

10 Feb. 22

Vantage 110 kV Substation

Compound Lighting Design Calculations



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

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H&MV ENGINEERING

Vantage 110 kV Substation

Compound Lightning Design Calculations

Issue: P02	Date of issue: 10/02/22
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1. Revision History

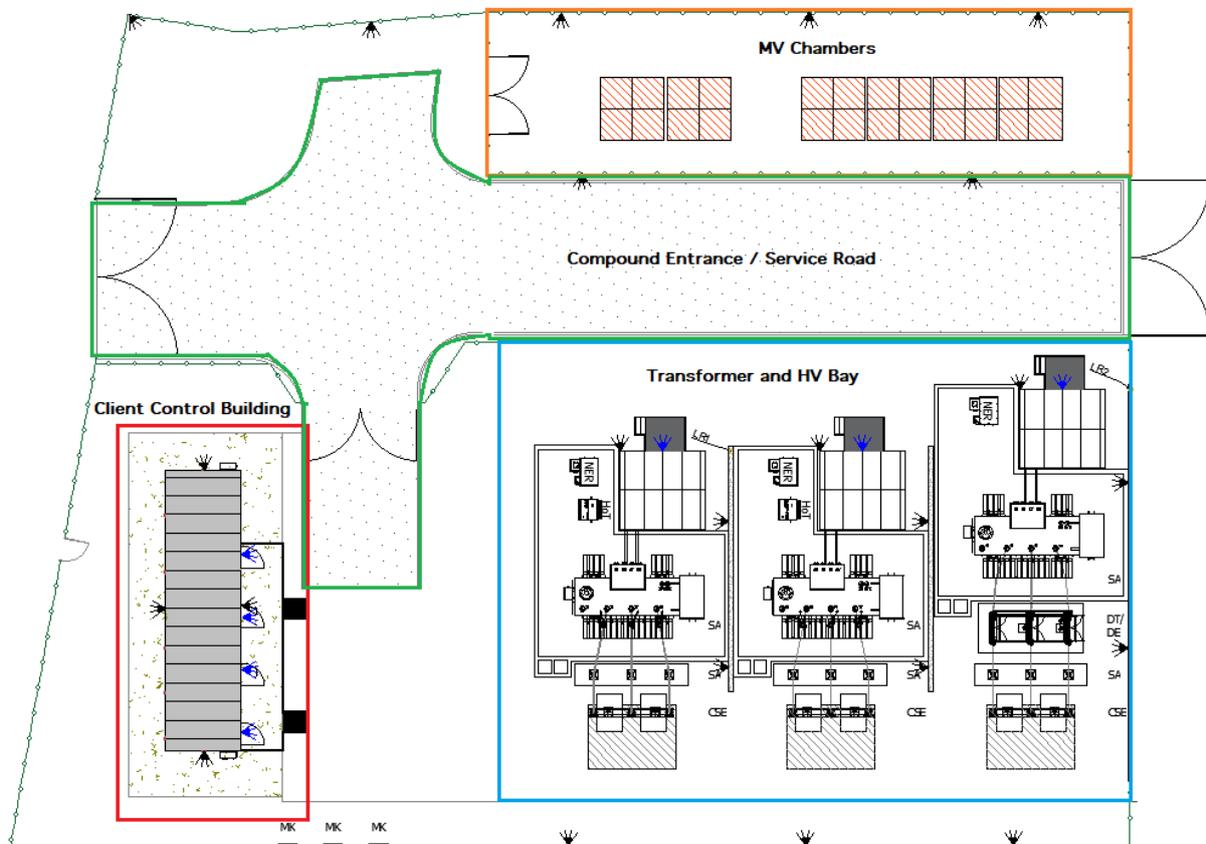
Date	Revision	Comment
07/02/2022	P01	Issued for review
10/02/2022	P02	Light fixture locations adjusted for third transformer bay

2. Introduction

The purpose of this study is to calculate the average illuminance in the Client 110 kV substation 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.



