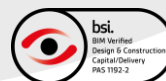


SHD Lighting Report
For the
External Lighting Installation
At
City Block 9 North Wall Quay, Dublin 1
For
Waterside Block 9 Development Limited

Date of Issue: 19/01/2021

Version: P03



professional projects. professional engineering.

Document History

| Version No. | Description | Prepared By | Reviewed By | Date |
|-------------|---------------------|-------------|-------------|------------|
| P01 | Issued for Planning | JC | CD | 30/10/2020 |
| P02 | Issued for Planning | JC | CD | 17/12/2020 |
| P03 | Issued for Planning | JC | CD | 19/01/2021 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Contents

| | |
|--|----|
| 1. Introduction..... | 4 |
| 2. Lighting Report | 5 |
| 2.1 Project Waterfront South Central -ABP-306158-19 / Luminaire Parts List..... | 5 |
| 2.2 Glamox 049-1810007 049 LED 4500 830 CL-OP / Luminaire Data Sheet..... | 6 |
| 2.3 Glamox 049-1810007 049 LED 4500 830 CL-OP / LDC (Polar)..... | 7 |
| 2.4 Glamox 049-1810007 049 LED 4500 830 CL-OP / LDC (Linear) | 8 |
| 2.5 Glamox 049-1810007 049 LED 4500 830 CL-OP / UGR-Table | 9 |
| 2.6 Glamox 049-1810007 049 LED 4500 830 CL-OP / Luminance Diagram..... | 10 |
| 2.7 Glamox 049-1810007 049 LED 4500 830 CL-OP / Cone Diagram..... | 11 |
| 2.8 Glamox 0472009P 025-W LED 2x450 HF 840 NB / Luminaire Data Sheet | 12 |
| 2.9 Glamox 0472009P 025-W LED 2x450 HF 840 NB / LDC (Polar)..... | 13 |
| 2.10 Glamox 0472009P 025-W LED 2x450 HF 840 NB / LDC (Linear)..... | 14 |
| 2.11 Glamox 0472009P 025-W LED 2x450 HF 840 NB / UGR-Table..... | 15 |
| 2.12 Glamox 0472009P 025-W LED 2x450 HF 840 NB / Luminance Diagram | 16 |
| 2.13 Glamox 0472009P 025-W LED 2x450 HF 840 NB / Cone Diagram | 17 |
| 2.14 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / Luminaire Data Sheet | 18 |
| 2.15 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / LDC (Polar)..... | 19 |
| 2.16 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / LDC (Linear)..... | 20 |
| 2.17 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / UGR-Table..... | 21 |
| 2.18 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / Luminance Diagram | 22 |
| 2.19 Waterfront South Central Lighting / Luminaire Parts List | 23 |
| 2.20 Waterfront South Central Lighting / Objects (Layout Plan)..... | 24 |
| 2.21 Waterfront South Central Lighting / Calculation surfaces (results overview) | 25 |
| 2.22 Waterfront South Central Lighting / 3D Rendering | 26 |
| 2.23 Waterfront South Central Lighting / False Colour Rendering | 27 |
| 2.24 Waterfront South Central Lighting / Top Right Walkway / Surface 1 / Isolines (E)..... | 28 |
| 2.25 Waterfront South Central Lighting / Top Left Walkway / Isolines (E, Perpendicular) | 29 |
| 2.26 Waterfront South Central Lighting / Centre Walkway / Isolines (E, Perpendicular) | 30 |
| 2.27 Waterfront South Central Lighting / South Centre Walkway / Isolines (E, Perpendicular)..... | 31 |
| 2.28 Waterfront South Central Lighting / South Right Walkway / Isolines (E, Perpendicular) | 32 |

1. Introduction

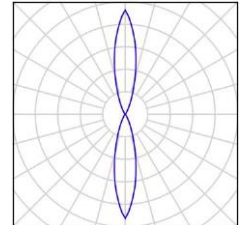
This lighting calculation report is pertinent to the Waterfront South Central development. The lighting calculation includes all main thoroughfares at podium level for the SHD scheme and the adjacent commercial development. The adjacent commercial development has been considered as part of this as all thoroughfares at podium level will be used to access the SHD scheme. The perimeter roadways will retain the existing street lighting arrangement.

The light levels are designed to achieve compliance with the relevant standards-based requirements.

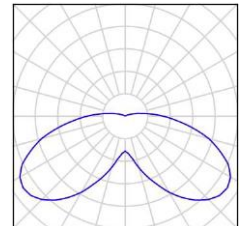
2. Lighting Report

2.1 Project Waterfront South Central -ABP-306158-19 / Luminaire Parts List

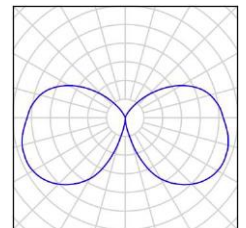
8 Pieces Glamox 0472009P O25-W LED 2x450 HF 840 NB
Article No.: 0472009P
Luminous flux (Luminaire): 900 lm
Luminous flux (Lamps): 900 lm
Luminaire Wattage: 9.0 W
Luminaire classification according to CIE: 50
CIE flux code: 95 99 100 50 100
Fitting: 1 x O25 2x450 840 (Correction Factor 1.000).



39 Pieces Glamox O49-1810007 O49 LED 4500 830 CL-OP
Article No.: O49-1810007
Luminous flux (Luminaire): 4150 lm
Luminous flux (Lamps): 4150 lm
Luminaire Wattage: 57.0 W
Luminaire classification according to CIE: 93
CIE flux code: 22 55 84 93 100
Fitting: 1 x O49 4500 830 CLOP (Correction Factor 1.000).

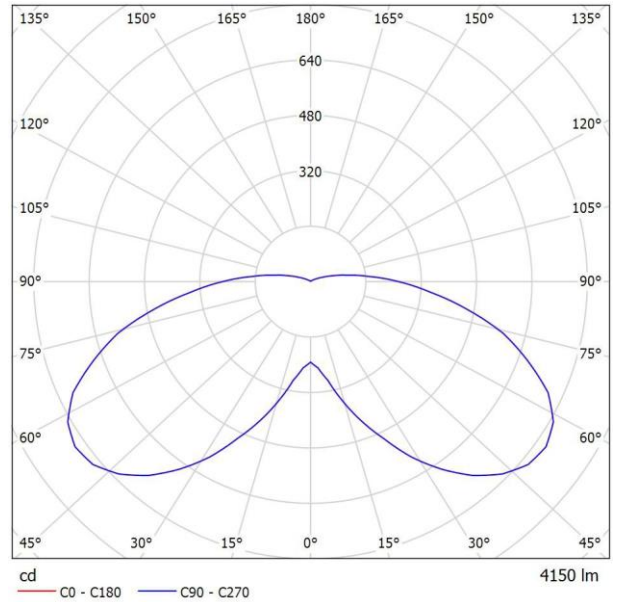


30 Pieces Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD]
Article No.: 96262100
Luminous flux (Luminaire): 507 lm
Luminous flux (Lamps): 507 lm
Luminaire Wattage: 14.0 W
Luminaire classification according to CIE: 62
CIE flux code: 16 43 72 62 100
Fitting: 1 x LED 14 W (Correction Factor 1.000).



2.2 Glamox O49-1810007 O49 LED 4500 830 CL-OP / Luminaire Data Sheet

Luminous emittance 1:



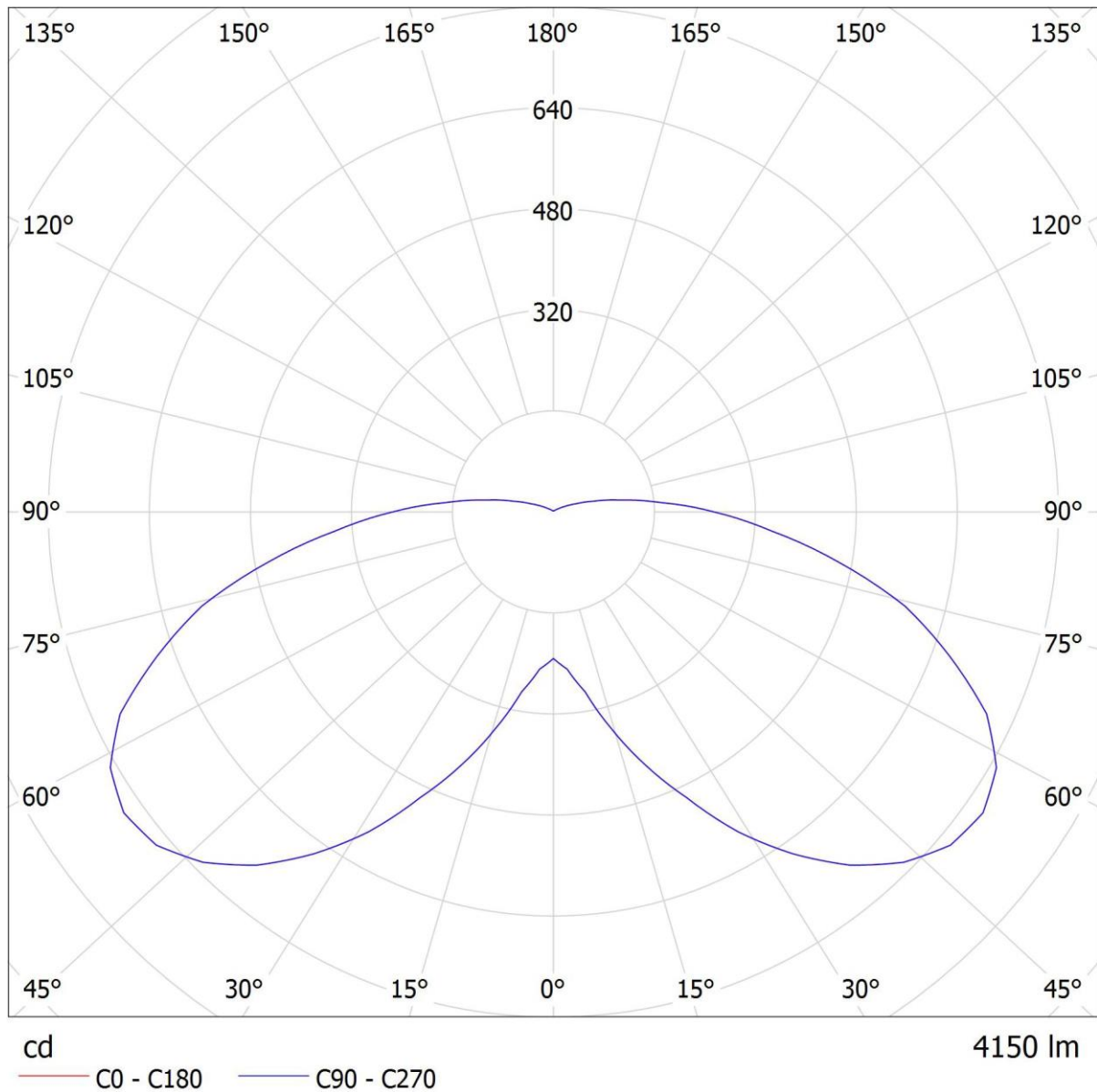
Luminaire classification according to CIE: 93
CIE flux code: 22 55 84 93 100

