

09 Mar. 22

Kishoge 110 kV Substation Compound Lighting Design Calculations



“Safety, Loyalty, Integrity, Commitment, & Teamwork”

	KISHOGE 110 KV GIS SUBSTATION COMPOUND LIGHTING DEISGN CALCULATIONS		Page:	2 of 19
	A1064D-HMV-XX-XX-RP-E-1019	Version	P01	Approved:

H&MV ENGINEERING

Kishoge 110 kV Substation

Compound Lighting Design Calculations

Issue: P01	Date of issue: 09/03/22
Prepared By:	Saad Khan
Reviewed By:	Fergus Lohan
Approved by:	Rory Bateman

COPYRIGHT H&MV ENGINEERING LIMITED

All rights reserved. No part of this work may be amended, copied or reproduced in any form or manner or by any means whether graphic, electronic or mechanical, including but not limited to photocopying, recording, capturing, or information and retrieval systems; or used for any other purpose but its designated one, without the written consent of H&MV ENGINEERING LIMITED.



	KISHOGE 110 KV GIS SUBSTATION COMPOUND LIGHTING DEISGN CALCULATIONS		Page:	3 of 19
	A1064D-HMV-XX-XX-RP-E-1019	Version	P01	Approved: 09 Mar. 22

TABLE OF CONTENTS

1. REVISION HISTORY	4
2. INTRODUCTION	4
3. CONCLUSION	5
4. LUMINAIRE PART LIST	6
5. COMPOUND AREAS	8
6. COMPOUND LUMINAIRE LAYOUT PLAN	9
7. OVERVIEW COMPOUND LAYOUT	10
8. CONTROL BUILDING SURROUND	12
9. TRANSFORMER AREA	14
10. ACCESS ROAD 1	16
11 ACCESS ROAD 2	18

1. Revision History

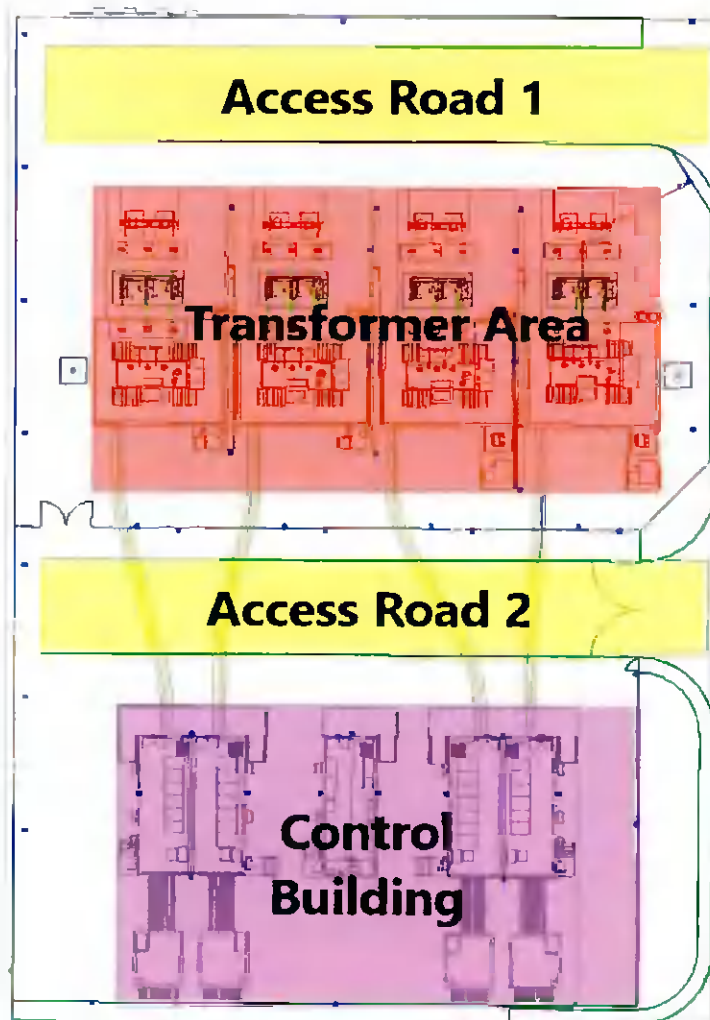
Date	Revision	Comment
09/03/2022	P01	Initial Revision

2. Introduction

The purpose of this study is to calculate the average illuminance in the outdoor compound. Sufficient illumination shall be provided to allow safe pedestrian travel within the compound.

The layout drawing below shows 4 zones of the compound which were individually tested.

The lighting for each zone was designed to meet the required average values of illuminance as set out in IEC standard EN 12464-2, Part 2 Outdoor Workplaces, Section 5.4. Each zone is designated a zone type depending on what activities will generally be carried out within that zone.



	KISHOGE 110 KV GIS SUBSTATION COMPOUND LIGHTING DEISGN CALCULATIONS		Page:	5 of 19
	A1064D-HMV-XX-XX-RP-E-1019	Version	P01	Approved: 09 Mar. 22

3. Conclusion

Summary results of the compound are as follows:

Area	Type of Area	Eav required (lx)	Eav achieved (lx)
Control Building Surround	Pedestrian passages, vehicle turning, loading and unloading points	50	116
Transformer Area	Cleaning and servicing	50	117
Access Road 1	Regular vehicle traffic / Traffic areas for slowly moving vehicles	20	46
Access Road 2	Regular vehicle traffic / Traffic areas for slowly moving vehicles	20	85

The full results for each zone and results for the overall compound can be found from section 5 onwards.