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3. Conclusion

Summary results of the compound are as follows:

Area	Type of Area	Eav required (lx)	Eav achieved (lx)
Client Control Building Surrounding	Pedestrian passages, vehicle turning, loading and unloading points	50	87
Transformer and HV Bay	General servicing work and reading of instruments	100	100
Compound Entrance / Service Road	Regular vehicle traffic / Traffic areas for slowly moving vehicles	20	61
MV Chambers	Cleaning and servicing	50	83

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

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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**

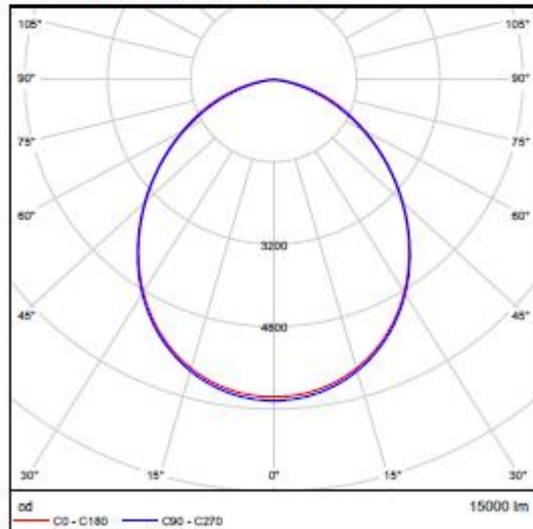


Luminaire with symmetrical light output with 135 W. Product features:
 Luminaire efficacy: up to 110 lm/W. Symmetrical beam angle: 100° x 100°. Mounting bracket for up to 180° tilting. Type of protection: IP65. Impact resistance: IK08. Ambient temperature in operation: -20...+50 °C. Connection via 1 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. D-sign according to EN 60598-2-24 for fire-risk commercial unit, f. e. 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 Illuminazione 610 Safety permanent 1 hr emergency S.E. Disano 610 FLC1*24 CEM-L grey 1xFLC24EM/20%

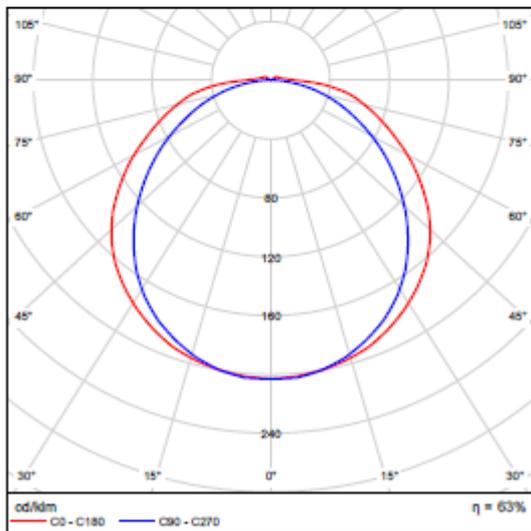


Housing: Vandal-resistant, self-extinguishing, UV-stabilized, anti-yellowing grey polycarbonate. Diffuser: Vandal resistant, V2 self-extinguishing, UV-stabilised clear polycarbonate, anti-glare frosted inside; smooth, dust-proof outside Reflector: Reflecting white polycarbonate. Lampholder: Polycarbonate with phosphorous bronze contacts Electric gear: -230V-240/60Hz power supply with electronic ballast. Hard wire, cross-section 0.50 sqmm, and high-temperature resistant (up to 90°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 \varnothing 1/2 inch gas thread (min cable \varnothing 9, max \varnothing 12 mm) to maintain IP65 protection. Standard inspection LED Regulations: Manufactured in compliance with EN60598 - CEI 34 -21 standards. The level of protection complies with the EN60529 standard. S.E. Emergency (Only emergency): In the event of a black-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: 60 minutes. When power is restored, the battery recharges automatically in 12 hours. On request with troubleshooting (sub-code -0066).