Luminous emittance 1:

| Glare Evaluation According to UGR | | | | | | | | | | | |
|---|--|------|------|------|------|--|------|------|------|------|------|
| ρ Ceiling | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 | |
| ρ Walls | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 | |
| ρ Floor | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Room Size X Y | Viewing direction at right angles to lamp axis | | | | | Viewing direction parallel to lamp axis | | | | | |
| 2H | 2H | 19.9 | 21.5 | 20.3 | 21.9 | 22.3 | 19.9 | 21.5 | 20.3 | 21.9 | 22.3 |
| | 3H | 22.6 | 24.1 | 23.1 | 24.5 | 25.0 | 22.6 | 24.1 | 23.1 | 24.5 | 25.0 |
| | 4H | 23.9 | 25.3 | 24.4 | 25.7 | 26.2 | 23.9 | 25.3 | 24.4 | 25.7 | 26.2 |
| | 6H | 25.0 | 26.3 | 25.5 | 26.8 | 27.3 | 25.0 | 26.3 | 25.5 | 26.8 | 27.3 |
| | 8H | 25.6 | 26.8 | 26.1 | 27.3 | 27.8 | 25.6 | 26.8 | 26.1 | 27.3 | 27.8 |
| 4H | 12H | 26.1 | 27.3 | 26.6 | 27.8 | 28.3 | 26.1 | 27.3 | 26.6 | 27.8 | 28.3 |
| | 2H | 20.7 | 22.1 | 21.2 | 22.6 | 23.0 | 20.7 | 22.1 | 21.2 | 22.6 | 23.0 |
| | 3H | 23.7 | 24.9 | 24.2 | 25.3 | 25.9 | 23.7 | 24.9 | 24.2 | 25.3 | 25.9 |
| | 4H | 25.1 | 26.2 | 25.6 | 26.7 | 27.2 | 25.1 | 26.2 | 25.6 | 26.7 | 27.2 |
| | 6H | 26.4 | 27.4 | 27.0 | 27.9 | 28.5 | 26.4 | 27.4 | 27.0 | 27.9 | 28.5 |
| 8H | 8H | 27.1 | 28.0 | 27.6 | 28.5 | 29.1 | 27.1 | 28.0 | 27.6 | 28.5 | 29.1 |
| | 12H | 27.7 | 28.5 | 28.3 | 29.1 | 29.7 | 27.7 | 28.5 | 28.3 | 29.1 | 29.7 |
| | 4H | 25.6 | 26.5 | 26.2 | 27.1 | 27.7 | 25.6 | 26.5 | 26.2 | 27.1 | 27.7 |
| | 6H | 27.2 | 28.0 | 27.8 | 28.5 | 29.1 | 27.2 | 28.0 | 27.8 | 28.5 | 29.1 |
| | 8H | 28.0 | 28.7 | 28.6 | 29.2 | 29.9 | 28.0 | 28.7 | 28.6 | 29.2 | 29.9 |
| 12H | 12H | 28.8 | 29.4 | 29.4 | 30.0 | 30.7 | 28.8 | 29.4 | 29.4 | 30.0 | 30.7 |
| | 4H | 25.7 | 26.6 | 26.3 | 27.1 | 27.7 | 25.7 | 26.6 | 26.3 | 27.1 | 27.7 |
| | 6H | 27.4 | 28.1 | 28.0 | 28.6 | 29.3 | 27.4 | 28.1 | 28.0 | 28.6 | 29.3 |
| | 8H | 28.3 | 28.9 | 28.9 | 29.5 | 30.1 | 28.3 | 28.9 | 28.9 | 29.5 | 30.1 |
| | Variation of the observer position for the luminaire distances S | | | | | | | | | | |
| S = 1.0H | +0.1 / -0.1 | | | | | +0.1 / -0.1 | | | | | |
| S = 1.5H | +0.2 / -0.2 | | | | | +0.2 / -0.2 | | | | | |
| S = 2.0H | +0.4 / -0.4 | | | | | +0.4 / -0.4 | | | | | |
| Standard table | BK11 | | | | | BK11 | | | | | |
| Correction Summand | 7.5 | | | | | 7.5 | | | | | |
| Corrected Glare Indices referring to 4150lm Total Luminous Flux | | | | | | | | | | | |

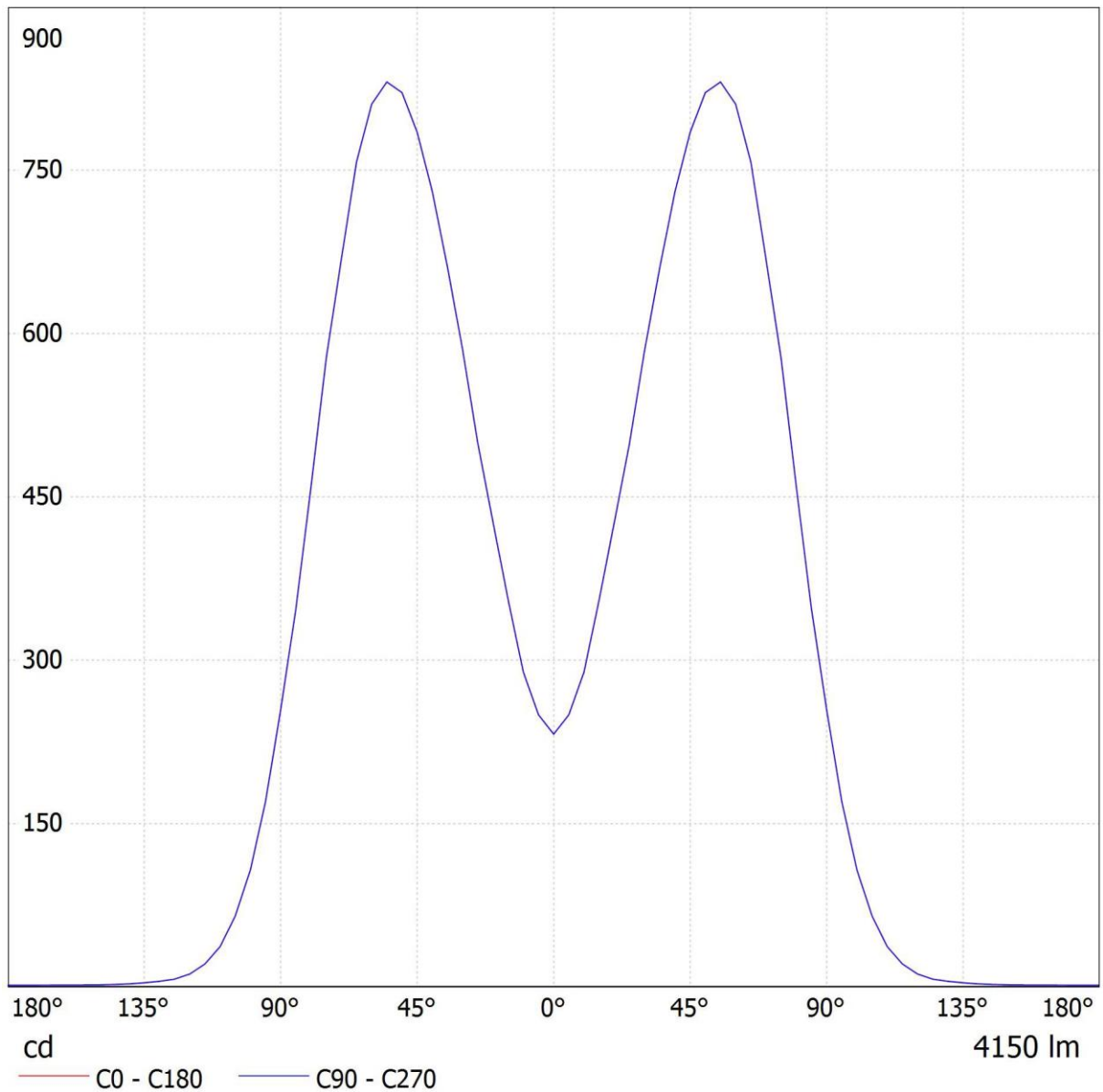
2.3 Glamox O49-1810007 O49 LED 4500 830 CL-OP / LDC (Polar)

Luminaire: Glamox O49-1810007 O49 LED 4500 830 CL-OP
Lamps: 1 x O49 4500 830 CLOP



2.4 Glamox O49-1810007 O49 LED 4500 830 CL-OP / LDC (Linear)

Luminaire: Glamox O49-1810007 O49 LED 4500 830 CL-OP
Lamps: 1 x O49 4500 830 CLOP



2.5 Glamox O49-1810007 O49 LED 4500 830 CL-OP / UGR-Table

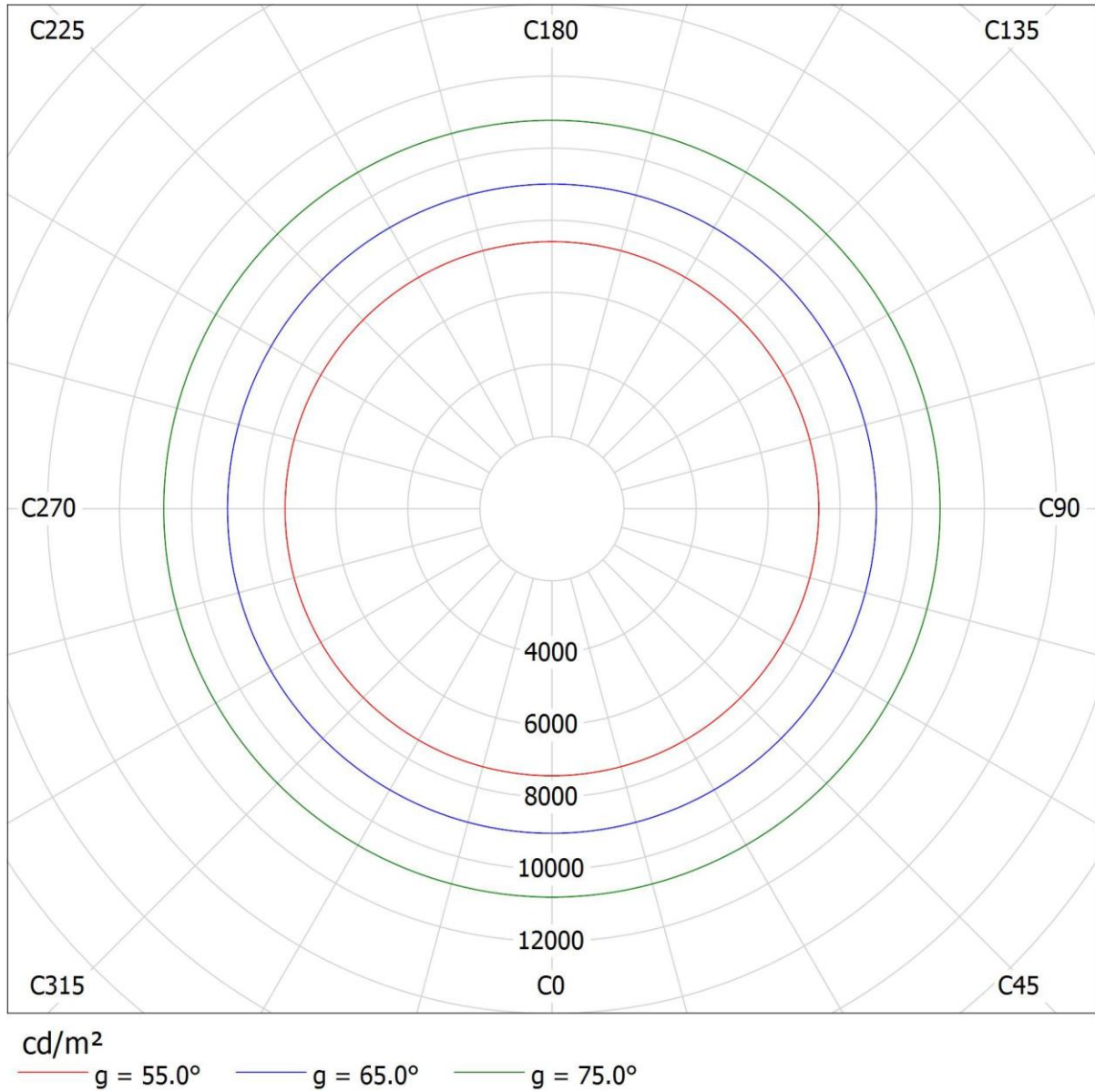
Luminaire: Glamox O49-1810007 O49 LED 4500 830 CL-OP
Lamps: 1 x O49 4500 830 CLOP