4. Luminaire Part List

4.1. LEDVANCE 4058075097704 FLOODLIGHT 135 135 W 4000 K IP65 BK 1xFLOODLIGHT 135 W 4000 K IP65 BK

**LEDVANCE 4058075097704 FLOODLIGHT 135 135 W 4000 K IP65 BK
1xFLOODLIGHT 135 W 4000 K IP65 BK**

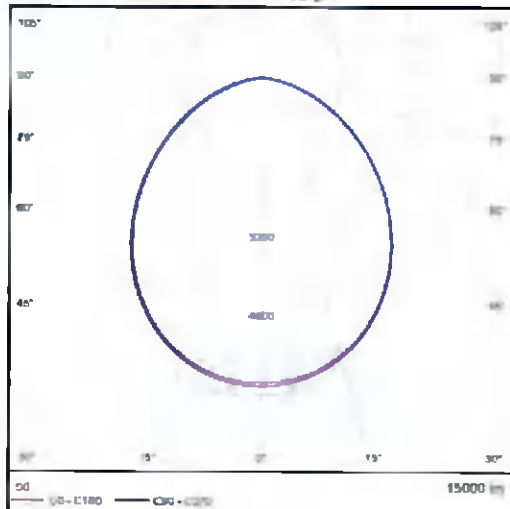


Luminaire with symmetrical light output with 135 W. Product features:
Luminaire efficacy: up to 110 lm/W. Symmetrical beam angle: 100° x 100°. Mounting bracket for up to 180° tilting. Type of protection: IP65. Impact resistance: IK08. Ambient temperature in operation: -20... +50 °C. Connection via 1 m cable, wiring required. Product benefits: Energy savings of up to 90 % compared to halogen lamp floodlights. Frosted cover made of tempered glass for uniform illumination. Optimized weight and size due to compact design. 5 years guarantee. Areas of application: Replacement for floodlights with halogen lamps. Garages. Public areas. Building facades. Construction areas. Design according to EN 60598-2-24 for fire-risk commercial unit, free by accumulation of dust.

Absolute photometry
Luminaire luminous flux: 15000 lm
Power: 135.0 W
Luminous efficacy: 111.1 lm/W

Colorimetric data
1xFLOODLIGHT 135 W 4000 K IP65 BK: CCT 4000 K, CRI 80

Luminous emittance 1 / Polar LDC



4.2. DISANO ILLUMINAZIONE 610 SAFETY PERMANENT 1 HR EMERGENCY S.E. DISANO 610 FLC1*24 CEM-L GREY 1XFLC24EM

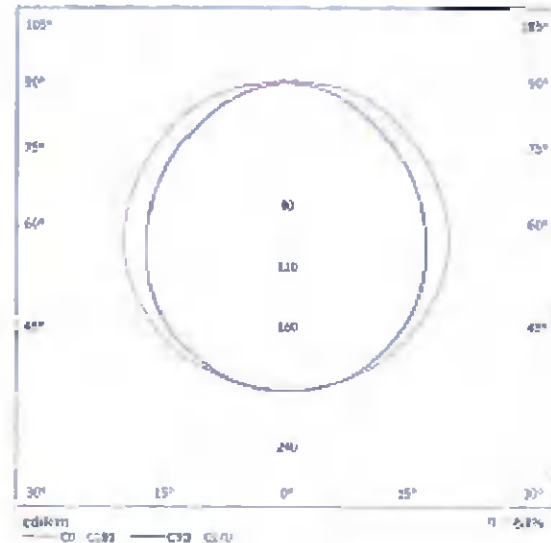
**Disano 610 Safety permanent 1 hr emergency S.E. Disano 610 FLC1*24 CEM-L grey /
Luminaire Data Sheet**



Luminaire classification according to CIE: 98
CIE flux code: 44 75 93 98 84

Housing: Vandal-resistant, self-extinguishing, UV-stabilized, anti-yellowing grey polycarbonate. Diffuser: Vandal-resistant, self-extinguishing, UV-stabilized clear polycarbonate, anti-glare frosted inside, smooth, dust-proof outside. Reflector: Reflecting white polycarbonate. Lampholder: Polycarbonate with phosphorus bronze contacts. Electric gear: 230V-2~50Hz power supply with electronic ballast. Hard wire, cross-section 0.50 mm², and high-temperature resistant (up to 93°C) PVC-HT sheath, in accordance with CEI 20-20 standards. 2P terminal block (maximum allowed lead cross-section 2.5 sqmm). Equipment: Rubber cable gland, 1/2 inch gas thread (min. cable Ø 9, max. Ø 12 mm) to maintain IP65 protection. Standard inspection LED. Regulators: Manufactured in compliance with EN50539 - CEI 34-21 standards. The level of protection complies with the EN50539 standard. S.E. Emergency (Only emergency): In the event of a back-out the one lamp connected to the back-up circuit stays on, thus avoiding the inconvenience caused by a sudden absence of all light. Emergency run time: 90 minutes. When power is restored, the battery recharges automatically in 12 hours. On request, with troubleshooting sub-code -9356.