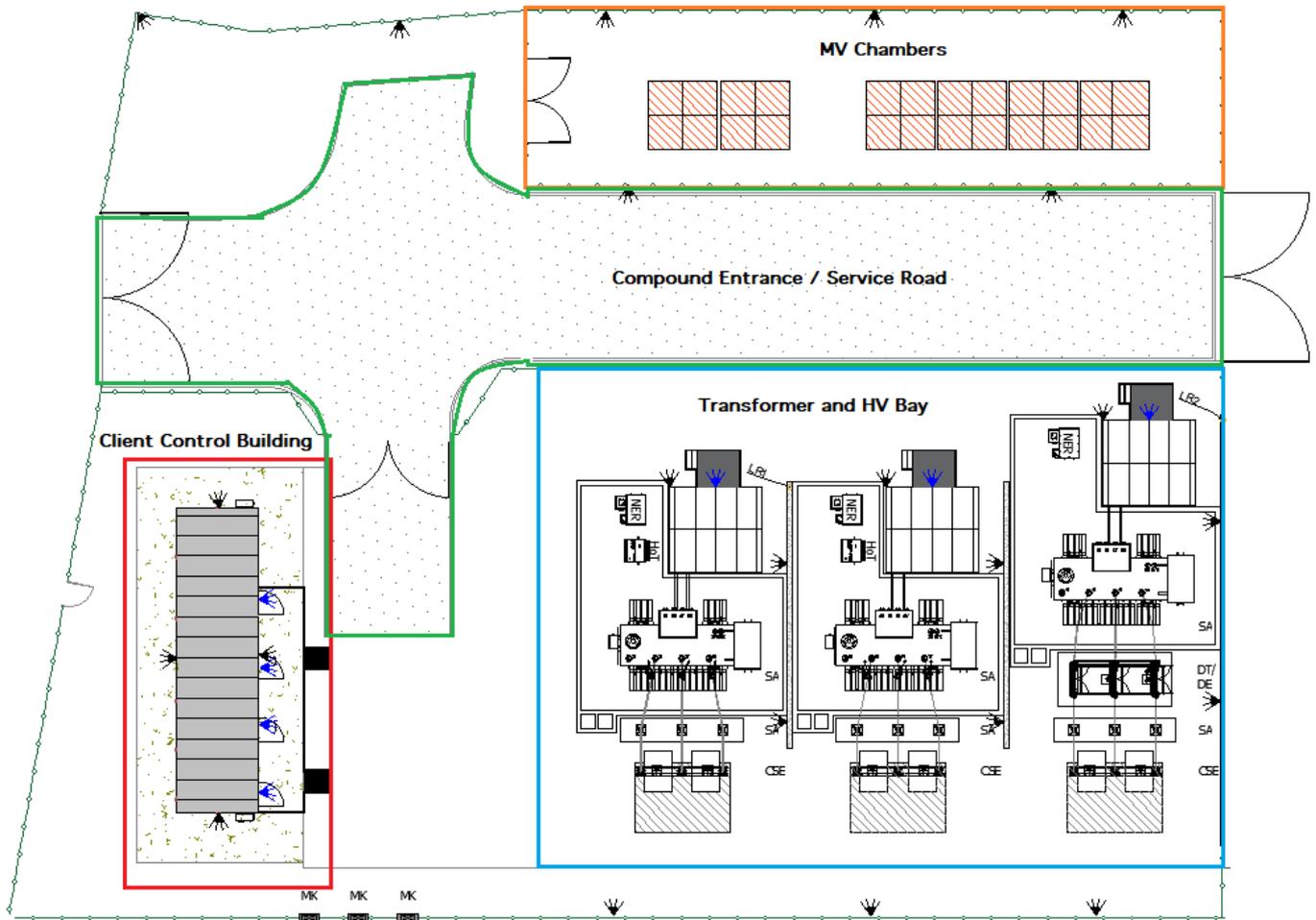
Light output ratio: 63.43%
Lamp luminous flux: 340 lm
Luminaire luminous flux: 216 lm
Power: 27.6 W
Luminous efficacy: 7.8 lm/W