| Glare Evaluation According to UGR | | | | | | | | | | | |
|--|-----|---|------|------|------|------|--|------|------|------|------|
| ρ Ceiling | | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 |
| ρ Walls | | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 |
| ρ Floor | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Room Size X Y | | Viewing direction at right angles to lamp axis | | | | | Viewing direction parallel to lamp axis | | | | |
| 2H | 2H | 19.9 | 21.5 | 20.3 | 21.9 | 22.3 | 19.9 | 21.5 | 20.3 | 21.9 | 22.3 |
| | 3H | 22.6 | 24.1 | 23.1 | 24.5 | 25.0 | 22.6 | 24.1 | 23.1 | 24.5 | 25.0 |
| | 4H | 23.9 | 25.3 | 24.4 | 25.7 | 26.2 | 23.9 | 25.3 | 24.4 | 25.7 | 26.2 |
| | 6H | 25.0 | 26.3 | 25.5 | 26.8 | 27.3 | 25.0 | 26.3 | 25.5 | 26.8 | 27.3 |
| | 8H | 25.6 | 26.8 | 26.1 | 27.3 | 27.8 | 25.6 | 26.8 | 26.1 | 27.3 | 27.8 |
| | 12H | 26.1 | 27.3 | 26.6 | 27.8 | 28.3 | 26.1 | 27.3 | 26.6 | 27.8 | 28.3 |
| 4H | 2H | 20.7 | 22.1 | 21.2 | 22.6 | 23.0 | 20.7 | 22.1 | 21.2 | 22.6 | 23.0 |
| | 3H | 23.7 | 24.9 | 24.2 | 25.3 | 25.9 | 23.7 | 24.9 | 24.2 | 25.3 | 25.9 |
| | 4H | 25.1 | 26.2 | 25.6 | 26.7 | 27.2 | 25.1 | 26.2 | 25.6 | 26.7 | 27.2 |
| | 6H | 26.4 | 27.4 | 27.0 | 27.9 | 28.5 | 26.4 | 27.4 | 27.0 | 27.9 | 28.5 |
| | 8H | 27.1 | 28.0 | 27.6 | 28.5 | 29.1 | 27.1 | 28.0 | 27.6 | 28.5 | 29.1 |
| | 12H | 27.7 | 28.5 | 28.3 | 29.1 | 29.7 | 27.7 | 28.5 | 28.3 | 29.1 | 29.7 |
| 8H | 4H | 25.6 | 26.5 | 26.2 | 27.1 | 27.7 | 25.6 | 26.5 | 26.2 | 27.1 | 27.7 |
| | 6H | 27.2 | 28.0 | 27.8 | 28.5 | 29.1 | 27.2 | 28.0 | 27.8 | 28.5 | 29.1 |
| | 8H | 28.0 | 28.7 | 28.6 | 29.2 | 29.9 | 28.0 | 28.7 | 28.6 | 29.2 | 29.9 |
| | 12H | 28.8 | 29.4 | 29.4 | 30.0 | 30.7 | 28.8 | 29.4 | 29.4 | 30.0 | 30.7 |
| 12H | 4H | 25.7 | 26.6 | 26.3 | 27.1 | 27.7 | 25.7 | 26.6 | 26.3 | 27.1 | 27.7 |
| | 6H | 27.4 | 28.1 | 28.0 | 28.6 | 29.3 | 27.4 | 28.1 | 28.0 | 28.6 | 29.3 |
| | 8H | 28.3 | 28.9 | 28.9 | 29.5 | 30.1 | 28.3 | 28.9 | 28.9 | 29.5 | 30.1 |
| Variation of the observer position for the luminaire distances S | | | | | | | | | | | |
| S = 1.0H | | +0.1 / -0.1 | | | | | +0.1 / -0.1 | | | | |
| S = 1.5H | | +0.2 / -0.2 | | | | | +0.2 / -0.2 | | | | |
| S = 2.0H | | +0.4 / -0.4 | | | | | +0.4 / -0.4 | | | | |
| Standard table | | BK11 | | | | | BK11 | | | | |
| Correction Summand | | 7.5 | | | | | 7.5 | | | | |
| Corrected Glare Indices referring to 4150lm Total Luminous Flux | | | | | | | | | | | |

The UGR values have been calculated according to CIE Publ. 117 Spacing-to-Height-Ratio = 1.00.

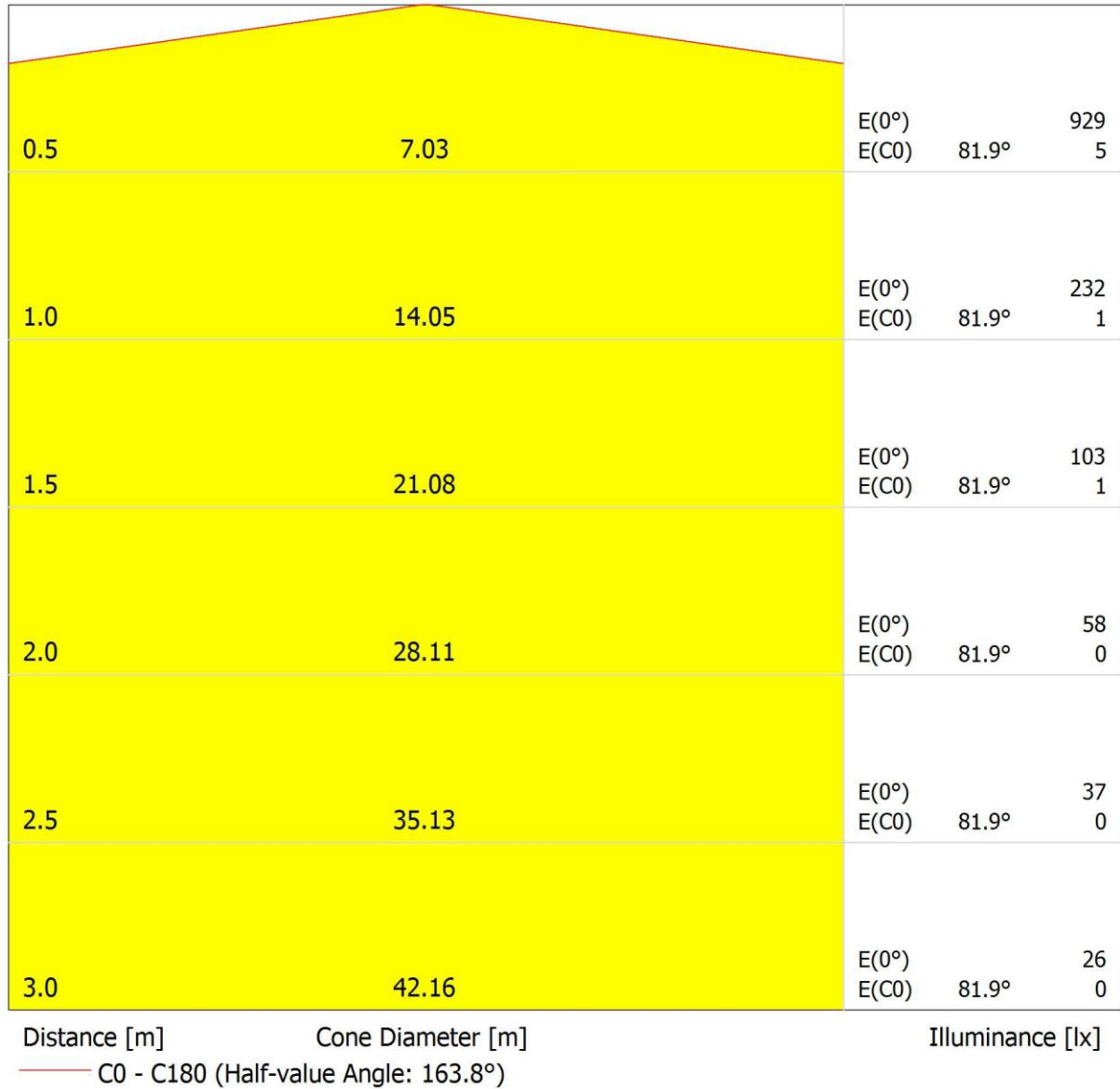
2.6 Glamox O49-1810007 O49 LED 4500 830 CL-OP / Luminance Diagram

Luminaire: Glamox O49-1810007 O49 LED 4500 830 CL-OP
Lamps: 1 x O49 4500 830 CLOP



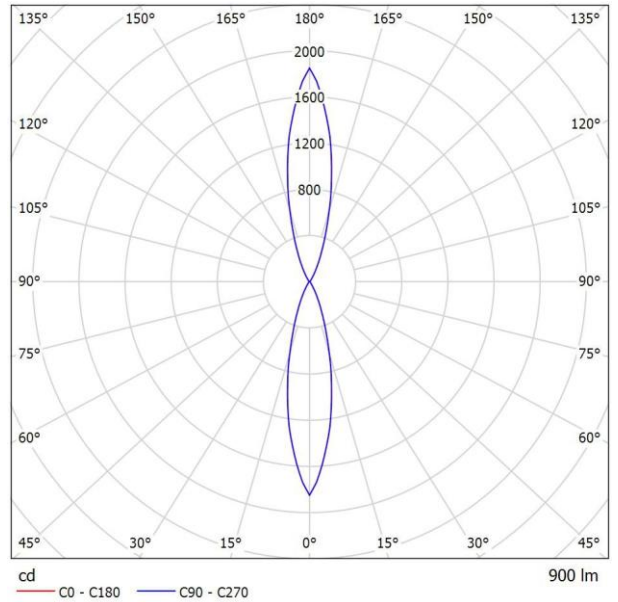
2.7 Glamox O49-1810007 O49 LED 4500 830 CL-OP / Cone Diagram

Luminaire: Glamox O49-1810007 O49 LED 4500 830 CL-OP
Lamps: 1 x O49 4500 830 CLOP



2.8 Glamox 0472009P O25-W LED 2x450 HF 840 NB / Luminaire Data Sheet

Luminous emittance 1:



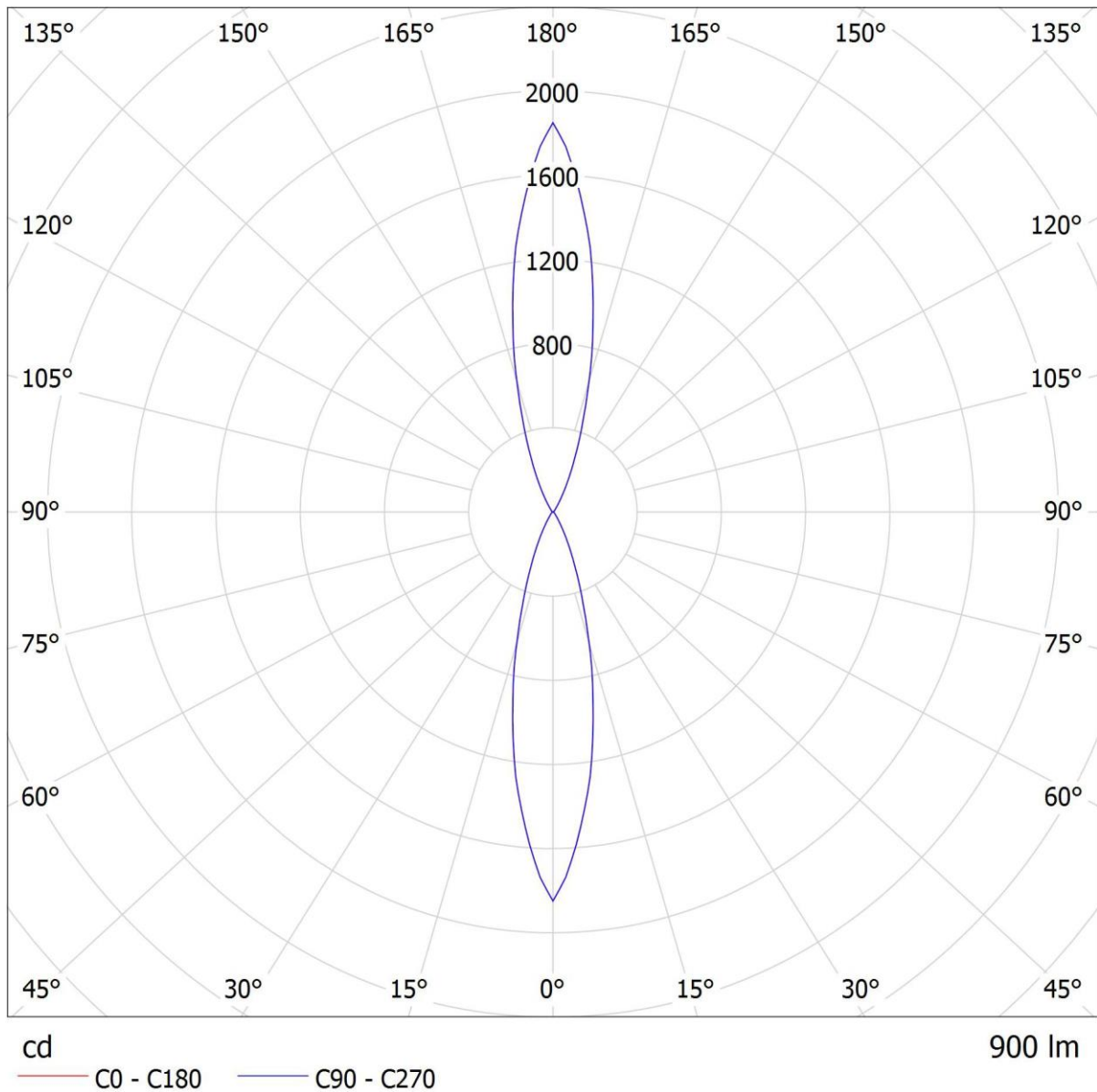
Luminaire classification according to CIE: 50
CIE flux code: 95 99 100 50 100