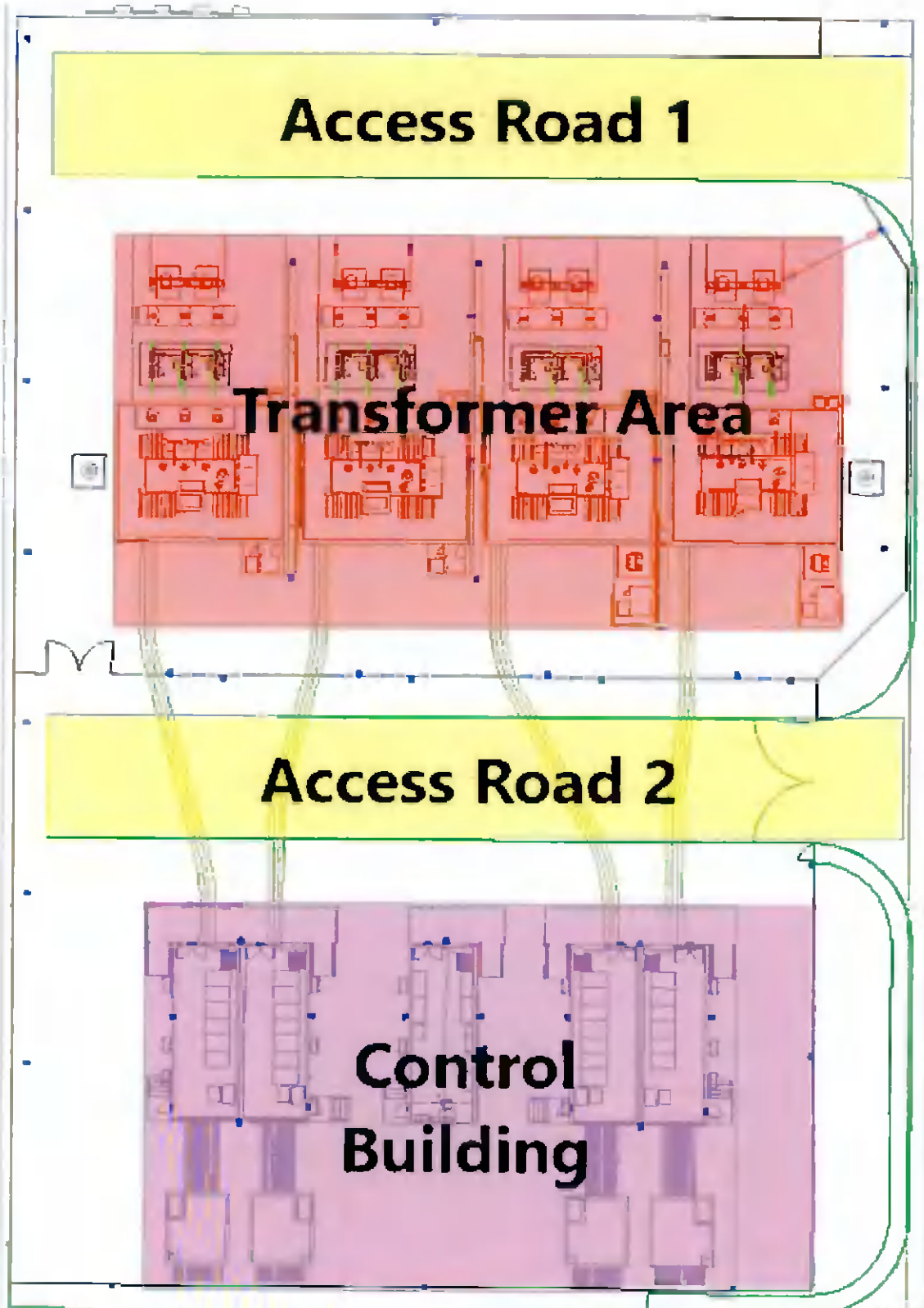
Luminous emittance 1:



Luminous emittance 1:

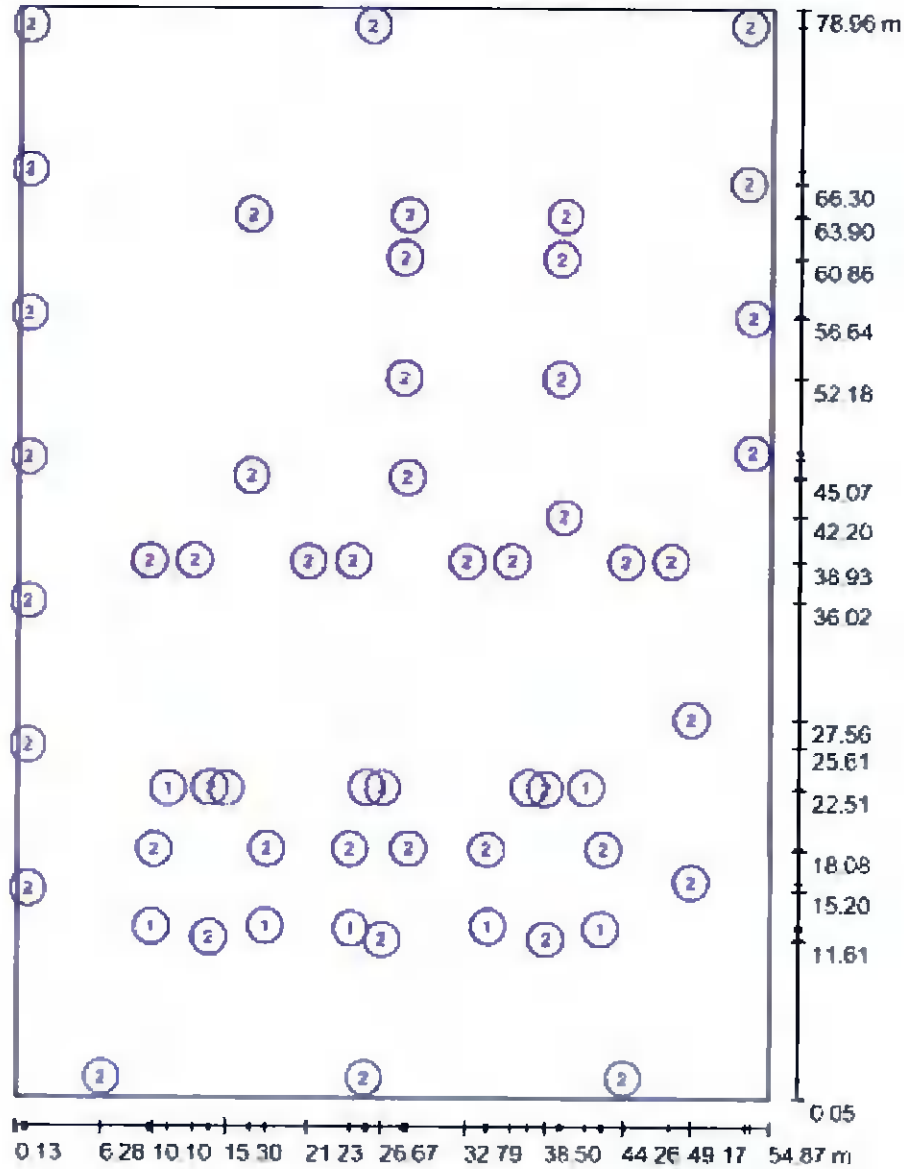
Glare Evaluation According to UGR											
Layout	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°
1 Floor	20	27	30	33	35	38	39	40	41	42	43
Room data	Viewing direction at right angles D (m) Ref					Viewing direction parallel D (m) Ref					
10	20	20	20	20	20	20	20	20	20	20	20
15	20	20	20	20	20	20	20	20	20	20	20
20	20	20	20	20	20	20	20	20	20	20	20
25	20	20	20	20	20	20	20	20	20	20	20
30	20	20	20	20	20	20	20	20	20	20	20
35	20	20	20	20	20	20	20	20	20	20	20
40	20	20	20	20	20	20	20	20	20	20	20
45	20	20	20	20	20	20	20	20	20	20	20
50	20	20	20	20	20	20	20	20	20	20	20
55	20	20	20	20	20	20	20	20	20	20	20
60	20	20	20	20	20	20	20	20	20	20	20
65	20	20	20	20	20	20	20	20	20	20	20
70	20	20	20	20	20	20	20	20	20	20	20
75	20	20	20	20	20	20	20	20	20	20	20
80	20	20	20	20	20	20	20	20	20	20	20
85	20	20	20	20	20	20	20	20	20	20	20
90	20	20	20	20	20	20	20	20	20	20	20
95	20	20	20	20	20	20	20	20	20	20	20
100	20	20	20	20	20	20	20	20	20	20	20
105	20	20	20	20	20	20	20	20	20	20	20
110	20	20	20	20	20	20	20	20	20	20	20
115	20	20	20	20	20	20	20	20	20	20	20
120	20	20	20	20	20	20	20	20	20	20	20
125	20	20	20	20	20	20	20	20	20	20	20
130	20	20	20	20	20	20	20	20	20	20	20
135	20	20	20	20	20	20	20	20	20	20	20
140	20	20	20	20	20	20	20	20	20	20	20
145	20	20	20	20	20	20	20	20	20	20	20
150	20	20	20	20	20	20	20	20	20	20	20
155	20	20	20	20	20	20	20	20	20	20	20
160	20	20	20	20	20	20	20	20	20	20	20
165	20	20	20	20	20	20	20	20	20	20	20
170	20	20	20	20	20	20	20	20	20	20	20
175	20	20	20	20	20	20	20	20	20	20	20
180	20	20	20	20	20	20	20	20	20	20	20
185	20	20	20	20	20	20	20	20	20	20	20
190	20	20	20	20	20	20	20	20	20	20	20
195	20	20	20	20	20	20	20	20	20	20	20
200	20	20	20	20	20	20	20	20	20	20	20

5. Compound Areas



6. Compound Luminaire Layout Plan

MV Compound / Luminaires (layout plan)



Luminaire Parts List

No. Pieces Designation

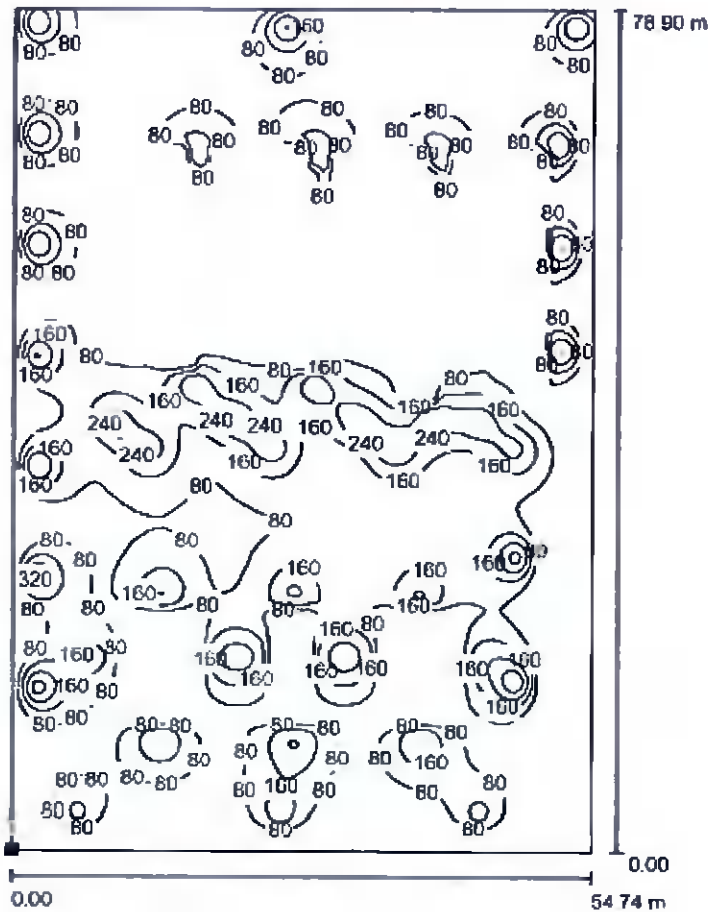
1. 10 Disano 610 Safety permanent 1 hr emergency S.E. Disano 610 FLC1*24 CEM-L grey
2. 47 LEDVANCE 4058075097704 FLOODLIGHT 135 135 W 4000 K IP65 BK

- Mounting height of Disano 610 bulkhead lights surrounding the client control building are wall mounted 3.6 metres above FFL.
- Mounting height of LEDVANCE floodlights surrounding the client control building and in the transformer bays are wall-mounted at 4 metres above FFL.
- Mounting height of LEDVANCE floodlights around the compound perimeter fence are fence-mounted at 2.6 metres above FFL.