Colorimetric data
1xFLC24EM/20%: CCT 4000 K, CRI 90

Luminous emittance 1 / Polar LDC

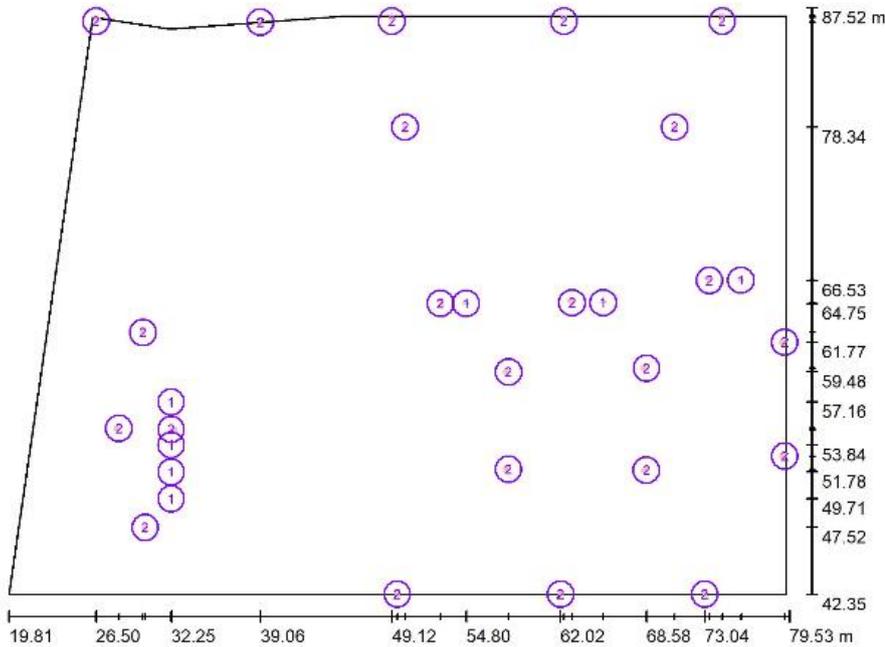


5. Compound Areas



6. Compound Luminaire Layout Plan

Client Compound / Luminaires (layout plan)



Scale 1 : 427

Luminaire Parts List

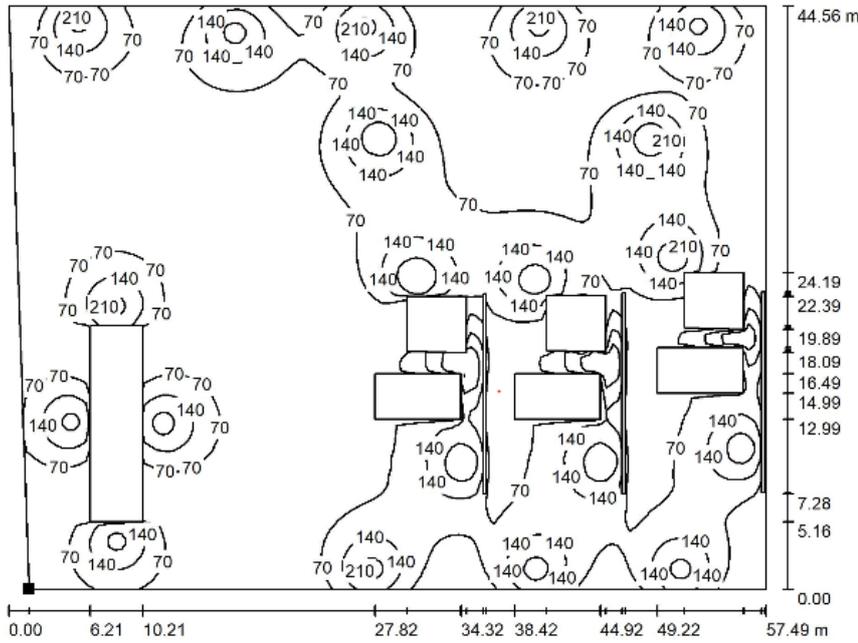
No.	Pieces	Designation
1	7	Disano 610 Safety permanent 1 hr emergency S.E. Disano 610 FLC1*24 CEM-L grey
2	23	LEDVANCE 4058075097704 FLOODLIGHT 135 135 W 4000 K IP65 BK

- 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 pole-mounted at 4 metres above FFL.