Luminous emittance 1:

| Glare Evaluation According to UGR | | | | | | | | | | | |
|--|---|------|------|------|------|--|------|------|------|------|------|
| ρ Ceiling | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 | |
| ρ Walls | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 | |
| ρ Floor | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Room Size X Y | Viewing direction at right angles to lamp axis | | | | | Viewing direction parallel to lamp axis | | | | | |
| 2H | 2H | 10.7 | 11.3 | 11.6 | 12.1 | 13.2 | 10.7 | 11.3 | 11.6 | 12.1 | 13.2 |
| | 3H | 11.6 | 12.1 | 12.5 | 13.0 | 14.1 | 11.6 | 12.1 | 12.5 | 13.0 | 14.1 |
| | 4H | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 |
| | 6H | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 |
| | 8H | 11.7 | 12.1 | 12.6 | 13.0 | 14.2 | 11.7 | 12.1 | 12.6 | 13.0 | 14.2 |
| 4H | 12H | 11.6 | 12.0 | 12.6 | 13.0 | 14.1 | 11.6 | 12.0 | 12.6 | 13.0 | 14.1 |
| | 2H | 10.9 | 11.3 | 11.8 | 12.2 | 13.4 | 10.9 | 11.3 | 11.8 | 12.2 | 13.4 |
| | 3H | 11.9 | 12.3 | 12.8 | 13.2 | 14.4 | 11.9 | 12.3 | 12.8 | 13.2 | 14.4 |
| | 4H | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 |
| | 6H | 12.1 | 12.4 | 13.1 | 13.4 | 14.7 | 12.1 | 12.4 | 13.1 | 13.4 | 14.7 |
| 8H | 8H | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 |
| | 12H | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 |
| | 4H | 12.0 | 12.3 | 13.1 | 13.3 | 14.6 | 12.0 | 12.3 | 13.1 | 13.3 | 14.6 |
| | 6H | 12.1 | 12.3 | 13.2 | 13.3 | 14.6 | 12.1 | 12.3 | 13.2 | 13.3 | 14.6 |
| | 8H | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 |
| 12H | 12H | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 |
| | 4H | 12.0 | 12.2 | 13.0 | 13.2 | 14.5 | 12.0 | 12.2 | 13.0 | 13.2 | 14.5 |
| | 6H | 12.1 | 12.2 | 13.1 | 13.3 | 14.6 | 12.1 | 12.2 | 13.1 | 13.3 | 14.6 |
| | 8H | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 |
| | 8H | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 |
| Variation of the observer position for the luminaire distances S | | | | | | | | | | | |
| S = 1.0H | +2.0 / -1.2 | | | | | +2.0 / -1.2 | | | | | |
| S = 1.5H | +3.8 / -1.8 | | | | | +3.8 / -1.8 | | | | | |
| S = 2.0H | +5.5 / -2.6 | | | | | +5.5 / -2.6 | | | | | |
| Standard table | BK02 | | | | | BK02 | | | | | |
| Correction Summand | -2.5 | | | | | -2.5 | | | | | |
| Corrected Glare Indices referring to 900lm Total Luminous Flux | | | | | | | | | | | |

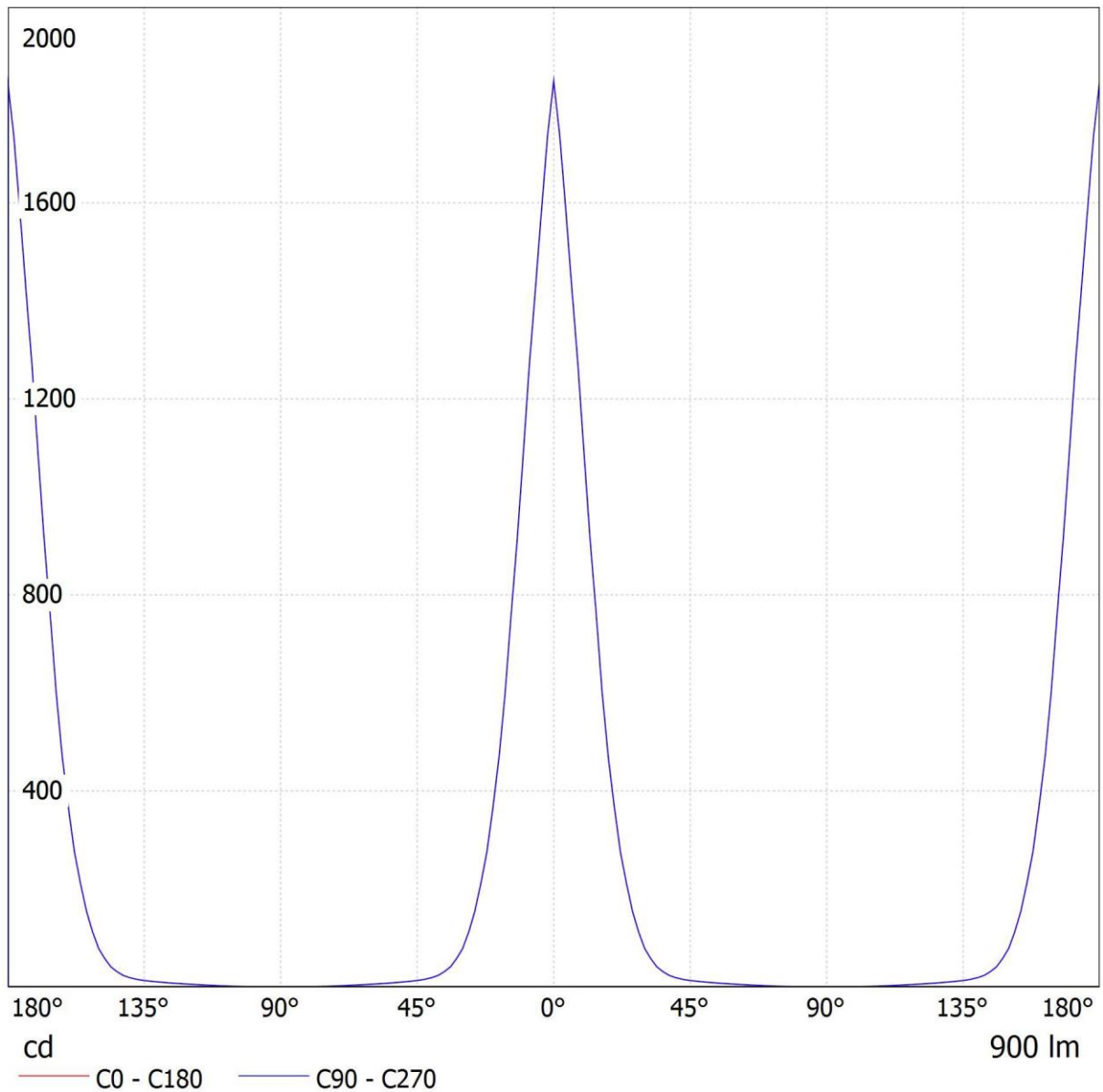
2.9 Glamox 0472009P O25-W LED 2x450 HF 840 NB / LDC (Polar)

Luminaire: Glamox 0472009P O25-W LED 2x450 HF 840 NB
Lamps: 1 x O25 2x450 840



2.10 Glamox 0472009P O25-W LED 2x450 HF 840 NB / LDC (Linear)

Luminaire: Glamox 0472009P O25-W LED 2x450 HF 840 NB
Lamps: 1 x O25 2x450 840



2.11 Glamox 0472009P O25-W LED 2x450 HF 840 NB / UGR-Table

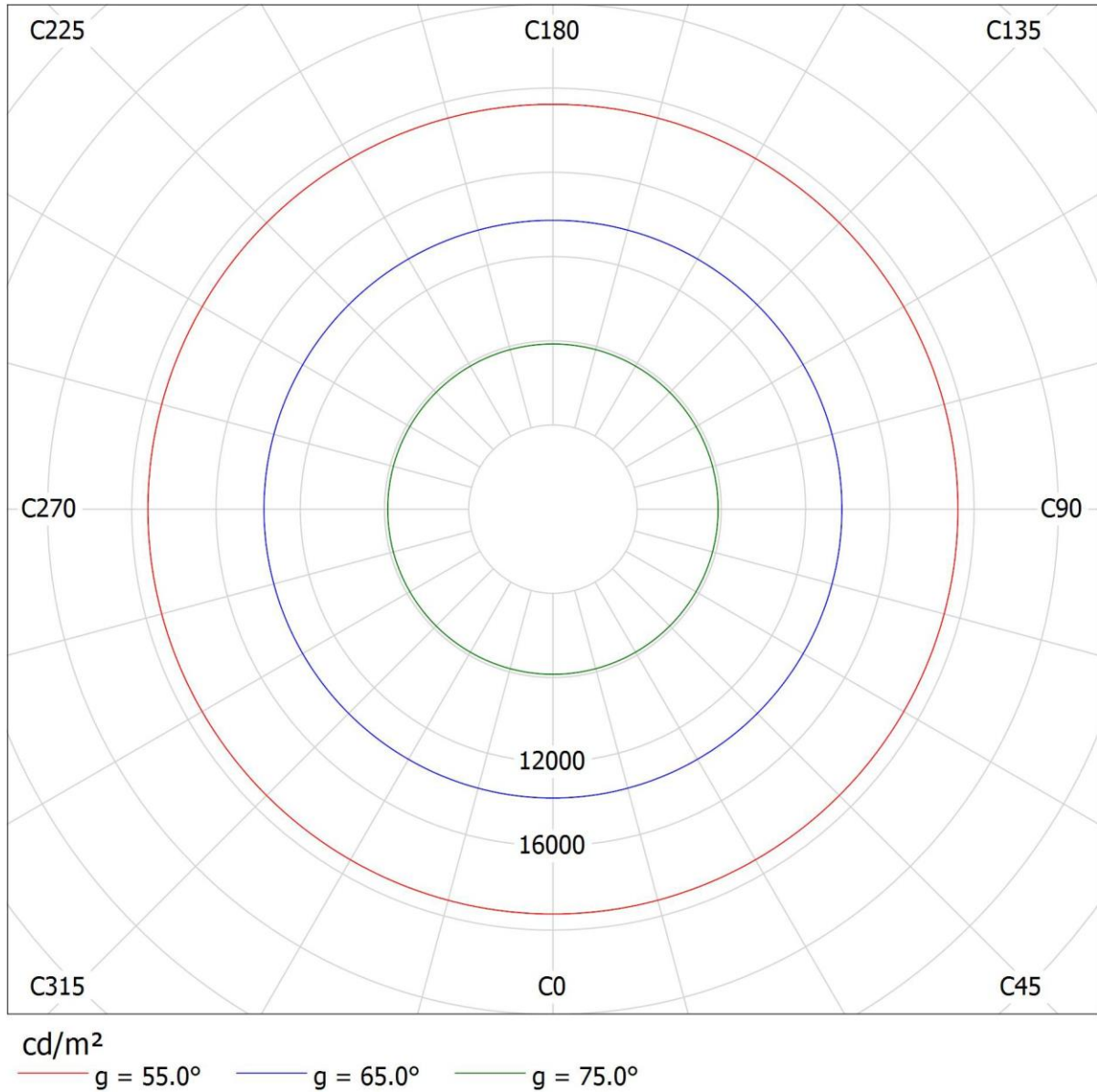
Luminaire: Glamox 0472009P O25-W LED 2x450 HF 840 NB
Lamps: 1 x O25 2x450 840

