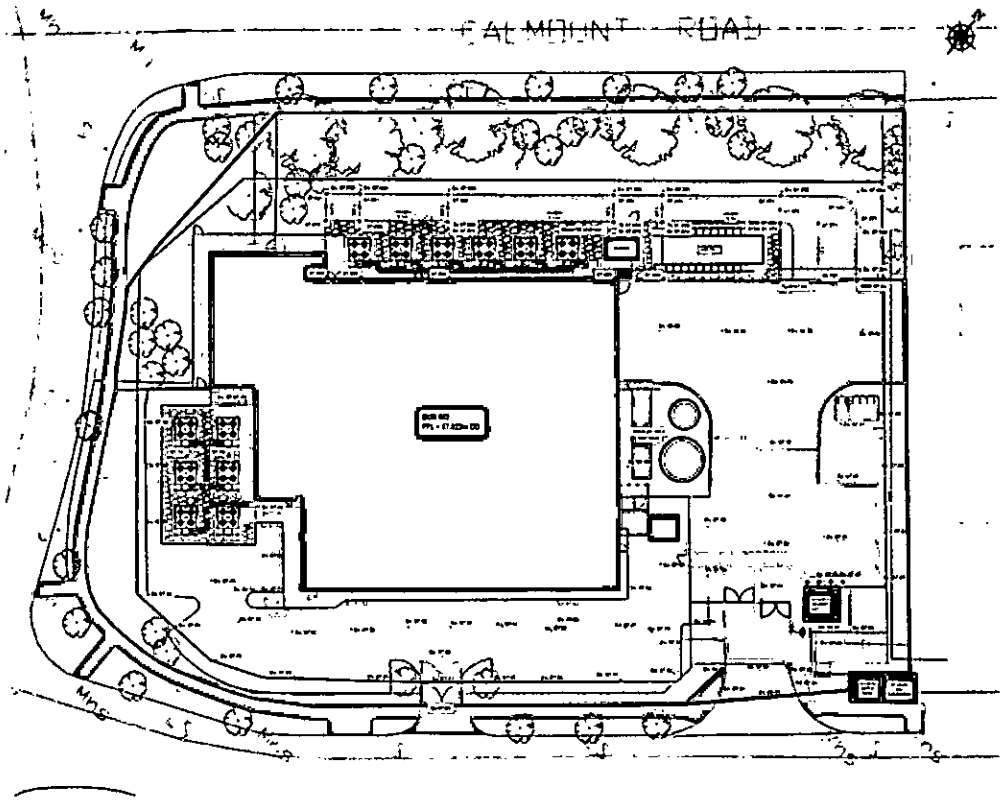


FIGURE 1 - OVERALL SITE MASTERPLAN

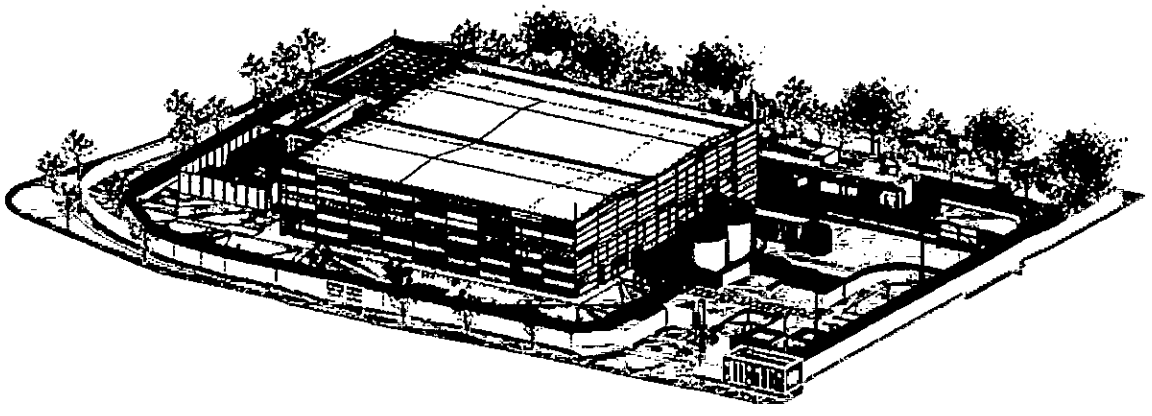


FIGURE 2 - SITE 3D VIEW

1.2 DESIGN STANDARDS

As Lighting Designers, our proposed External Lighting scheme, as indicated on our drawings for the Phase 1 and completed development lighting plans, are based on National & International Industry Standards and best practice, incorporating the following;

1. IS EN 12464-2:2014 *'Lighting for Work Places. Outdoor Work Places'*
2. IS EN 13201-2:2015 *'Road Lighting. Performance Requirements'*
3. I.S. 10101:2020 *'National Rules for Electrical Installations'*
4. BS 5489-1:2020 *'Code of Practice for the Design of Road Lighting – Part 1: Lighting Roads and Public Amenity Areas'*
5. GN 01/20 (2020) *'Guidance Notes for the Reduction of Obtrusive Light'* Institution of Lighting Professionals.
6. CIE 150 (2017*) 'Guide on the limitation of the effects of obtrusive light from outdoor lighting installations'*
7. GN 08/18 (2018) *'Bats and Artificial Lighting in the UK'*. Institution of Lighting Professionals.
8. LG06/16 (2016*) CIBSE Lighting Guide 06. 'The Exterior Environment'*. CIBSE
9. Building Control Regulations

All external lighting equipment shall be specified in accordance with the latest edition and amendments of all applicable standards, codes, laws and regulations listed below.

1. Directive 2014/35/EU - *Low Voltage Directive*
2. Directive 2014/30/EU - *Electromagnetic Compatibility (EMC) Directive*
3. Directive 93/68/EEC – *CE Marking*
4. RoHS Directive: 2011/65/EC

Note: All electrical equipment and systems supplied shall conform to the appropriate EU Directive and shall carry the appropriate CE Marking.

PART 2 - SITE LIGHTING BASIS OF DESIGN

2.1 LIGHT POLLUTION - OVERVIEW

Light pollution is a recognized statutory nuisance. Obtrusive light from luminaires within the site boundary onto adjacent roads and local wild-life districts shall be minimized taking into consideration the following; (a) sky glow from direct upward waste light and reflected light from surfaces), (b) vertical and intrusive light into windows, (c) reflected light from building and illuminated signs, (d) glare (viewed source intensity). Refer to Illustration 1.

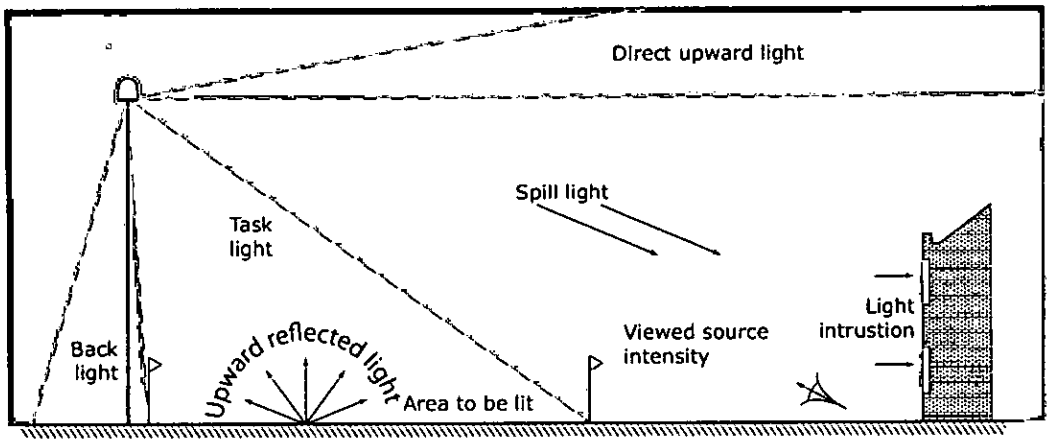


FIGURE 3 - LIGHT POLLUTION DIAGRAM

2.2 ENVIRONMENTAL CLASSIFICATION

Predictive modeling has been undertaken to study, identify and reduce potential light pollution from the proposed site to achieve compliance with ILP GN 01/20 *Guidance Notes for the Reduction of Obtrusive Light* with reference to CIE 150:2017 and ISEN 12464-2 Table 2, for **Environmental Zone E3**.

Environmental Zone E3 is defined in ISEN 12464-2 Clause 4.5 as "medium district brightness areas, such as industrial or residential suburbs".