7. Overview Compound Layout

7.1. OVERALL CLIENT COMPOUND – ISOLINES

Client Compound / Client Compound / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 412

Position of surface in external scene:
Marked point: (23.578 m, 42.355 m, 0.000 m)

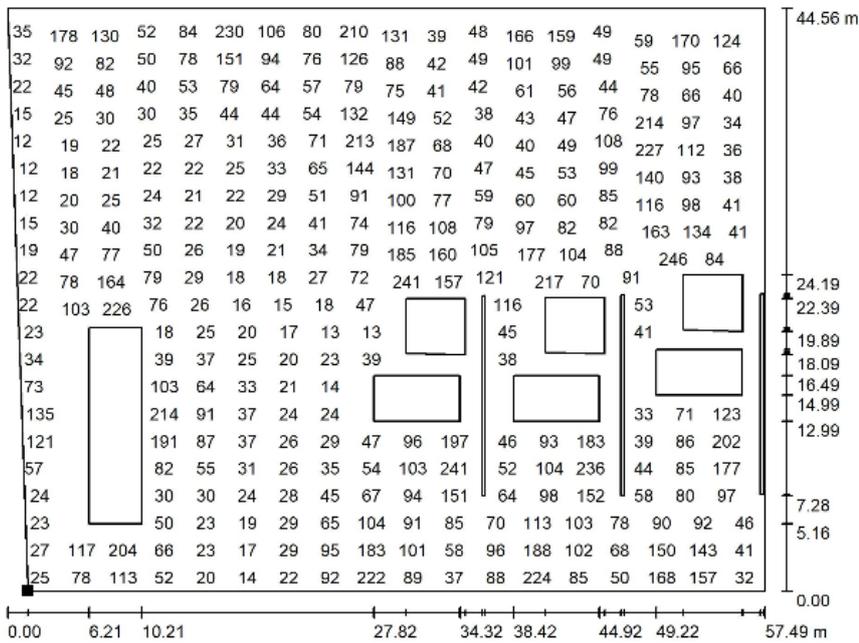


Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
78	6.20	321	0.079	0.019

7.2. OVERALL COMPOUND – VALUE CHART

Client Compound / Client Compound / Value Chart (E, Perpendicular)



Values in Lux, Scale 1 : 412

Not all calculated values could be displayed.

Position of surface in external scene:
Marked point: (23.578 m, 42.355 m, 0.000 m)



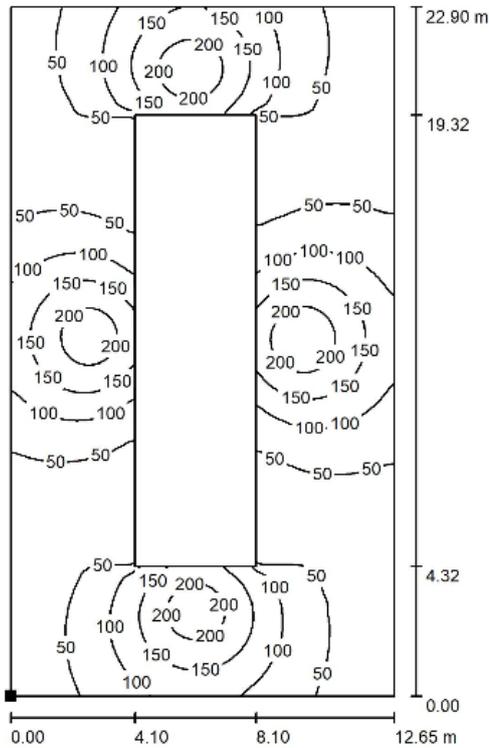
Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
78	6.20	321	0.079	0.019

8. Client Control Building Surround

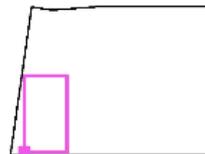
8.1. CLIENT CONTROL BUILDING SURROUND - ISOLINES

Client Compound / Client Control Building Surround / Isolines (E)



Values in Lux, Scale 1 : 180

Position of surface in external scene:
Marked point: (24.149 m, 43.200 m, 0.000 m)