7. Overview Compound Layout

7.1. OVERALL COMPOUND – ISOLINES

Exterior Scene 1 / Ground Element 1 / Surface 1 / Isolines (E)



Values in Lux, Scale 1 : 617

Position of surface in external scene:
Marked point:
(0.130 m, 0.050 m, 0.000 m)



Grid: 128 x 128 Points

E_{av} [lx]
74

E_{min} [lx]
0.01

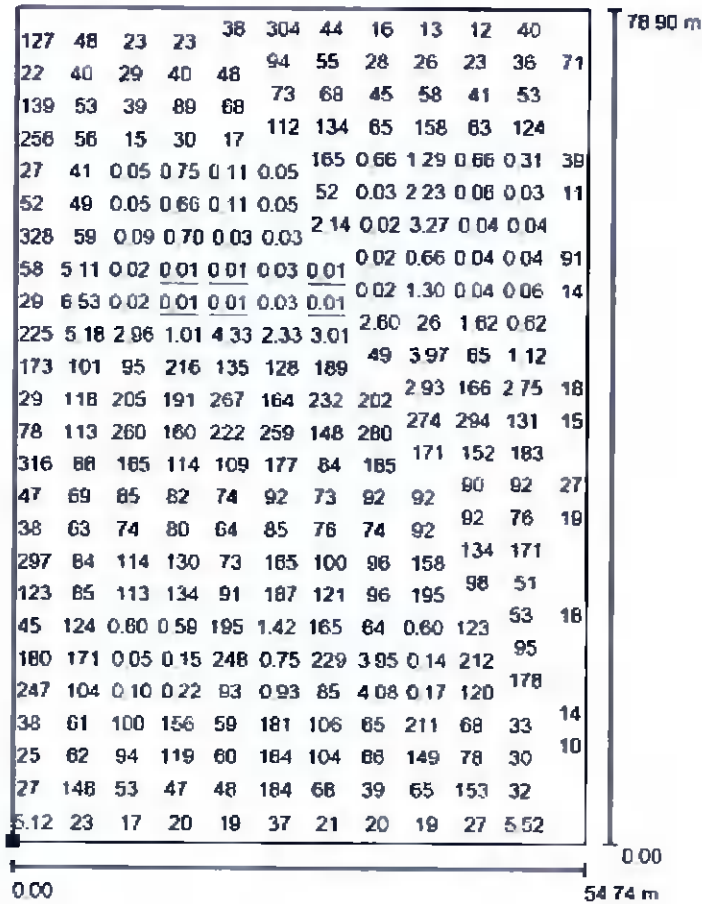
E_{max} [lx]
397

$u0$
0.000

E_{min} / E_{max}
0.000

7.2. OVERALL COMPOUND – VALUE CHART

Exterior Scene 1 / Ground Element 1 / Surface 1 / Value Chart (E)



Values in Lux, Scale 1 : 617

Not all calculated values could be displayed

Position of surface in external scene:
Marked point:
(0.130 m, 0.053 m, 0.000 m)