Environmental zone	Light on properties		Luminaire intensity		Upward light ratio	Luminance	
	E_v lx		I cd			L_b cd m²	L_s cd m²
	Pre-curfew[a]	Post-curfew	Pre-curfew	Post-curfew	R_{UL} %	Building Façade	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	15	800
E4	25	5	25 000	2 500	25	25	1 000

[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.

TABLE 1 - ISEN 12464-2:2014 OBTRUSIVE LIGHT LIMITS FOR EXTERIOR LIGHTING INSTALLATIONS

2.3 OBTRUSIVE LIGHT LEVELS

In accordance with the table 1, the lighting will be as per the requirement of Environmental Zone E3, i.e. medium district brightness, with a maximum Upward Light Ration (URL) of 15%, maximum intrusive light (onto windows of adjoining properties) of between 2 to 10 lux (pre and post curfew). In the absence of curfew regulations and given that the proposed building will operate as a 24/7 facility, the lighting installation has been designed to comply with the more onerous "post curfew" requirements of Table 1, i.e., 2 lux vertical on properties and 1000 cd viewed source intensity.

The lighting design model has evaluated the vertical illuminance and the actual projected source intensity of all luminaires on a 10m high vertical grid for any adjacent properties under CIE 150.

A 1.0 lux horizontal spill light contour and colour rendering have been included in the lighting report to demonstrate the extent of light spill beyond the site boundary (if any), excluding entrance gates from access roadways.

It should be noted that horizontal and vertical light calculations do not take into consideration additional light spill control afforded by landscaping and/or vegetative screening, nor do they consider existing road lighting around the site.

2.4 DESIGN LIGHTING LEVELS

Roadways within the site shall be designed as a minimum to class "P1" under ISEN 13201-2:2015. Clause 6 which is intended for "for pedestrians and pedal cyclists on footways, cycleways, emergency lanes and other road areas lying separately or along the carriageway of a traffic route, and for residential roads, pedestrian streets, parking places, schoolyards etc".

Minimum maintained illuminance levels shall be designed to achieve between 5 and 15 lux, measured at road level.

Class	Horizontal illuminance		Additional requirements if facial recognition is necessary	
	E^a (minimum maintained) lx	E_{min} (maintained) lx	$E_{v.min}$ (maintained) lx	$E_{sc.min}$ (maintained) lx
P1	15,0	3,00	5,00	5,00
P2	10,0	2,00	3,00	2,00
P3	7,50	1,50	2,50	1,50
P4	5,00	1,00	1,50	1,00
P5	3,00	0,60	1,00	0,60
P6	2,00	0,40	5,0	0,20
P7	performance not determined	performance not determined		

[a] To provide for uniformity, the actual value of the maintained average illuminance shall not exceed 1.5 times the minimum E value indicated for the class.

TABLE 2 - ISEN 13201-2: 2015 LIGHTING CLASSES

Lighting for carparking areas shall be designed to Table 5.9.3 ISEN 12464-2:2014 i.e. Eav: 20 lux, with a minimum overall uniformity (Uo) of 0.25.

Lighting for Mobility Impaired Parking (MIP) spaces and accessible routes, where identified, shall be designed to Section 1.1.3.1 Cause(g) of Building Control Regulations Technical Guidance Document Part M:2010.

Ref. no.	Type of area, task or activity	*Em* lx	*Uo* -	*GR* -	*Ra* -
5.9.1	Light traffic, e.g. parking lots of shops, schools, churches, terraced and apartment houses.	5	0.25	55	20
5.9.2	Medium traffic, e.g. parking lots of department stores, office buildings, plants, sports and multi-purpose building complexes.	10	0.25	50	20
5.9.3	Heavy traffic, e.g. parking lots of major shopping centres, major sports and multi-purpose building complexes.	20	0.25	50	20

TABLE 3 - TABLE FROM 5.9.3 ISEN 12464-2:2014 CARPARK LIGHTING LEVELS

Accessible Access Route Type	*Emin (maintained)* lx
Level and gently sloped*	20
Ramps or steps, measured at ramp, thread and landing level	100
* also applicable to Mobility Impaired Parking (MIP) spaces	

TABLE 4 - SECTION 1.1.3.1 CLAUSE(G) BUILDING CONTROL REGULATIONS TGD PART M LIGHTING OF ACCESSIBLE ROUTES

2.5 OBTRUSIVE LIGHT ASSESSMENT

The application site totalling 8,915 sqm in extent and is located in the M50 Business Park, Ballymount to the west of Dublin City.

The site is bound to the north-west by Calmount Road, to the north-east by an existing warehouse unit, to the south-east by an internal estate road within the M50 Business Park, and to the south-west by Ballymount Road Upper

PART 3 - DETAILED DESIGN

3.1 DESIGN CALCULATIONS

The complete external lighting design and has been calculated (in accordance with the with ISEN 12464-2 Environmental zone E3 requirements) using Dialux lighting design software. The calculations results can be found in Appendix of this report. The software calculation output can be found in has been plotted on drawings E320 & E321 which can be found in Appendix C & D.

3.2 ADHERANCE RO STANDARDS – SUMMARY TABLES

Upward Light Ratio (ULR) Maximum			
	Required	Achieved	Comment
	ULR %	*ULR* %	
	15.0	5.0	PASS

TABLE 5 - UPWARD LIGHT OUTPUT RATIO (ULR) SUMMARY

Class	Horizontal illuminance		Horizontal illuminance Achieved		
	E^a (minimum maintained) *lx*	E_{min} (maintained) *lx*	E^a (minimum maintained) *lx*	E_{min} (maintained) *lx*	Comment
P1	15,0	3,00	20.4	10.7	Compliance
Eave achieved is ≤ 1.5 times Eave for the lighting class.					Compliance

TABLE 6 - ROADWAYS TO ISEN 13201:2015 P1 CLASS – SUMMARY

Carparking Requirements	Required		Achieved		Comment
Carparks 1, 2, & 3	*Em* lx	*Uo* -	*Em* lx	*Uo* -	
Carparking ISEN 12464-2:2014 & Client Security	20	0.25	25.3	0.31	Compliance

TABLE 7 - CARPARKING TO ISEN 12464-2:2014 – SUMMARY

It can be noted that the 2.0 lux spill contour is confined within the site boundary, excluding, entrance gates from access roadways. (See Appendix B: External Lighting Design Layout Drawing).

It should be noted that the results achieved above are based on a worst-case design scenario without consideration of any existing or proposed landscaping (screening). In addition, there is significant vegetative screening on the boundary of the properties identified in the obtrusive light assessment.

3.3 DESIGN CONCLUSIONS

This analysis and the results achieved demonstrate compliance with the Standards and Guidance Notes as set out above, with respect to the proposed lighting design for this project.

Design Calculation Images

Lighting design simulation results have been included below, for reference purposes. The following table should be referred to in conjunction with the images below.