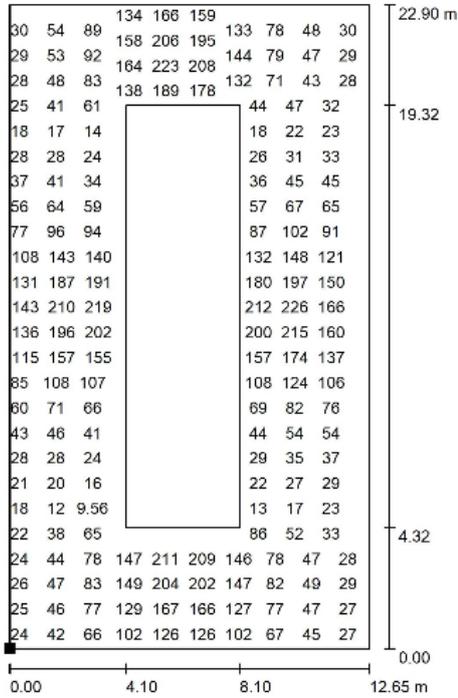


Grid: 128 x 128 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
Client Control Building Surround	87	3.83	233	0.044	0.016
Surrounding Area	52	15	146	0.295	0.106

8.2. CONTROL BUILDING SURROUND – VALUE CHART

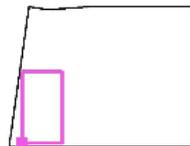
Client Compound / Client Control Building Surround / Value Chart (E)



Values in Lux, Scale 1 : 180

Not all calculated values could be displayed.

Position of surface in external scene:
Marked point (24.149 m, 43.200 m, 0.000 m)



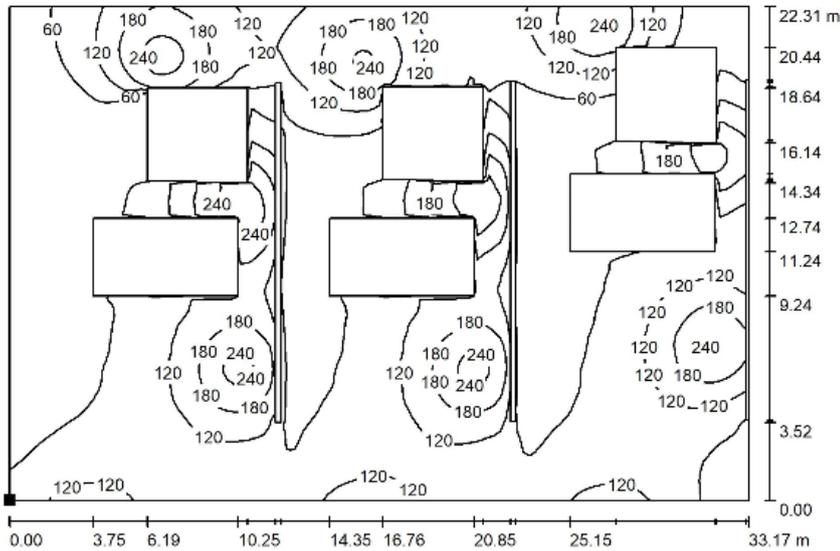
Grid: 128 x 128 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
Client Control Building Surround	87	3.83	233	0.044	0.016
Surrounding Area	52	15	146	0.295	0.106

9. Transformer and HV Bays

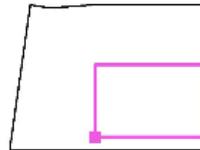
9.1. TRANSFORMER AND HV BAYS – ISOLINES

Client Compound / Transformer and HV Bay / Isolines (E)



Values in Lux, Scale 1 : 238

Position of surface in external scene:
Marked point: (46.100 m, 46.111 m, 0.000 m)