| Glare Evaluation According to UGR | | | | | | | | | | | |
|--|-----|---|------|------|------|------|--|------|------|------|------|
| ρ Ceiling | | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 |
| ρ Walls | | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 |
| ρ Floor | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Room Size X Y | | Viewing direction at right angles to lamp axis | | | | | Viewing direction parallel to lamp axis | | | | |
| 2H | 2H | 10.7 | 11.3 | 11.6 | 12.1 | 13.2 | 10.7 | 11.3 | 11.6 | 12.1 | 13.2 |
| | 3H | 11.6 | 12.1 | 12.5 | 13.0 | 14.1 | 11.6 | 12.1 | 12.5 | 13.0 | 14.1 |
| | 4H | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 |
| | 6H | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 | 11.7 | 12.2 | 12.7 | 13.1 | 14.2 |
| | 8H | 11.7 | 12.1 | 12.6 | 13.0 | 14.2 | 11.7 | 12.1 | 12.6 | 13.0 | 14.2 |
| | 12H | 11.6 | 12.0 | 12.6 | 13.0 | 14.1 | 11.6 | 12.0 | 12.6 | 13.0 | 14.1 |
| 4H | 2H | 10.9 | 11.3 | 11.8 | 12.2 | 13.4 | 10.9 | 11.3 | 11.8 | 12.2 | 13.4 |
| | 3H | 11.9 | 12.3 | 12.8 | 13.2 | 14.4 | 11.9 | 12.3 | 12.8 | 13.2 | 14.4 |
| | 4H | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 |
| | 6H | 12.1 | 12.4 | 13.1 | 13.4 | 14.7 | 12.1 | 12.4 | 13.1 | 13.4 | 14.7 |
| | 8H | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 | 12.1 | 12.4 | 13.1 | 13.4 | 14.6 |
| | 12H | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 |
| 8H | 4H | 12.0 | 12.3 | 13.1 | 13.3 | 14.6 | 12.0 | 12.3 | 13.1 | 13.3 | 14.6 |
| | 6H | 12.1 | 12.3 | 13.2 | 13.3 | 14.6 | 12.1 | 12.3 | 13.2 | 13.3 | 14.6 |
| | 8H | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 | 12.1 | 12.3 | 13.1 | 13.3 | 14.6 |
| | 12H | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 |
| 12H | 4H | 12.0 | 12.2 | 13.0 | 13.2 | 14.5 | 12.0 | 12.2 | 13.0 | 13.2 | 14.5 |
| | 6H | 12.1 | 12.2 | 13.1 | 13.3 | 14.6 | 12.1 | 12.2 | 13.1 | 13.3 | 14.6 |
| | 8H | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 | 12.1 | 12.2 | 13.1 | 13.2 | 14.6 |
| Variation of the observer position for the luminaire distances S | | | | | | | | | | | |
| S = 1.0H | | +2.0 / -1.2 | | | | | +2.0 / -1.2 | | | | |
| S = 1.5H | | +3.8 / -1.8 | | | | | +3.8 / -1.8 | | | | |
| S = 2.0H | | +5.5 / -2.6 | | | | | +5.5 / -2.6 | | | | |
| Standard table | | BK02 | | | | | BK02 | | | | |
| Correction Summand | | -2.5 | | | | | -2.5 | | | | |
| Corrected Glare Indices referring to 900lm Total Luminous Flux | | | | | | | | | | | |

The UGR values have been calculated according to CIE Publ. 117 Spacing-to-Height-Ratio = 1.00.

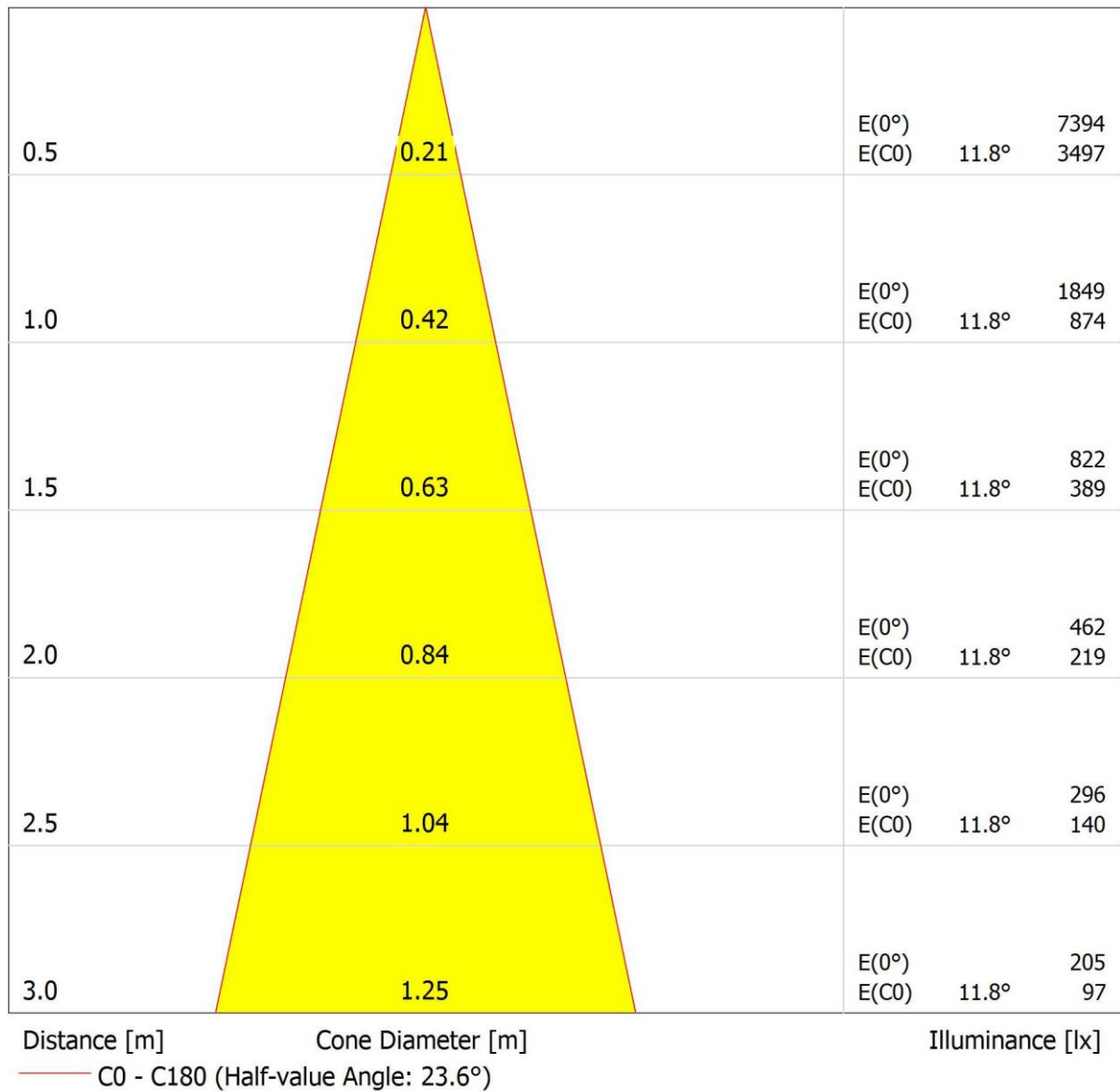
2.12 Glamox 0472009P O25-W LED 2x450 HF 840 NB / Luminance Diagram

Luminaire: Glamox 0472009P O25-W LED 2x450 HF 840 NB
Lamps: 1 x O25 2x450 840



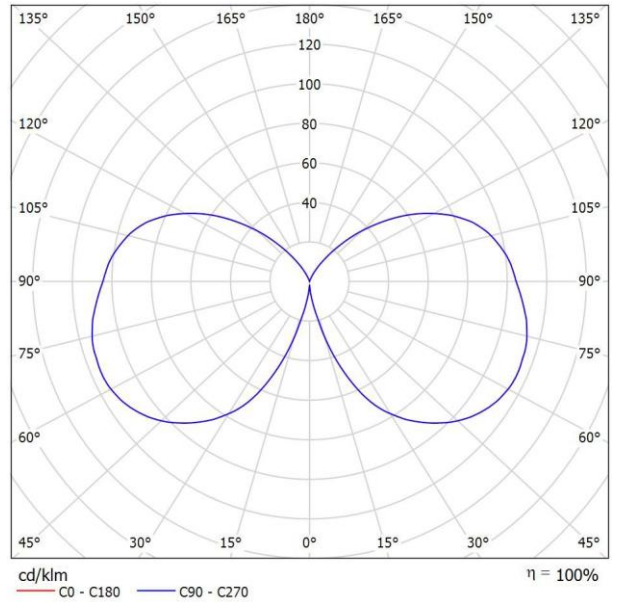
2.13 Glamox 0472009P O25-W LED 2x450 HF 840 NB / Cone Diagram

Luminaire: Glamox 0472009P O25-W LED 2x450 HF 840 NB
Lamps: 1 x O25 2x450 840



2.14 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / Luminaire Data Sheet

Luminous emittance 1:



Luminaire classification according to CIE: 62
CIE flux code: 16 43 72 62 100

A timeless LED bollard. Electronic, fixed output control gear. Class I electrical, IP65. Top and body: aluminium powder coated grey 900. Diffuser: semi-opal anti-UV polycarbonate. Suitable for flange mounting or with root spike (available separately). Complete with 3000K LED