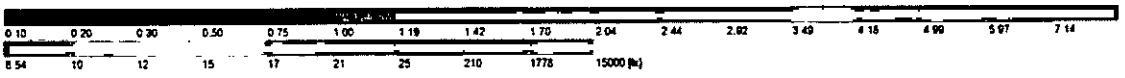


FIGURE 4 - FALSE COLOURS

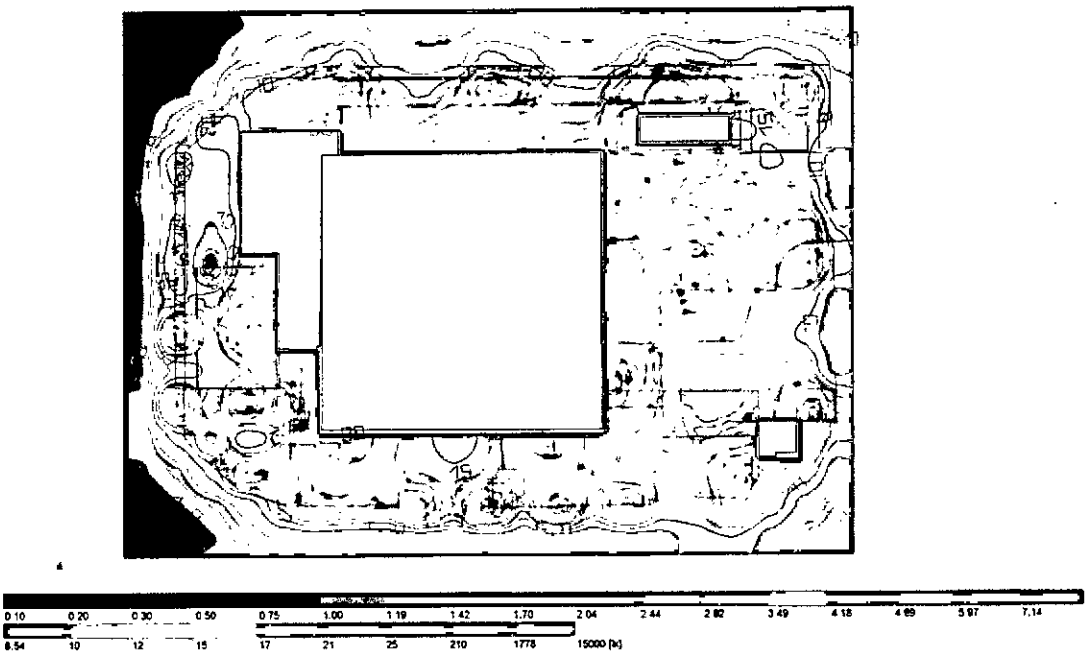


FIGURE 5 - KEY PLAN

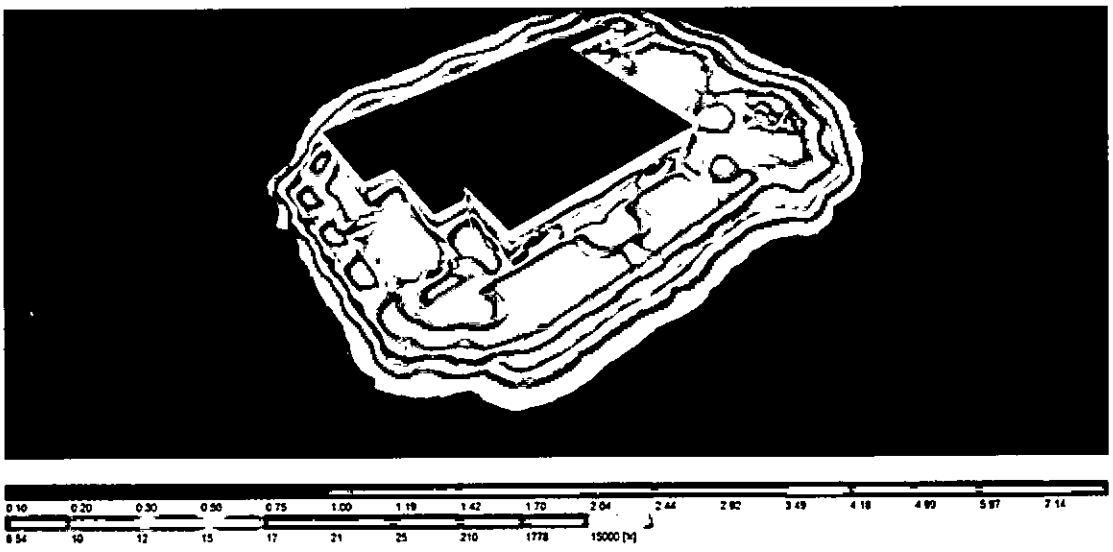


FIGURE 6 - 3D RENDERING OVERALL VIEW OF THE SITE 1

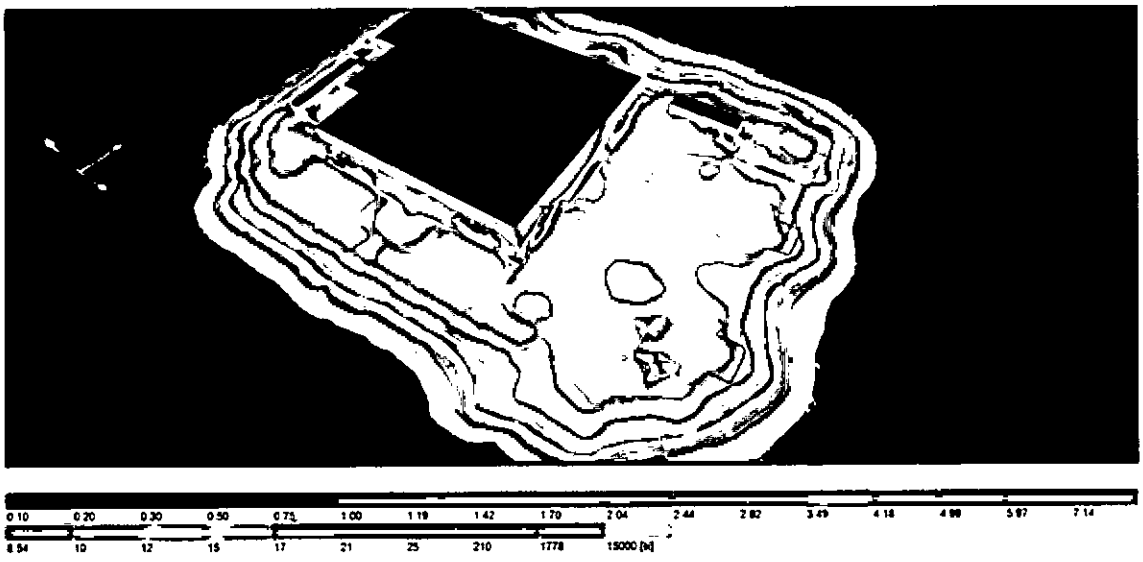


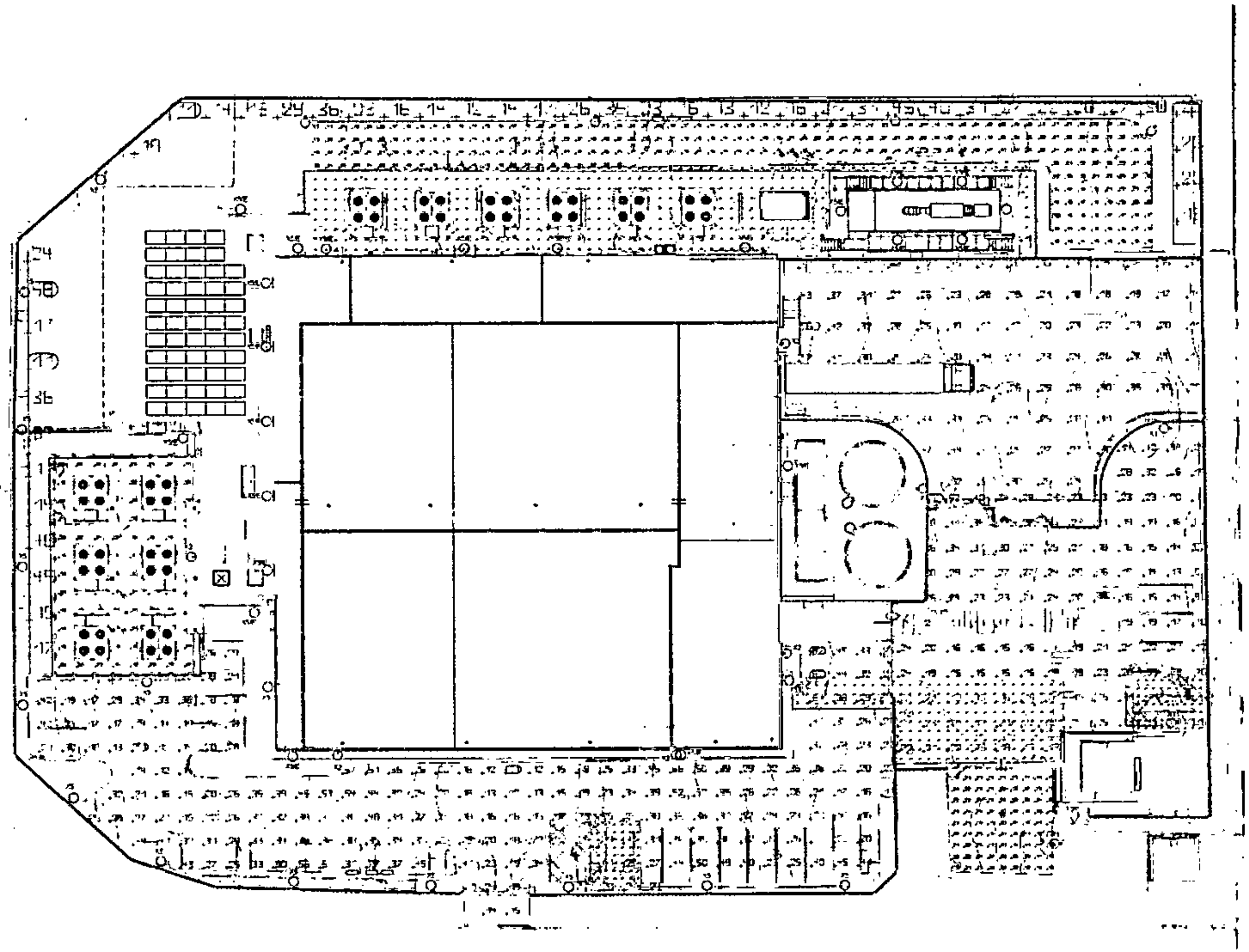
FIGURE 7- 3D RENDERING OVERALL VIEW OF THE SITE 2