Grid: 128 x 128 Points

E_{av} [lx]
74

E_{min} [lx]
0.01

E_{max} [lx]
397

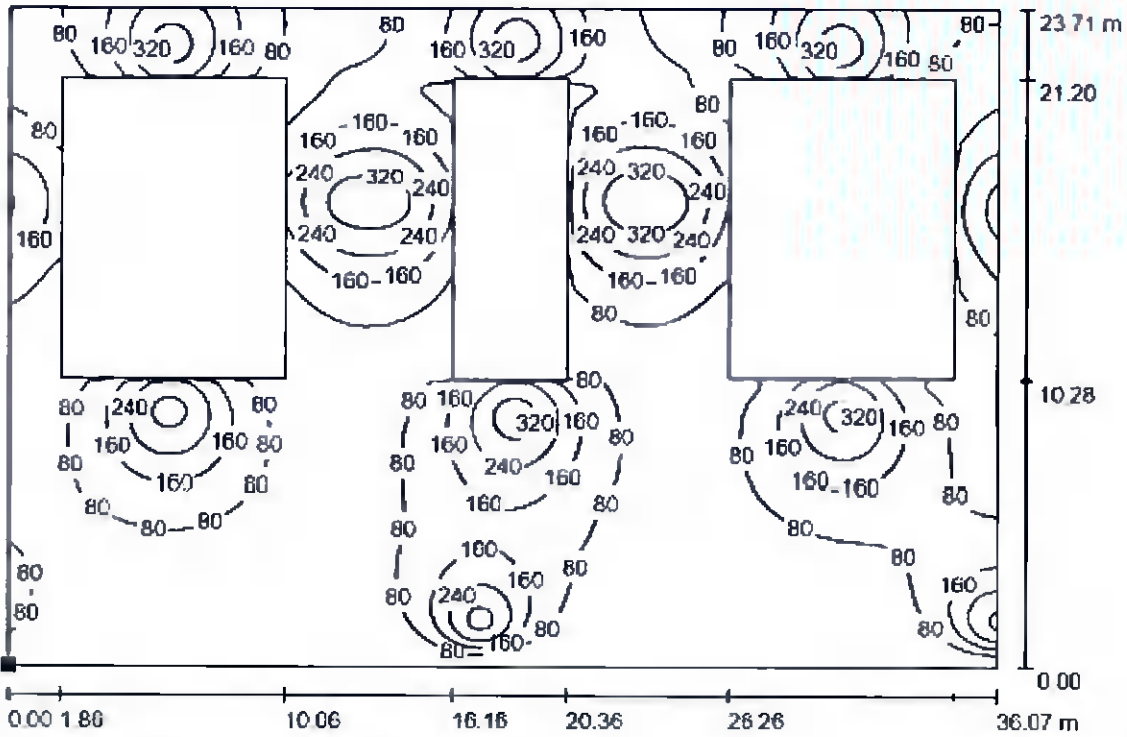
$u3$
0.000

E_{min} / E_{max}
0.000

8. Control Building Surround

8.1. CONTROL BUILDING - ISOLINES

Exterior Scene 1 / CCB / Isolines (E. Perpendicular)



Values in Lux, Scale 1 : 258

Position of surface in external scene
Marked point:
(8.238 m, 1.400 m, 0.750 m)



Grid: 128 x 128 Points

E_{av} [lx]
116

E_{min} [lx]
11

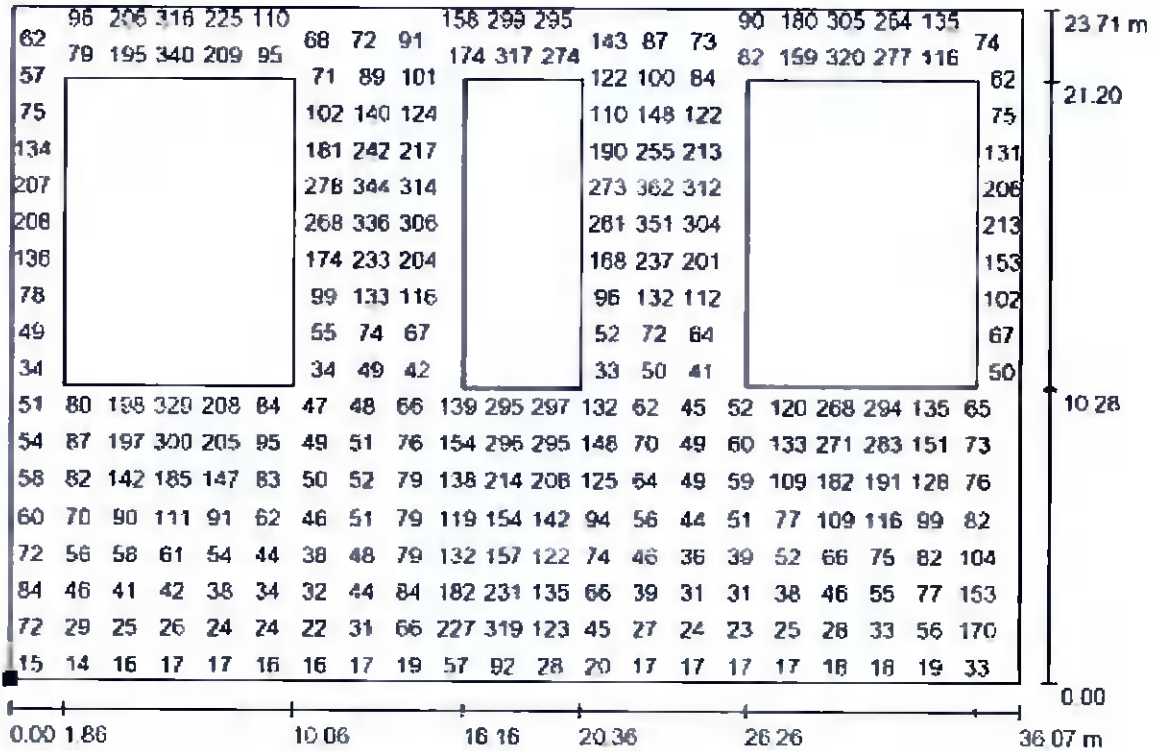
E_{max} [lx]
377

uD
0.092

E_{min} / E_{max}
0.028

8.2. CONTROL BUILDING SURROUND – VALUE CHART

Exterior Scene 1 / CCB / Value Chart (E. Perpendicular)



Values in Lux, Scale 1 : 258

Not all calculated values could be displayed

Position of surface in external scene:
Marked point:
(8.238 m, 1.400 m, 0.750 m)