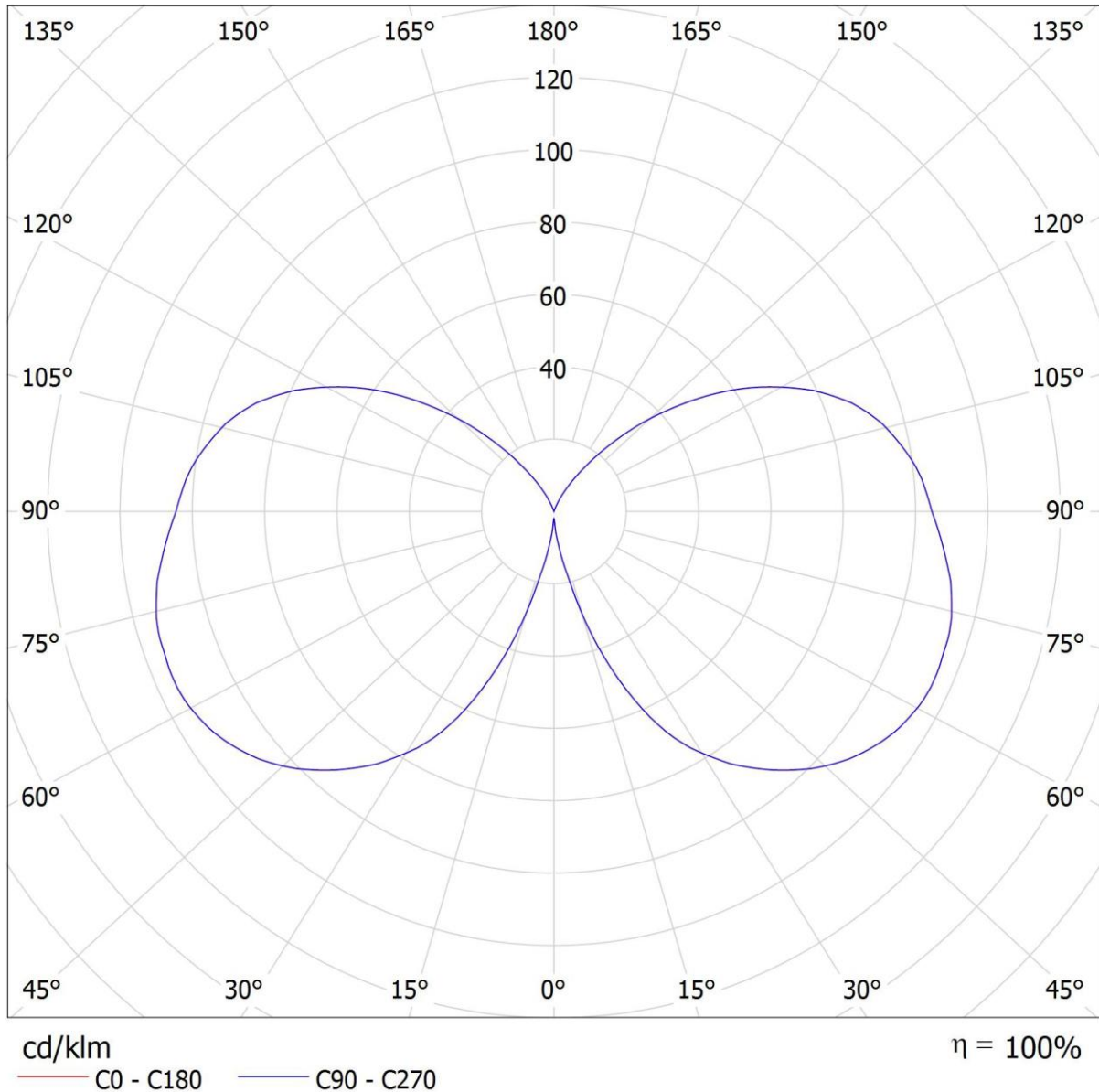
Dimensions: Ø150 x 1000
mm Total power: 14 W
Weight: 5.45 kg

Luminous emittance 1:

| Glare Evaluation According to UGR | | | | | | | | | | | |
|--|---|------|------|------|--|------|------|------|------|------|------|
| | 70 | 70 | 50 | 30 | 70 | 70 | 50 | 30 | 70 | 30 | |
| ρ Ceiling | 50 | 30 | 50 | 30 | 50 | 30 | 50 | 30 | 50 | 30 | |
| ρ Walls | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| ρ Floor | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Room Size X Y | Viewing direction at right angles to lamp axis | | | | Viewing direction parallel to lamp axis | | | | | | |
| 2H | 2H | 12.3 | 13.4 | 13.1 | 14.2 | 15.2 | 12.3 | 13.4 | 13.1 | 14.2 | 15.2 |
| | 3H | 15.0 | 16.1 | 15.8 | 16.9 | 17.9 | 15.0 | 16.1 | 15.8 | 16.9 | 17.9 |
| | 4H | 16.3 | 17.3 | 17.2 | 18.2 | 19.2 | 16.3 | 17.3 | 17.2 | 18.2 | 19.2 |
| | 6H | 17.6 | 18.5 | 18.4 | 19.4 | 20.4 | 17.6 | 18.5 | 18.4 | 19.4 | 20.4 |
| | 8H | 18.2 | 19.1 | 19.0 | 19.9 | 21.0 | 18.2 | 19.1 | 19.0 | 19.9 | 21.0 |
| | 12H | 18.7 | 19.6 | 19.6 | 20.5 | 21.6 | 18.7 | 19.6 | 19.6 | 20.5 | 21.6 |
| 4H | 2H | 13.0 | 14.0 | 13.8 | 14.8 | 15.9 | 13.0 | 14.0 | 13.8 | 14.8 | 15.9 |
| | 3H | 16.0 | 16.8 | 16.8 | 17.7 | 18.8 | 16.0 | 16.8 | 16.8 | 17.7 | 18.8 |
| | 4H | 17.4 | 18.2 | 18.3 | 19.1 | 20.2 | 17.4 | 18.2 | 18.3 | 19.1 | 20.2 |
| | 6H | 18.9 | 19.6 | 19.7 | 20.5 | 21.6 | 18.9 | 19.6 | 19.7 | 20.5 | 21.6 |
| | 8H | 19.5 | 20.2 | 20.4 | 21.1 | 22.2 | 19.5 | 20.2 | 20.4 | 21.1 | 22.2 |
| | 12H | 20.2 | 20.8 | 21.1 | 21.7 | 22.9 | 20.2 | 20.8 | 21.1 | 21.7 | 22.9 |
| 8H | 4H | 17.9 | 18.6 | 18.8 | 19.5 | 20.7 | 17.9 | 18.6 | 18.8 | 19.5 | 20.7 |
| | 6H | 19.6 | 20.2 | 20.5 | 21.1 | 22.3 | 19.6 | 20.2 | 20.5 | 21.1 | 22.3 |
| | 8H | 20.4 | 20.9 | 21.4 | 21.9 | 23.1 | 20.4 | 20.9 | 21.4 | 21.9 | 23.1 |
| | 12H | 21.3 | 21.7 | 22.2 | 22.7 | 23.9 | 21.3 | 21.7 | 22.2 | 22.7 | 23.9 |
| 12H | 4H | 18.0 | 18.6 | 18.9 | 19.6 | 20.7 | 18.0 | 18.6 | 18.9 | 19.6 | 20.7 |
| | 6H | 19.8 | 20.3 | 20.7 | 21.2 | 22.4 | 19.8 | 20.3 | 20.7 | 21.2 | 22.4 |
| | 8H | 20.7 | 21.2 | 21.7 | 22.1 | 23.3 | 20.7 | 21.2 | 21.7 | 22.1 | 23.3 |
| Variation of the observer position for the luminaire distances S | | | | | | | | | | | |
| S = 1.0H | +0.1 / -0.1 | | | | +0.1 / -0.1 | | | | | | |
| S = 1.5H | +0.2 / -0.2 | | | | +0.2 / -0.2 | | | | | | |
| S = 2.0H | +0.3 / -0.4 | | | | +0.3 / -0.4 | | | | | | |
| Standard table | BK11 | | | | BK11 | | | | | | |
| Correction Summand | 8.1 | | | | 8.1 | | | | | | |
| Corrected Glare Indices referring to 507lm Total Luminous Flux | | | | | | | | | | | |

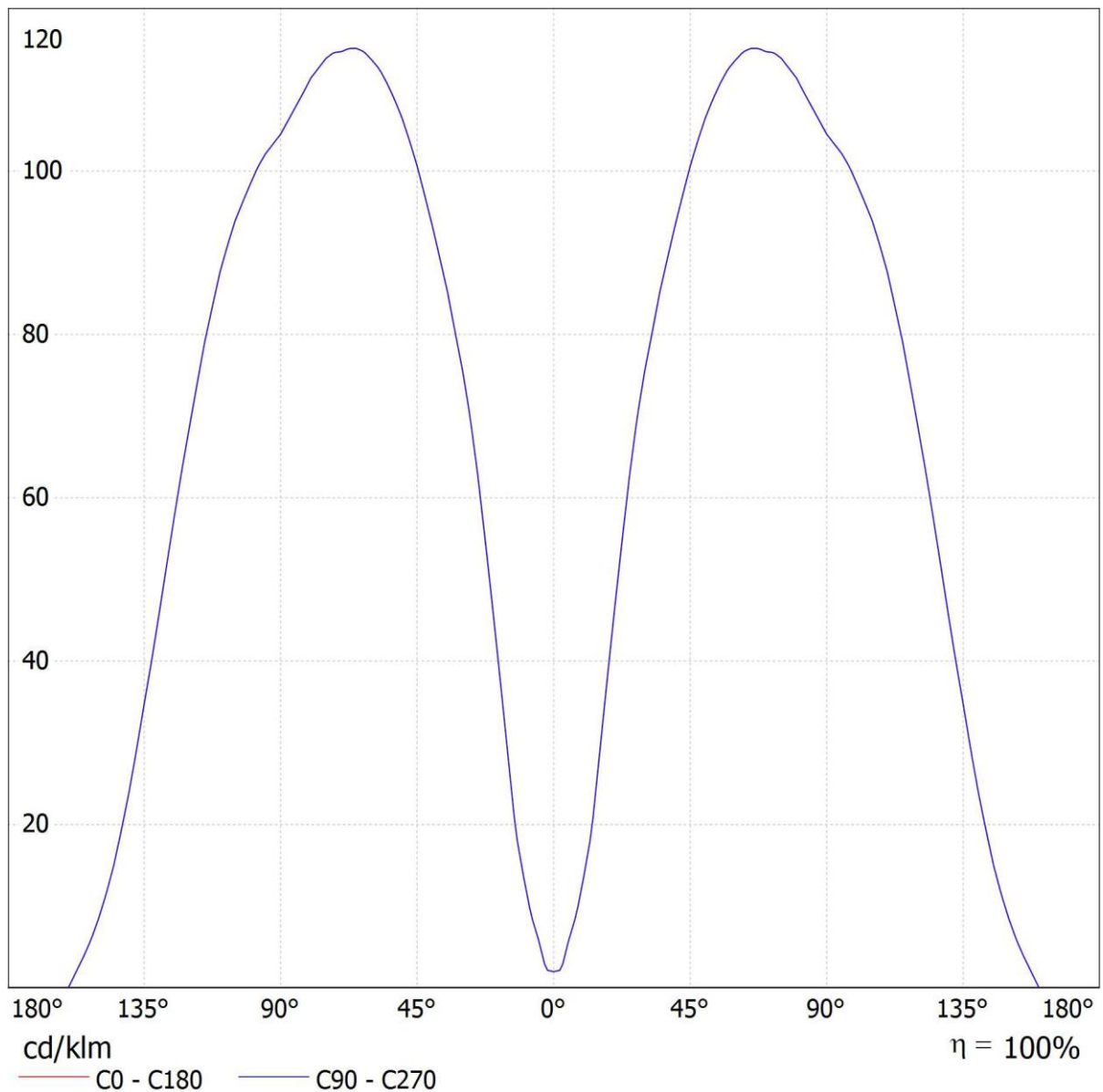
2.15 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / LDC (Polar)

Luminaire: Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD]
Lamps: 1 x LED 14 W



2.16 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / LDC (Linear)

Luminaire: Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD]
Lamps: 1 x LED 14 W