PART 4 - APPENDICES

4.1 APPENDIX A – EXTERNAL LIGHTING DESIGN LAYOUIT DRAWINGS - VALUE PLOT

Lighting Fixture Schedule

Type Mark	Luminaire Legend Description	Luminaire Legend Location
	[illegible]	[illegible]
E1	[illegible]	OFFICE SPACES
E2	[illegible]	[illegible]
L1	[illegible]	[illegible]
L2	[illegible]	[illegible]
L3	[illegible]	OFFICE AREAS
L4	[illegible]	FALLOW SPACE
L4E	[illegible]	FALLOW SPACE
L5E	[illegible]	STAIRCORES
D1	[illegible]	MOUNTED ON ... COLUMN
D2	[illegible]	MOUNTED ON BUILDING FACADE
D3	[illegible]	EXTERNAL ...
D3E	[illegible]	EXTERNAL BULKHEAD



NOTES

LEGEND

REV	DATE	DESCRIPTION	DRN	CHD	CHK	APP

MECHANICAL & ELECTRICAL ENGINEER | CIVIL & STRUCTURAL ENGINEER

ARCHITECT | FIRE ENGINEER

FIRE SAFETY ENGINEER | CIVIL ENGINEER

PROJECT: DUB602

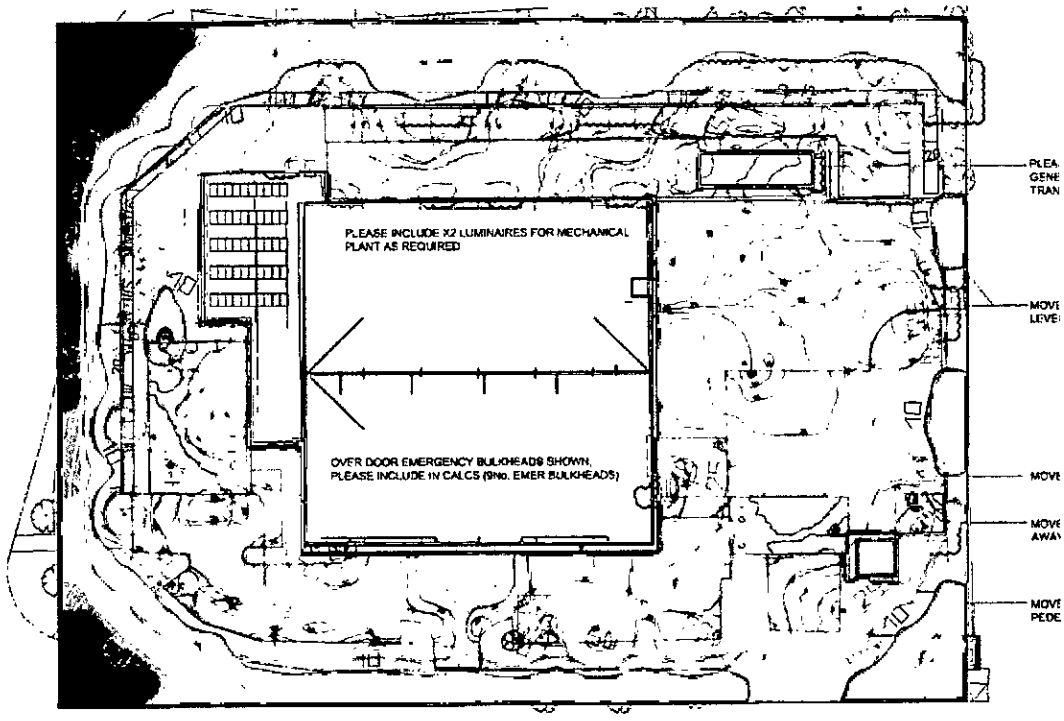
TITLE: SITE LIGHTING ILLUMINANCE LAYOUT

E-1011

A1 SCALE

4.2 APPENDIX B – EXTERNAL LIGHTING DESIGN SOFTWARE RESULTS

Date 22/09/2022



External lighting

R1 25-08-22
R2 22/09/22

Please see our Lighting Design Terms and Conditions at www.thorlux.com/terms

Contacts

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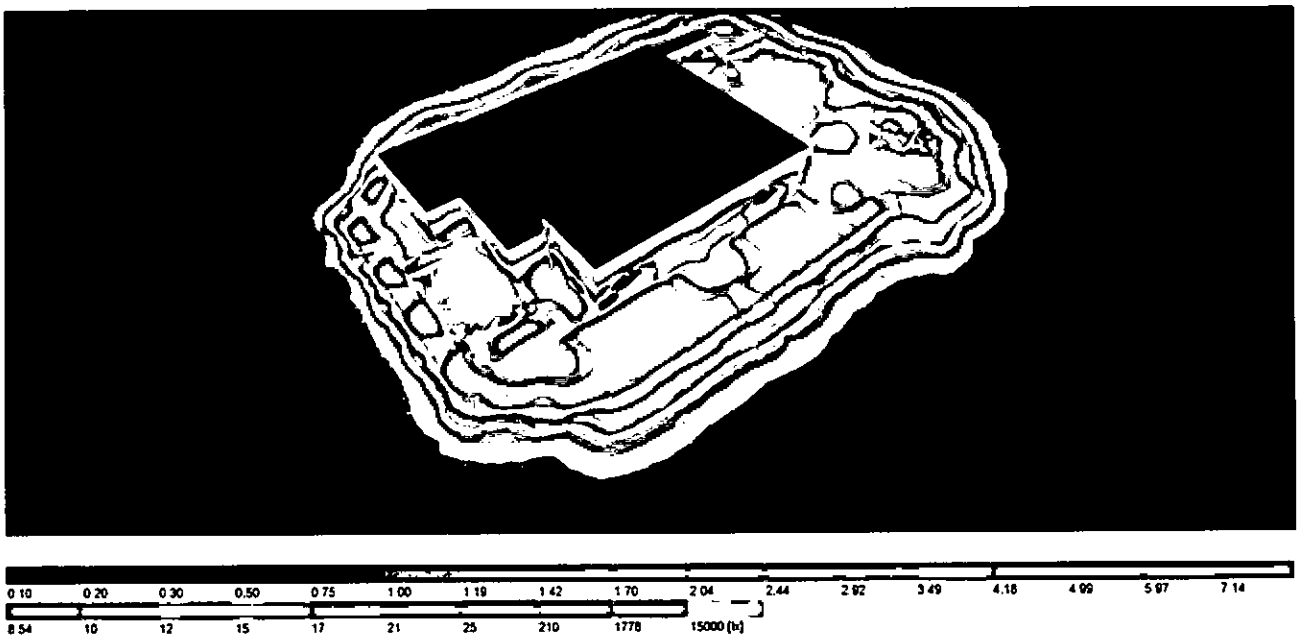
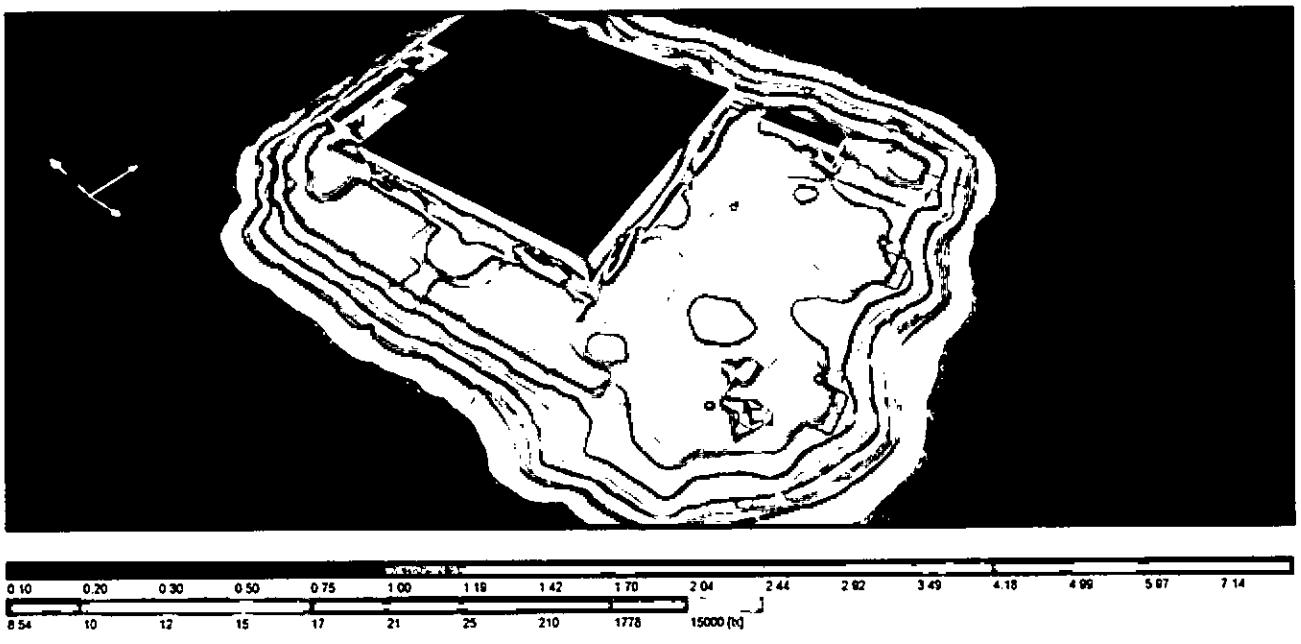
Images