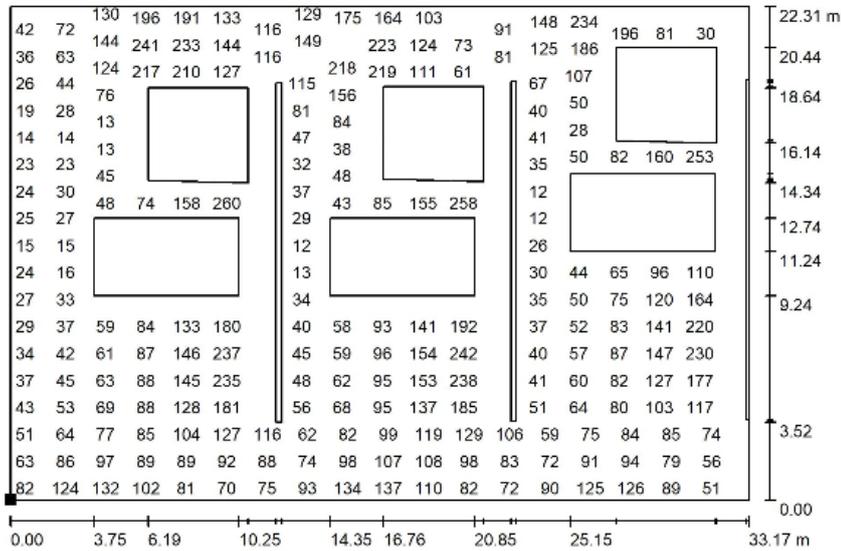


Grid: 128 x 128 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
Transformer and HV Bay	100	8.65	288	0.086	0.030
Surrounding Area	90	13	234	0.146	0.056

9.2. TRANSFORMER AND HV BAYS – VALUE CHART

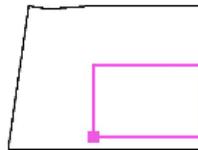
Client Compound / Transformer and HV Bay / Value Chart (E)



Values in Lux, Scale 1 : 238

Not all calculated values could be displayed.

Position of surface in external scene:
Marked point: (46.100 m, 46.111 m, 0.000 m)



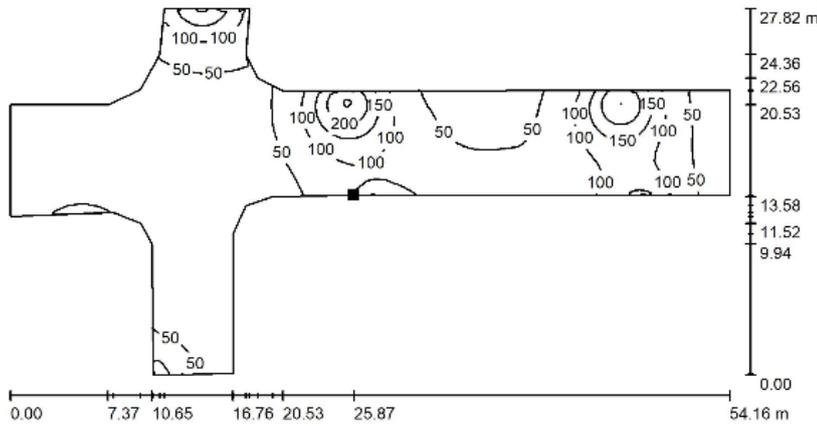
Grid: 128 x 128 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
Transformer and HV Bay	100	8.65	288	0.086	0.030
Surrounding Area	90	13	234	0.146	0.056

10. Compound Entrance / Service Road

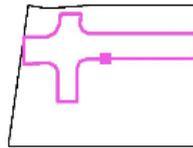
10.1. COMPOUND ENTRANCE / SERVICE ROAD – ISOLINES

Client Compound / Compound Entrance / Service Road / Isolines (E)



Values in Lux, Scale 1 : 388

Position of surface in external scene:
Marked point: (50.646 m, 69.914 m, 0.000 m)