Gnd: 128 x 128 Points

E_{av} [lx]
116

E_{min} [lx]
11

E_{max} [lx]
377

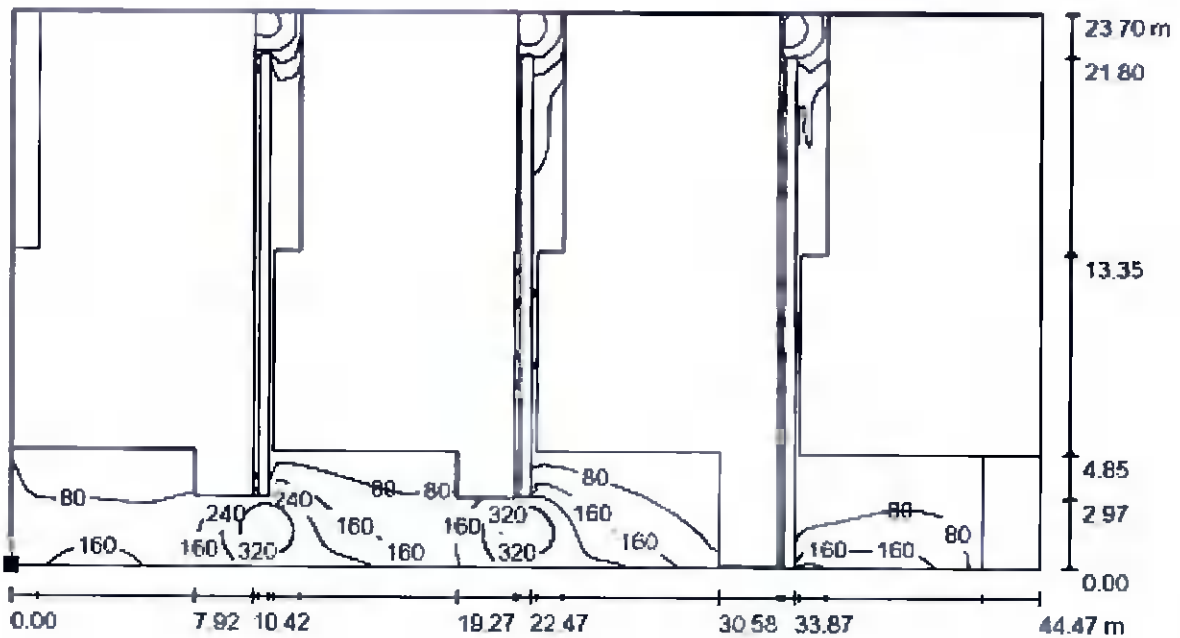
$u0$
0.062

E_{min} / E_{max}
0.028

9. Transformer Area

9.1. TRANSFORMER AREA – ISOLINES

Exterior Scene 1 / Transformer Area / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 318

Position of surface in external scene:

Marked point:
(6.183 m, 42.100 m, 0.750 m)



Grid: 128 x 128 Points

E_{av} [lx]
117

E_{min} [lx]
1.29

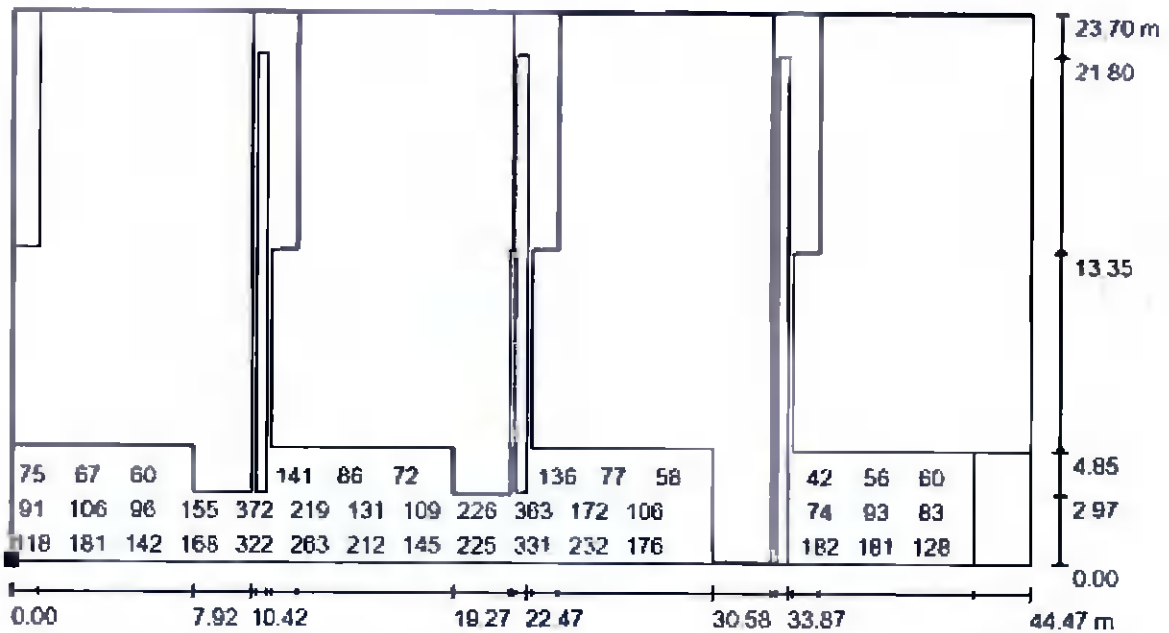
E_{max} [lx]
389

uD
0.011

E_{min} / E_{max}
0.003

9.2. TRANSFORMER AREA – VALUE CHART

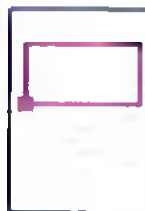
Exterior Scene 1 / Transformer Area / Value Chart (E. Perpendicular)



Values in Lux, Scale 1 : 318

Not all calculated values could be displayed.