0.10 0.20 0.30 0.50 0.75 1.00 1.19 1.42 1.70 2.04 2.44 2.92 3.49 4.18 4.99 5.97 7.14
8.54 10 12 15 17 21 25 210 1778 15000 (lx)


0.10 0.20 0.30 0.50 0.75 1.00 1.19 1.42 1.70 2.04 2.44 2.92 3.49 4.18 4.99 5.97 7.14
8.54 10 12 15 17 21 25 210 1778 15000 (lx)

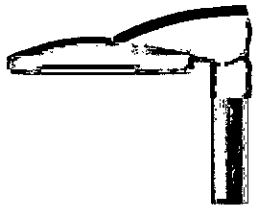
Luminaire list

Φ_{total}	P_{total}	Luminous efficacy	$\Phi_{Emergency\ lighting}$	$P_{Emergency\ lighting}$
237394 lm	1820.0 W	130.4 lm/W	7000 lm	64.4 W

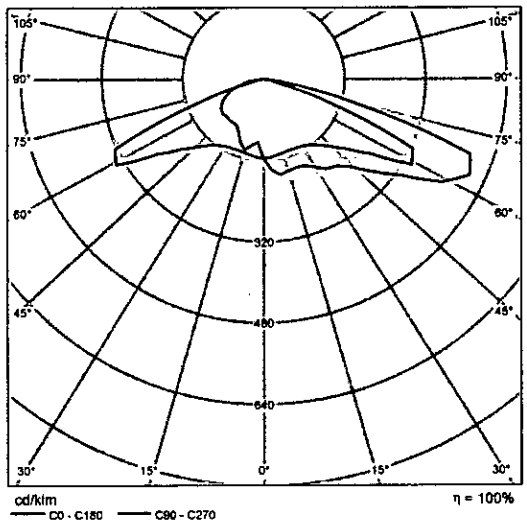
pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy	Index
4	TRT Lighting	AS48_LED_65W_GA2_4000K_FG	AS48_LED_65W_GA2_4000K_FG	65.0 W	9670 lm	148.8 lm/W	X2
9	TRT Lighting	AS48_LED_80W_GA2_4000K_FG	AS48_LED_80W_GA2_4000K_FG	80.0 W	11710 lm	146.4 lm/W	X1
28	Thorlux Lighting	MER19104	Mercian LED - 26W - 4000K	30.0 W	3333 lm	111.1 lm/W	M1
				2.3 W	250 lm (8 %)	-	

Product data sheet

TRT Lighting - AS48_LED_65W_GA2_4000K_FG



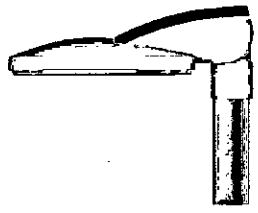
Article No.	AS48_LED_65W_GA2_4000K_FG
P	65.0 W
Φ_{Lamp}	9670 lm
$\Phi_{Luminaire}$	9670 lm
η	100.00 %
Luminous efficacy	148.8 lm/W
CCT	3000 K
CRI	100
Index	X2



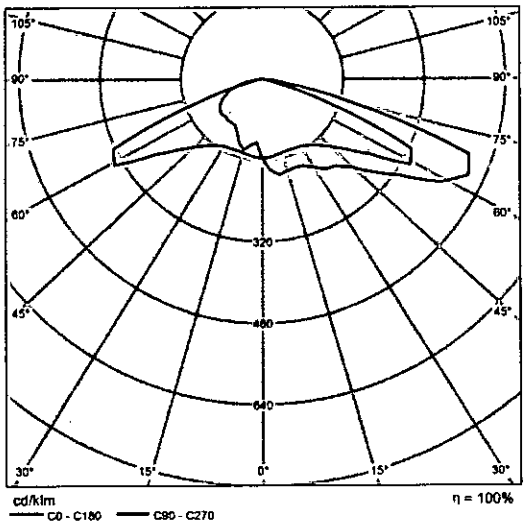
Polar LDC

Product data sheet

TRT Lighting - AS48_LED_80W_GA2_4000K_FG



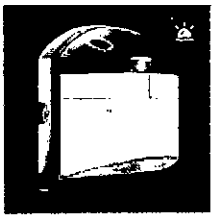
Article No.	AS48_LED_80W_GA2_4000K_FG
P	80.0 W
Φ_{Lamp}	11710 lm
$\Phi_{Luminaire}$	11710 lm
η	100.00 %
Luminous efficacy	146.4 lm/W
CCT	3000 K
CRI	100
Index	X1



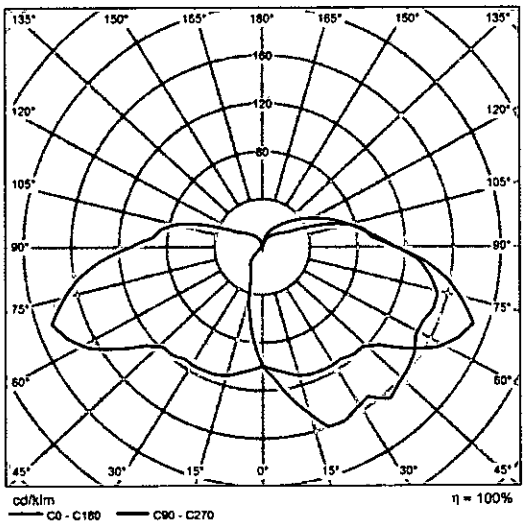
Polar LDC

Product data sheet

Thorlux Lighting - Mercian LED - 26W - 4000K



Article No.	MER19104
P	30.0 W
$P_{Emergency\ lighting}$	2.3 W
Φ_{Lamp}	3330 lm
$\Phi_{Luminaire}$	3333 lm
$\Phi_{Emergency\ lighting}$	250 lm
η	100.09 %
Luminous efficacy	111.1 lm/W
CCT	4000 K
CRI	80
ELF	8 %
Index	M1



Polar LDC

Vandal resistant luminaires photometrically designed to achieve wide luminaire spacing. Die cast aluminium body and impact resistant, flame-retardant prismatic polycarbonate cover. New - LED version.