2.17 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / UGR-Table

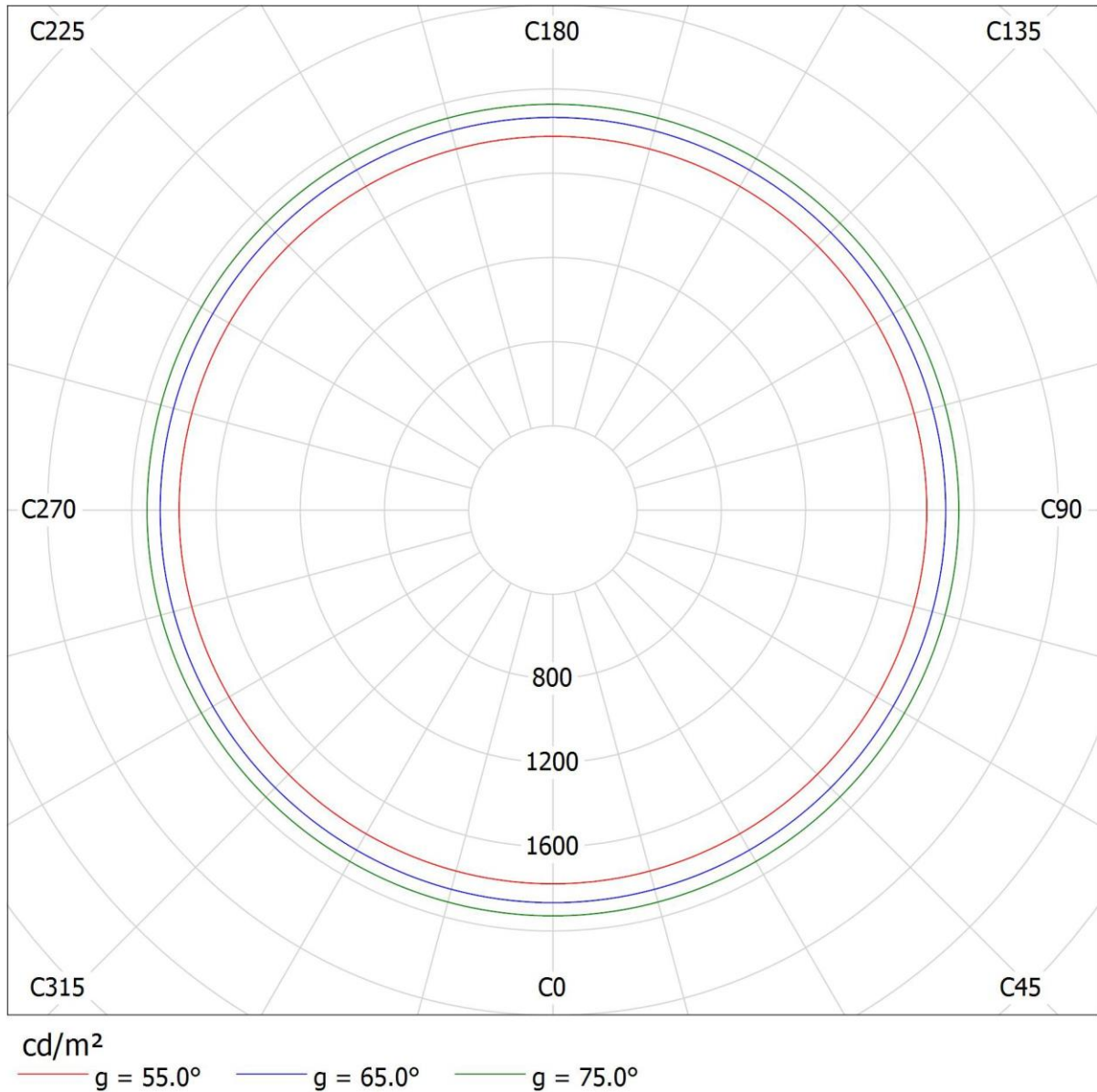
Luminaire: Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD]
Lamps: 1 x LED 14 W

| Glare Evaluation According to UGR | | | | | | | | | | | |
|--|-----|---|------|------|------|------|--|------|------|------|------|
| ρ Ceiling | | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 |
| ρ Walls | | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 |
| ρ Floor | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Room Size X Y | | Viewing direction at right angles to lamp axis | | | | | Viewing direction parallel to lamp axis | | | | |
| 2H | 2H | 12.3 | 13.4 | 13.1 | 14.2 | 15.2 | 12.3 | 13.4 | 13.1 | 14.2 | 15.2 |
| | 3H | 15.0 | 16.1 | 15.8 | 16.9 | 17.9 | 15.0 | 16.1 | 15.8 | 16.9 | 17.9 |
| | 4H | 16.3 | 17.3 | 17.2 | 18.2 | 19.2 | 16.3 | 17.3 | 17.2 | 18.2 | 19.2 |
| | 6H | 17.6 | 18.5 | 18.4 | 19.4 | 20.4 | 17.6 | 18.5 | 18.4 | 19.4 | 20.4 |
| | 8H | 18.2 | 19.1 | 19.0 | 19.9 | 21.0 | 18.2 | 19.1 | 19.0 | 19.9 | 21.0 |
| | 12H | 18.7 | 19.6 | 19.6 | 20.5 | 21.6 | 18.7 | 19.6 | 19.6 | 20.5 | 21.6 |
| 4H | 2H | 13.0 | 14.0 | 13.8 | 14.8 | 15.9 | 13.0 | 14.0 | 13.8 | 14.8 | 15.9 |
| | 3H | 16.0 | 16.8 | 16.8 | 17.7 | 18.8 | 16.0 | 16.8 | 16.8 | 17.7 | 18.8 |
| | 4H | 17.4 | 18.2 | 18.3 | 19.1 | 20.2 | 17.4 | 18.2 | 18.3 | 19.1 | 20.2 |
| | 6H | 18.9 | 19.6 | 19.7 | 20.5 | 21.6 | 18.9 | 19.6 | 19.7 | 20.5 | 21.6 |
| | 8H | 19.5 | 20.2 | 20.4 | 21.1 | 22.2 | 19.5 | 20.2 | 20.4 | 21.1 | 22.2 |
| | 12H | 20.2 | 20.8 | 21.1 | 21.7 | 22.9 | 20.2 | 20.8 | 21.1 | 21.7 | 22.9 |
| 8H | 4H | 17.9 | 18.6 | 18.8 | 19.5 | 20.7 | 17.9 | 18.6 | 18.8 | 19.5 | 20.7 |
| | 6H | 19.6 | 20.2 | 20.5 | 21.1 | 22.3 | 19.6 | 20.2 | 20.5 | 21.1 | 22.3 |
| | 8H | 20.4 | 20.9 | 21.4 | 21.9 | 23.1 | 20.4 | 20.9 | 21.4 | 21.9 | 23.1 |
| | 12H | 21.3 | 21.7 | 22.2 | 22.7 | 23.9 | 21.3 | 21.7 | 22.2 | 22.7 | 23.9 |
| 12H | 4H | 18.0 | 18.6 | 18.9 | 19.6 | 20.7 | 18.0 | 18.6 | 18.9 | 19.6 | 20.7 |
| | 6H | 19.8 | 20.3 | 20.7 | 21.2 | 22.4 | 19.8 | 20.3 | 20.7 | 21.2 | 22.4 |
| | 8H | 20.7 | 21.2 | 21.7 | 22.1 | 23.3 | 20.7 | 21.2 | 21.7 | 22.1 | 23.3 |
| Variation of the observer position for the luminaire distances S | | | | | | | | | | | |
| S = 1.0H | | +0.1 / -0.1 | | | | | +0.1 / -0.1 | | | | |
| S = 1.5H | | +0.2 / -0.2 | | | | | +0.2 / -0.2 | | | | |
| S = 2.0H | | +0.3 / -0.4 | | | | | +0.3 / -0.4 | | | | |
| Standard table | | BK11 | | | | | BK11 | | | | |
| Correction Summand | | 8.1 | | | | | 8.1 | | | | |
| Corrected Glare Indices referring to 507lm Total Luminous Flux | | | | | | | | | | | |

The UGR values have been calculated according to CIE Publ. 117 Spacing-to-Height-Ratio = 1.00.

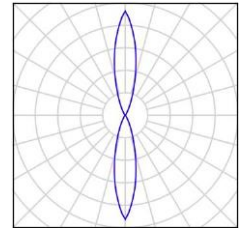
2.18 Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD] / Luminance Diagram

Luminaire: Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD]
Lamps: 1 x LED 14 W

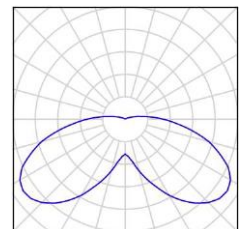


2.19 Waterfront South Central Lighting / Luminaire Parts List

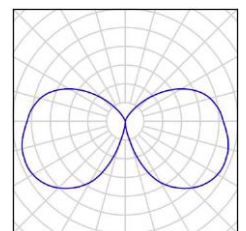
8 Pieces Glamox 0472009P O25-W LED 2x450 HF 840 NB
Article No.: 0472009P
Luminous flux (Luminaire): 900 lm
Luminous flux (Lamps): 900 lm
Luminaire Wattage: 9.0 W
Luminaire classification according to CIE: 50
CIE flux code: 95 99 100 50 100
Fitting: 1 x O25 2x450 840 (Correction Factor 1.000).



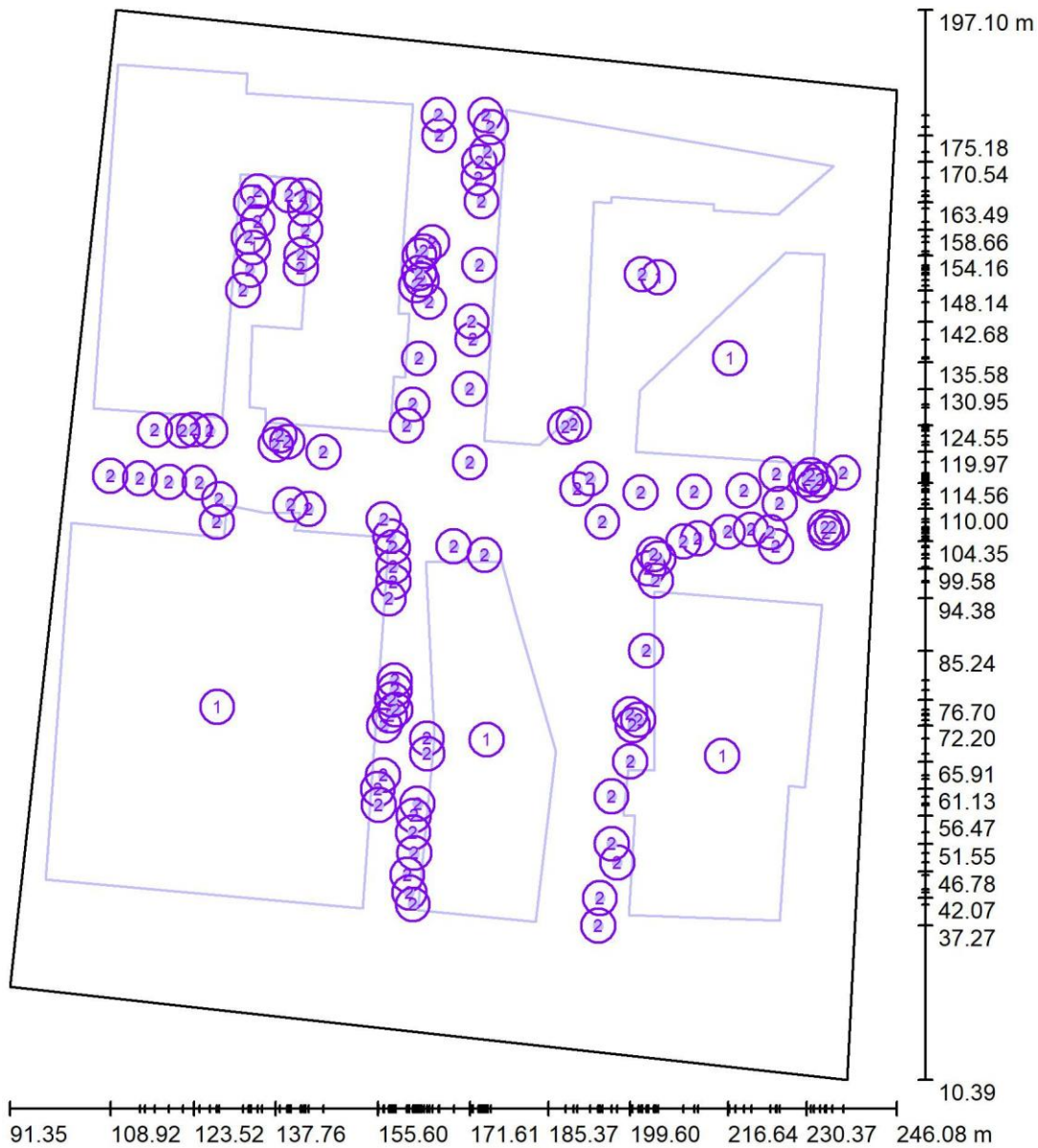
39 Pieces Glamox O49-1810007 O49 LED 4500 830 CL-OP
Article No.: O49-1810007
Luminous flux (Luminaire): 4150 lm
Luminous flux (Lamps): 4150 lm
Luminaire Wattage: 57.0 W
Luminaire classification according to CIE: 93
CIE flux code: 22 55 84 93 100
Fitting: 1 x O49 4500 830 CLOP (Correction Factor 1.000).