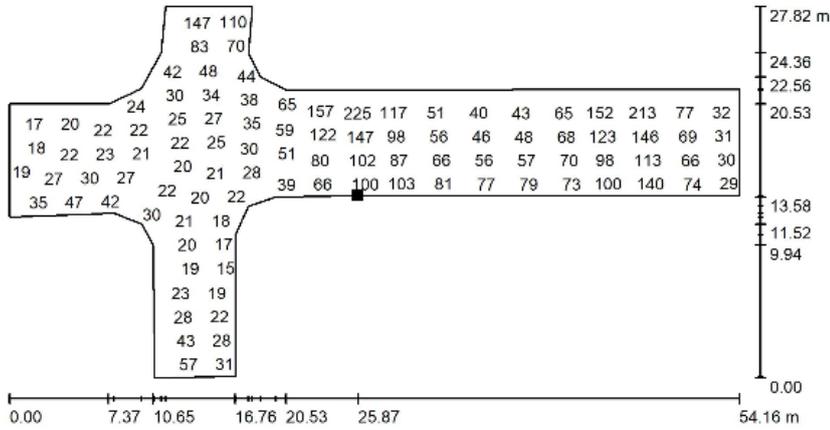


Grid: 128 x 128 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
Compound Entrance / Service Road	61	14	254	0.233	0.056
Surrounding Area	81	11	294	0.139	0.039

10.2. COMPOUND ENTRANCE / SERVICE ROAD – VALUE CHART

Client Compound / Compound Entrance / Service Road / Value Chart (E)

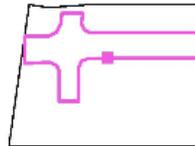


Values in Lux, Scale 1 : 388

Not all calculated values could be displayed.

Position of surface in external scene:

Marked point: (50.646 m, 69.914 m, 0.000 m)



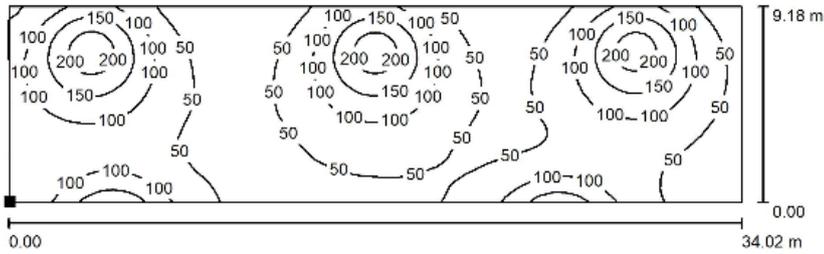
Grid: 128 x 128 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
Compound Entrance / Service Road	61	14	254	0.233	0.056
Surrounding Area	81	11	294	0.139	0.039

11. MV Chambers

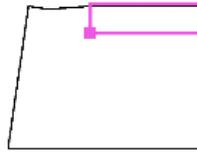
11.1 MV CHAMBERS— ISOLINES

Client Compound / MV Chambers / Isolines (E)



Values in Lux, Scale 1 : 244

Position of surface in external scene:
Marked point: (45.318 m, 78.339 m, 0.000 m)

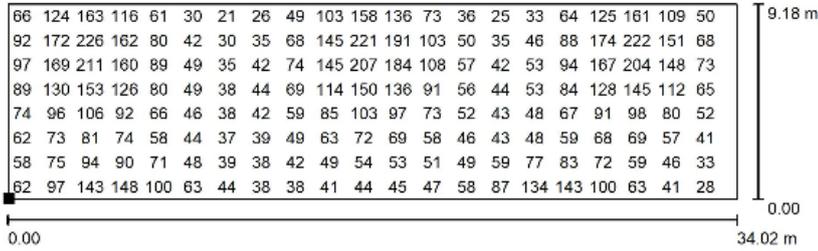


Grid: 128 x 64 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
MV Chambers	83	17	229	0.204	0.074
Surrounding Area	87	21	255	0.241	0.082

11.2. MV CHAMBERS – VALUE CHART

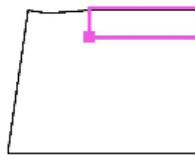
Client Compound / MV Chambers / Value Chart (E)



Values in Lux, Scale 1 : 244

Not all calculated values could be displayed.

Position of surface in external scene:
Marked point: (45.318 m, 78.339 m, 0.000 m)



Grid: 128 x 64 Points

	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
MV Chambers	83	17	229	0.204	0.074
Surrounding Area	87	21	255	0.241	0.082