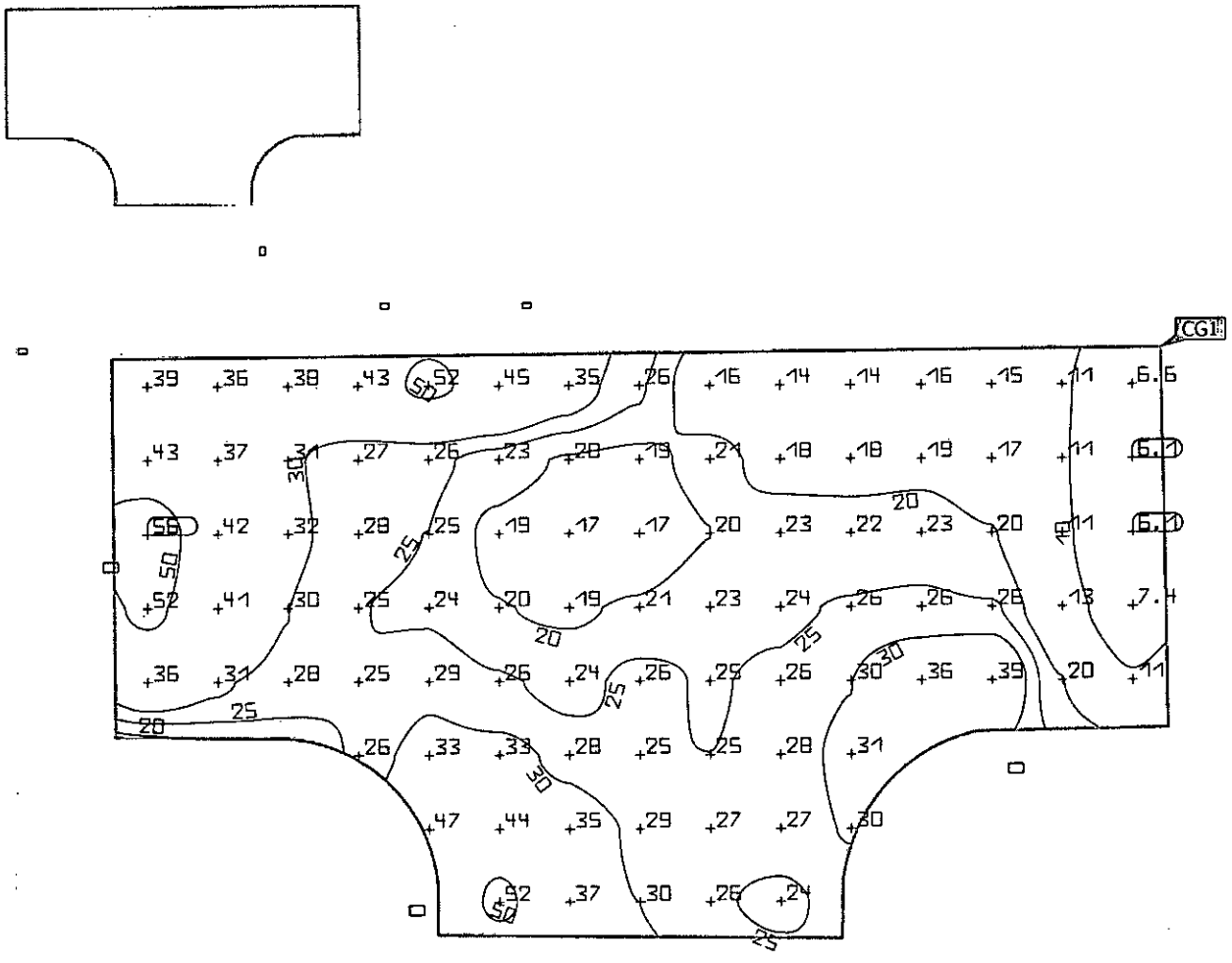
Applications: walkways and entrance areas, commercial premises, educational institutes and hospital/healthcare buildings.

γ	C0°	C90°	C0°- C360°
0°-180°	551.31	625.34	1223.11
60°-90°	507.33	625.34	1223.11

Glare valuation table [cd]

Site 1 (Light scene 1)

Back right-hand side yard

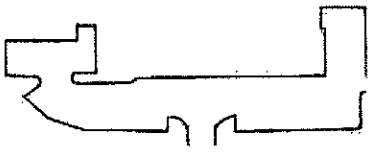


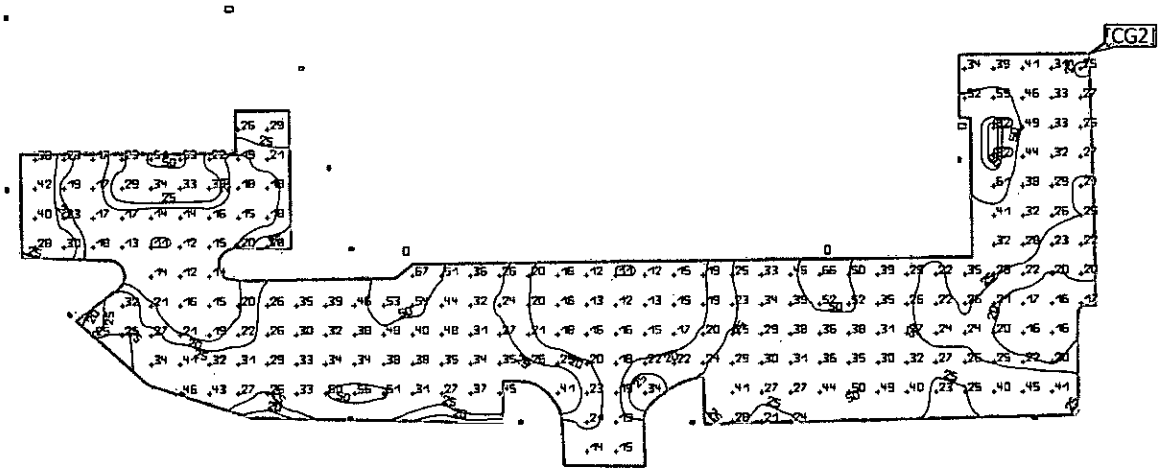
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Back right-hand side yard Perpendicular illuminance Height: 0.000 m	26.6 lx	6.07 lx	56.5 lx	0.23	0.11	CG1

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Front yard and carpark



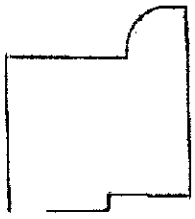


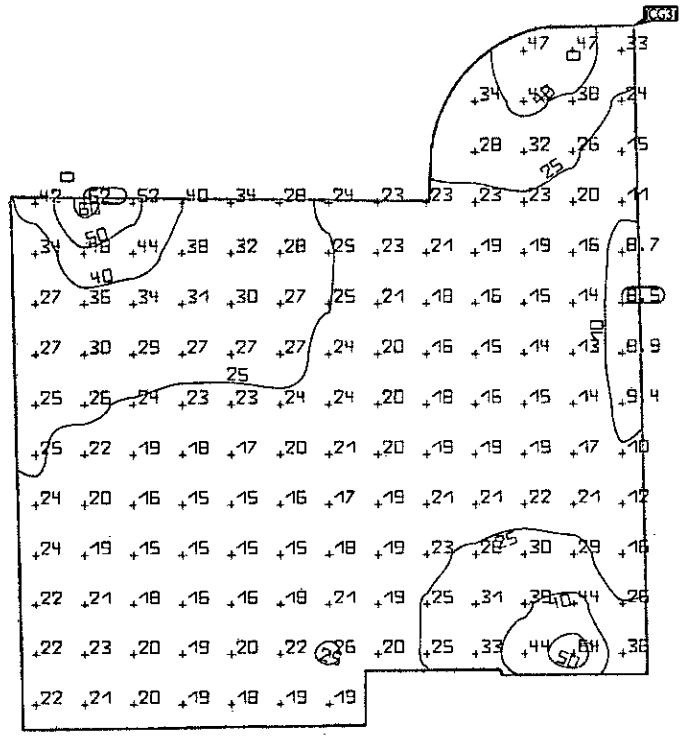
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Front yard and carpark Perpendicular illuminance Height: 0.000 m	29.5 lx	11.0 lx	81.8 lx	0.37	0.13	CG2