Position of surface in external scene:
Marked point:
(6.183 m, 42.100 m, 0.750 m)



Grid: 128 x 128 Points

E_{av} [lx]
117

E_{min} [lx]
1.29

E_{max} [lx]
389

$u0$
0.011

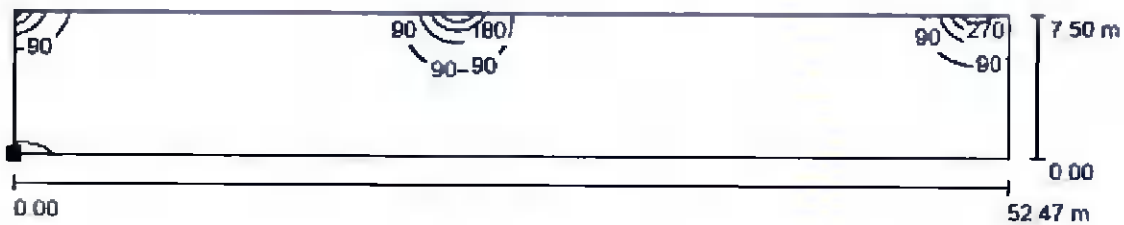
E_{min} / E_{max}
0.003

	KISHOGE 110 KV GIS SUBSTATION COMPOUND LIGHTING DEISGN CALCULATIONS		Page:	16 of 19
	A1064D-HMV-XX-XX-RP-E-1019	Version	P01	Approved:

10. Access Road 1

10.1. ACCESS ROAD 1 – ISOLINES

Exterior Scene 1 / Access Road 1 / Isolines (E, Perpendicular)

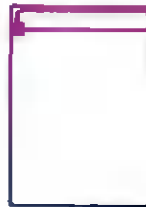


Values in Lux, Scale 1 : 370

Position of surface in external scene:

Marked point:

(2.400 m, 60.400 m, 0.750 m)



Grid: 128 x 64 Points

E_{av} [lx]
46

E_{min} [lx]
11

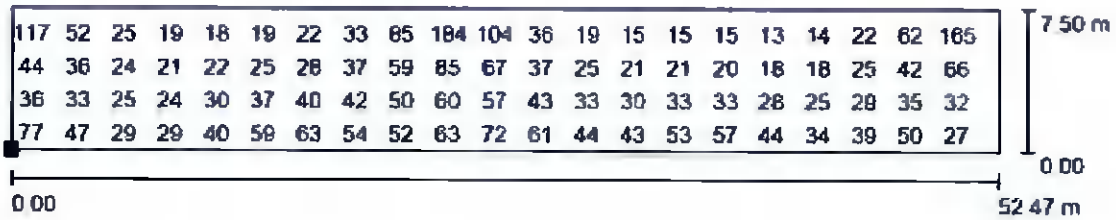
E_{max} [lx]
456

$u0$
0.232

E_{min} / E_{max}
0.024

10.2. ACCESS ROAD 1 – VALUE CHART

Exterior Scene 1 / Access Road 1 / Value Chart (E, Perpendicular)



Values in Lux, Scale 1 : 376

Not all calculated values could be displayed

Position of surface in external scene:

Marked point:
(2.400 m, 68.400 m, 0.750 m)



Grid: 128 x 64 Points

E_{av} [lx]
46

E_{min} [lx]
11

E_{max} [lx]
458

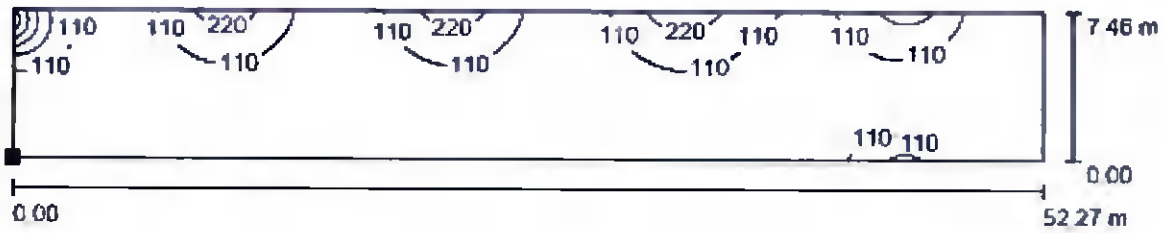
$u0$
0.232

E_{min} / E_{max}
0.024

11 Access Road 2

11.1 ACCESS ROAD 2 – ISOLINES

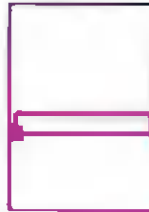
Exterior Scene 1 / Access Road 2 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 374

Position of surface in external scene:

Marked point:
(2.241 m, 28.100 m, 0.750 m)



Grid: 128 x 64 Points

E_{av} [lx]
85

E_{min} [lx]
13

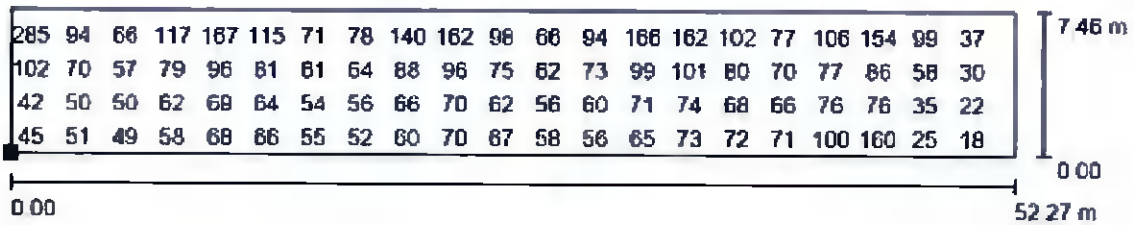
E_{max} [lx]
553

$u0$
0.156

E_{min} / E_{max}
0.024

11.2 ACCESS ROAD 2 – VALUE CHART

Exterior Scene 1 / Access Road 2 / Value Chart (E, Perpendicular)



Values in Lux, Scale 1 : 374

Not all calculated values could be displayed.

Position of surface in external scene:
Marked point:
(2.241 m, 29.100 m, 0.750 m)



Grid: 128 x 64 Points

E_{zk} [lx]
85

E_{min} [lx]
13

E_{max} [lx]
553

$u0$
0.156

E_{min} / E_{max}
0.024