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Front right-hand side yard



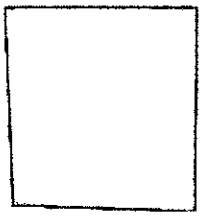


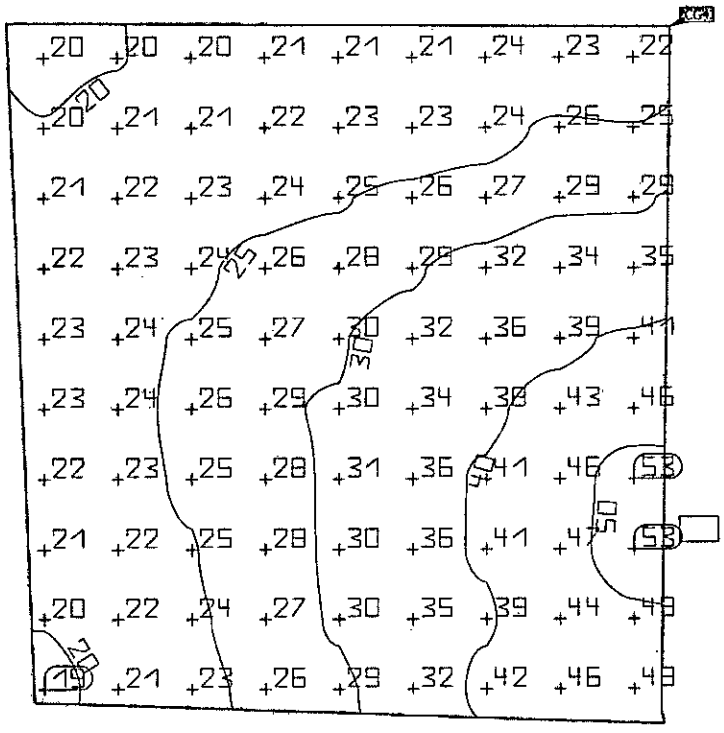
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Front right-hand side yard Perpendicular illuminance Height: 0.000 m	23.9 lx	8.48 lx	61.9 lx	0.35	0.14	CG3

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

External Entrance area



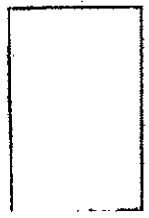


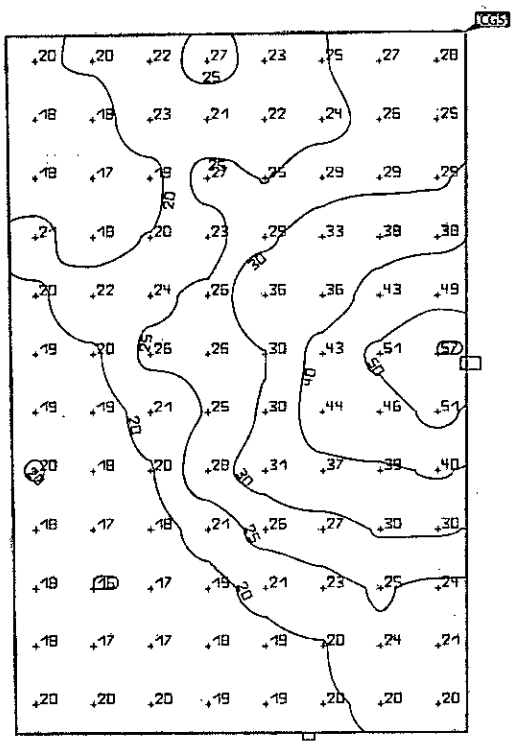
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
External Entrance area Perpendicular illuminance Height: 0.000 m	29.2 lx	19.2 lx	53.2 lx	0.66	0.36	CG4

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Fenced yard



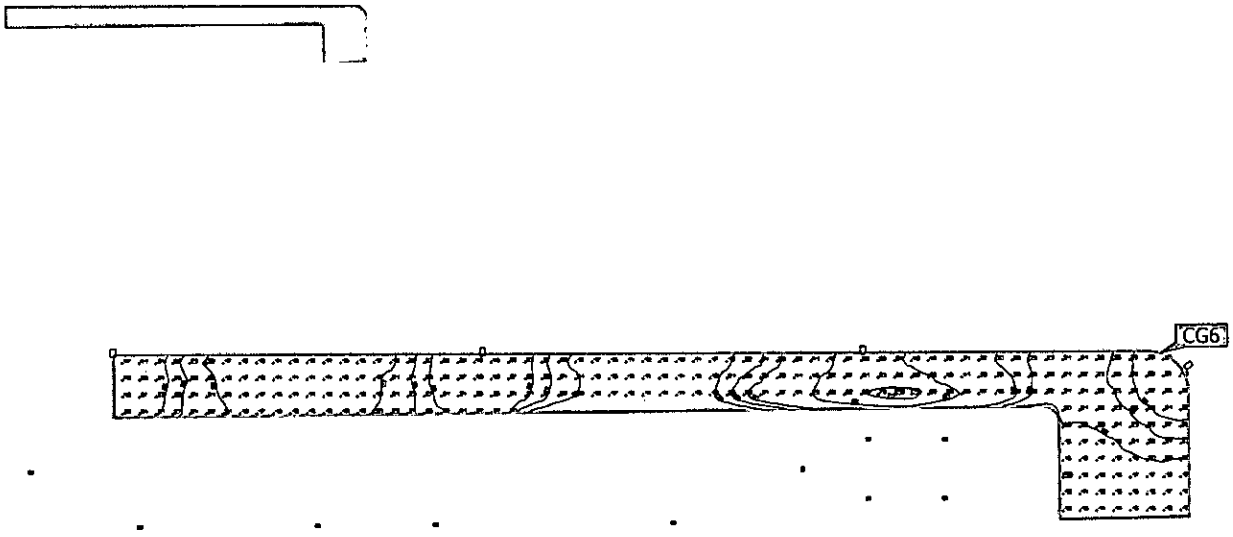


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Fenced yard Perpendicular illuminance Height: 0.000 m	25.6 lx	15.8 lx	57.1 lx	0.62	0.28	CG5

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Technical Maintenance Road

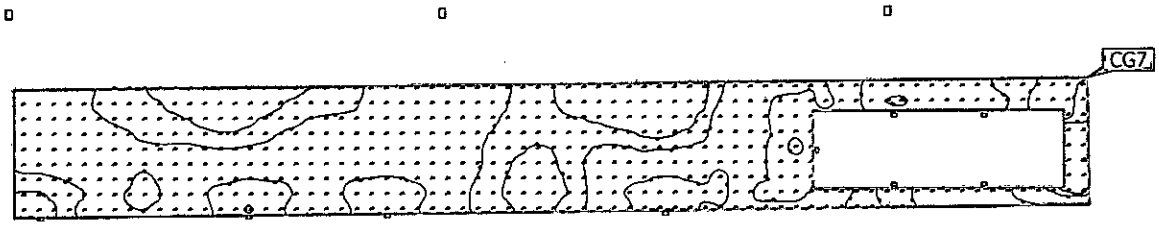


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Technical Maintenance Road Perpendicular illuminance Height: 0.000 m	27.0 lx	11.8 lx	75.0 lx	0.44	0.16	CG6

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Tech yard

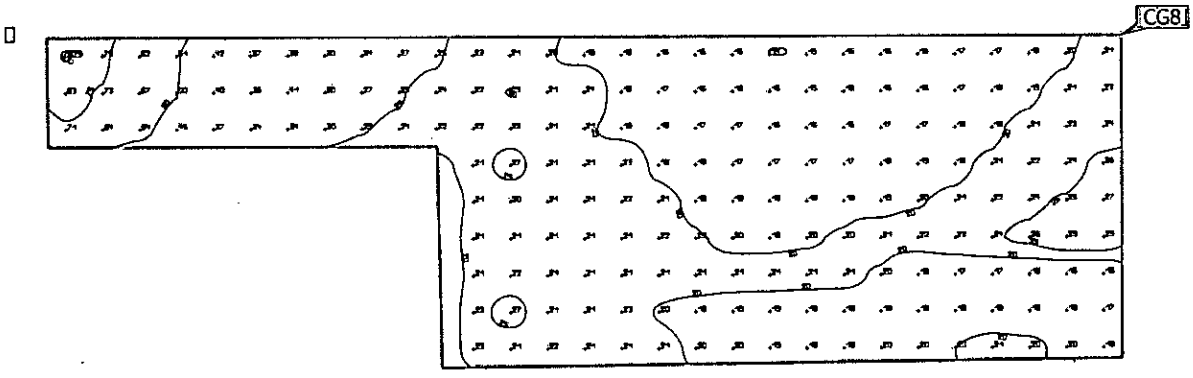


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Tech yard Perpendicular illuminance Height: 0.000 m	37.0 lx	10.2 lx	104 lx	0.28	0.098	CG7

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Internal Entrance area and footpath

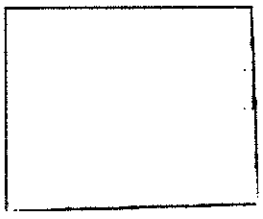


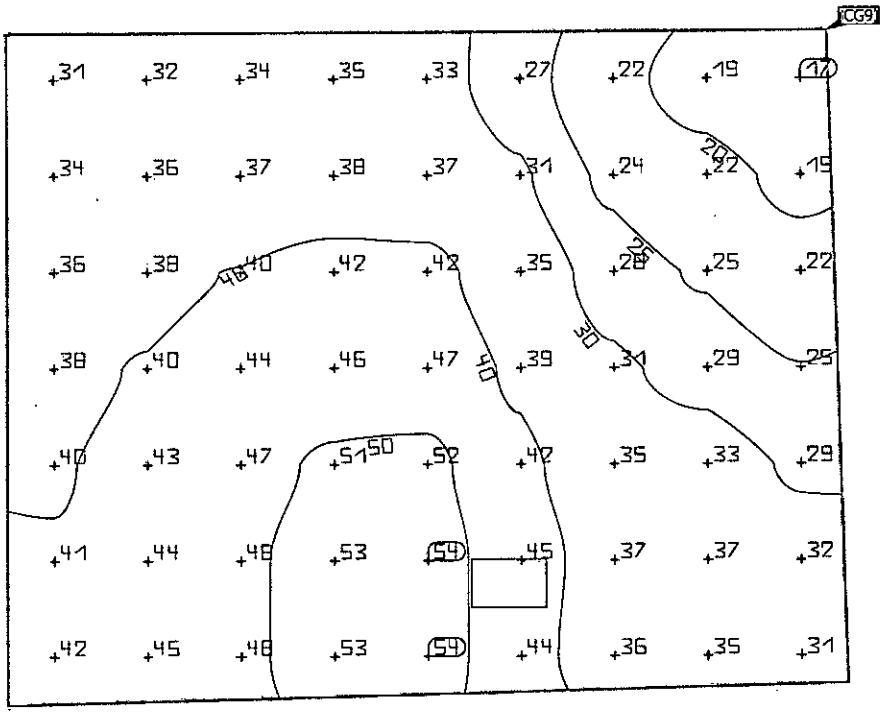
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Internal Entrance area and footpath Perpendicular illuminance Height: 0.000 m	23.9 lx	14.5 lx	101 lx	0.61	0.14	CG8

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

ACC Carpark



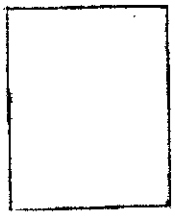


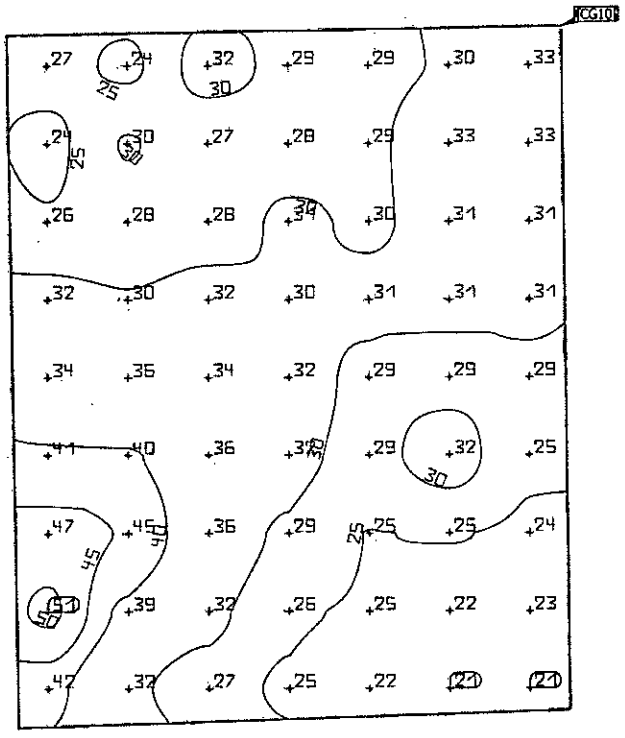
Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
ACC Carpark Perpendicular illuminance Height: 0.000 m	36.8 lx	16.7 lx	53.9 lx	0.45	0.31	CG9

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

ACC Carpark



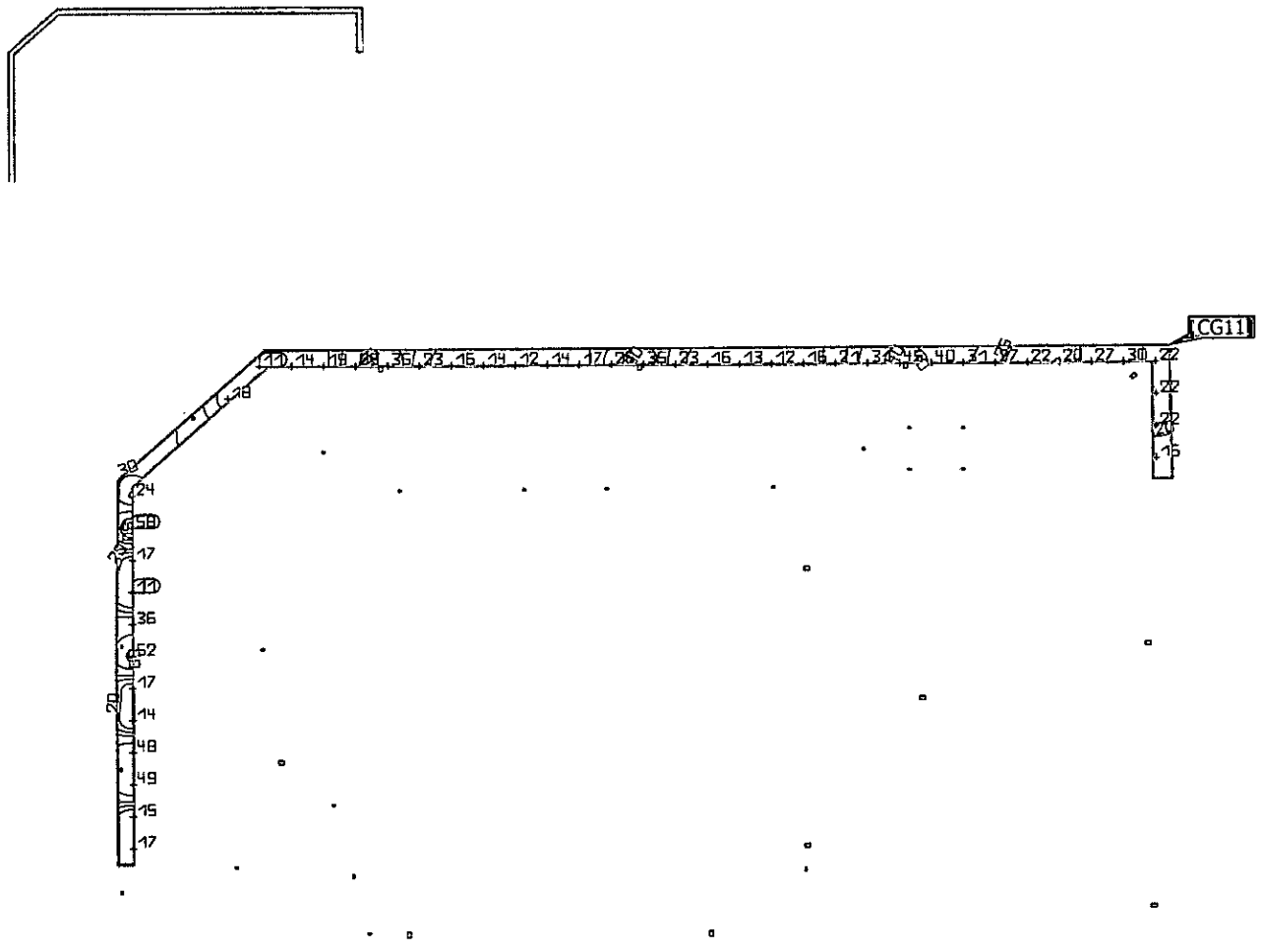


Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
ACC Carpark Perpendicular illuminance Height: 0.000 m	30.6 lx	21.1 lx	50.8 lx	0.69	0.42	CG10

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)

Site 1 (Light scene 1)

Security Perimeter



Properties	Ē	E_{min}	E_{max}	g_1	g_2	Index
Security Perimeter Perpendicular illuminance Height: 0.000 m	24.4 lx	10.5 lx	58.3 lx	0.43	0.18	CG11

Utilisation profile: DIALux presetting, Standard (outdoor transportation area)