30 Pieces Thorn 96262100 D-CO LED BOLLARD 1000 30L50 830 CL1 [STD]
Article No.: 96262100
Luminous flux (Luminaire): 507 lm
Luminous flux (Lamps): 507 lm
Luminaire Wattage: 14.0 W
Luminaire classification according to CIE: 62
CIE flux code: 16 43 72 62 100
Fitting: 1 x LED 14 W (Correction Factor 1.000).



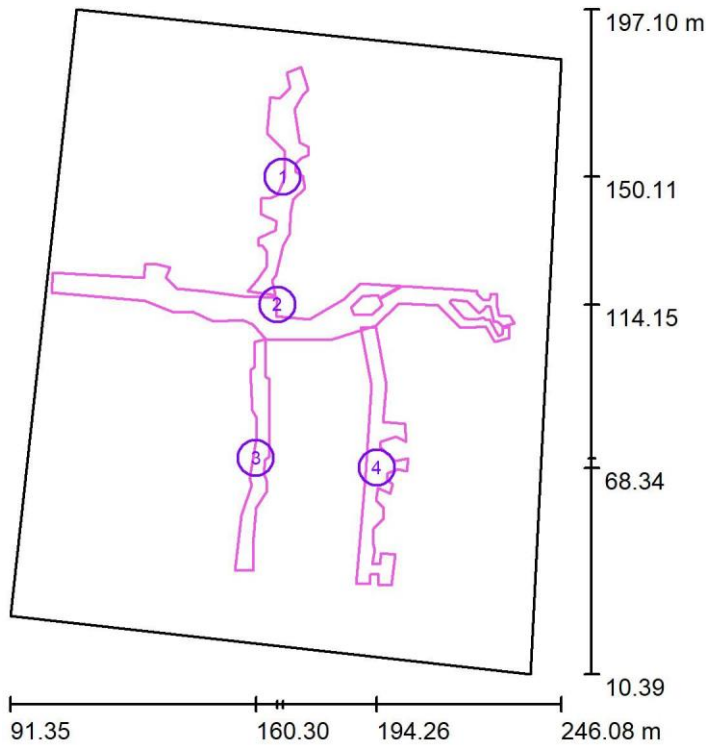
2.20 Waterfront South Central Lighting / Objects (Layout Plan)



Object parts list

| No. | Pieces | Designation |
|-----|--------|------------------|
| 1 | 6 | Extrusion Volume |
| 2 | 116 | Tree02 |

2.21 Waterfront South Central Lighting / Calculation surfaces (results overview)



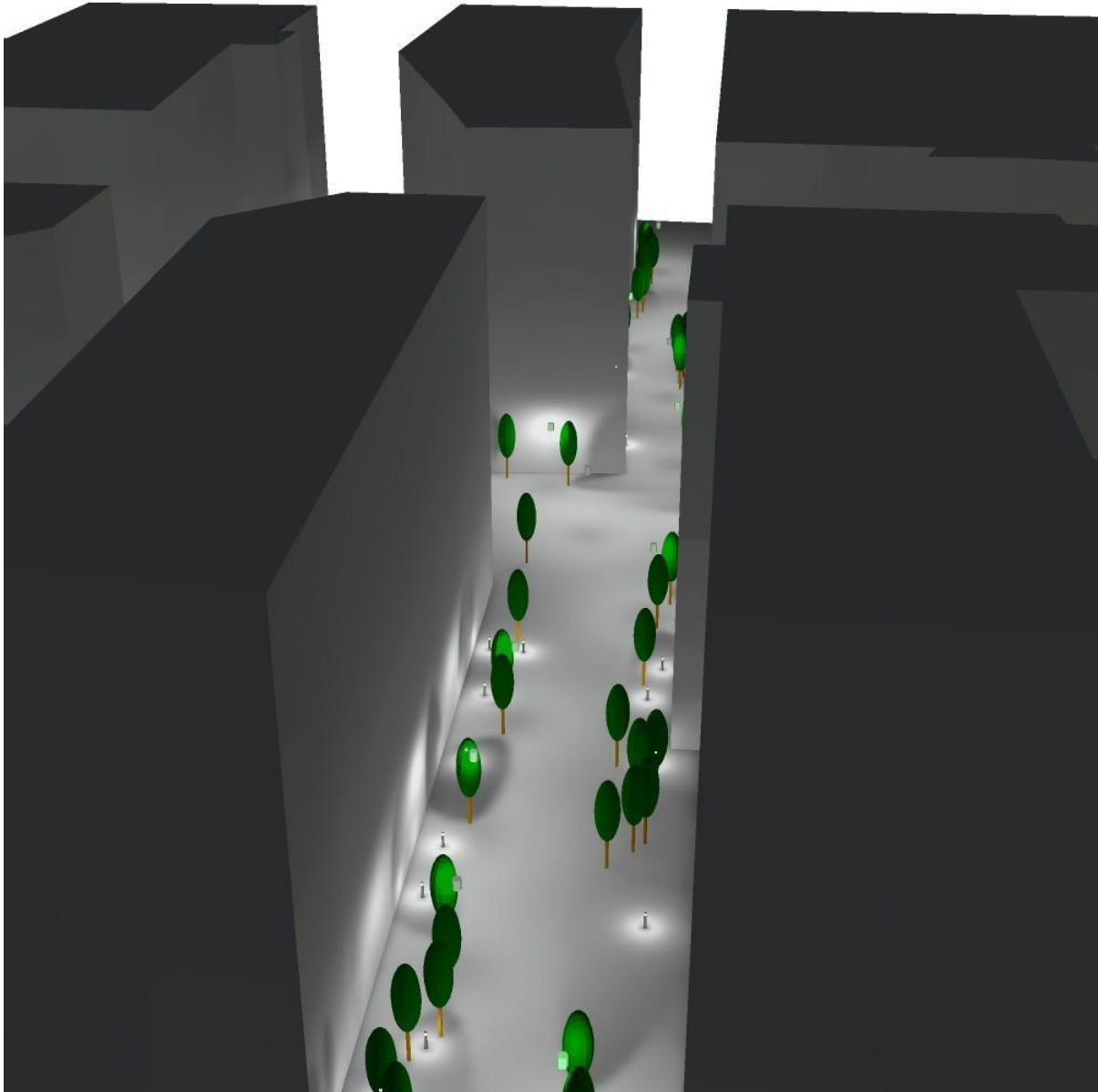
Calculation Surface List

| No. | Designation | Type | Grid | E_{av} [lx] | E_{min} [lx] | E_{max} [lx] | $u0$ | E_{min} E_{max} |
|-----|----------------------|---------------|-----------|------------------|-------------------|-------------------|-------|------------------------|
| 1 | Top Left Walkway | perpendicular | 128 x 128 | 12 | 2.68 | 28 | 0.233 | 0.096 |
| 2 | Centre Walkway | perpendicular | 128 x 64 | 14 | 3.13 | 31 | 0.230 | 0.101 |
| 3 | South Centre Walkway | perpendicular | 128 x 32 | 12 | 4.43 | 31 | 0.369 | 0.143 |
| 4 | South Right Walkway | perpendicular | 128 x 128 | 13 | 6.33 | 33 | 0.484 | 0.193 |

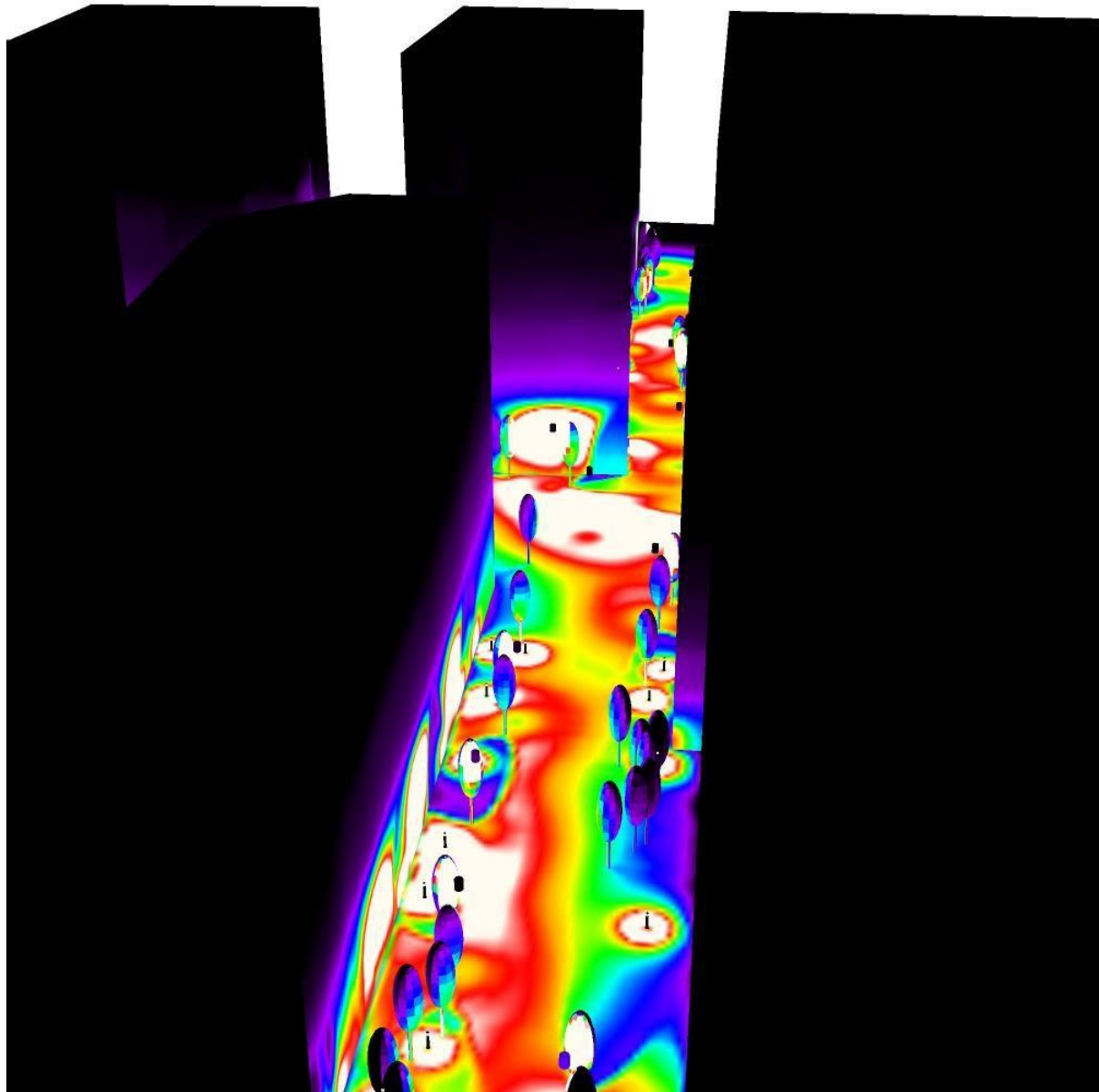
Summary of Results

| Type | Quantity | Average [lx] | Min [lx] | Max [lx] | $u0$ | E_{min} / E_{max} |
|---------------|----------|--------------|----------|----------|------|---------------------|
| perpendicular | 4 | 13 | 2.68 | 33 | 0.21 | 0.08 |

2.22 Waterfront South Central Lighting / 3D Rendering

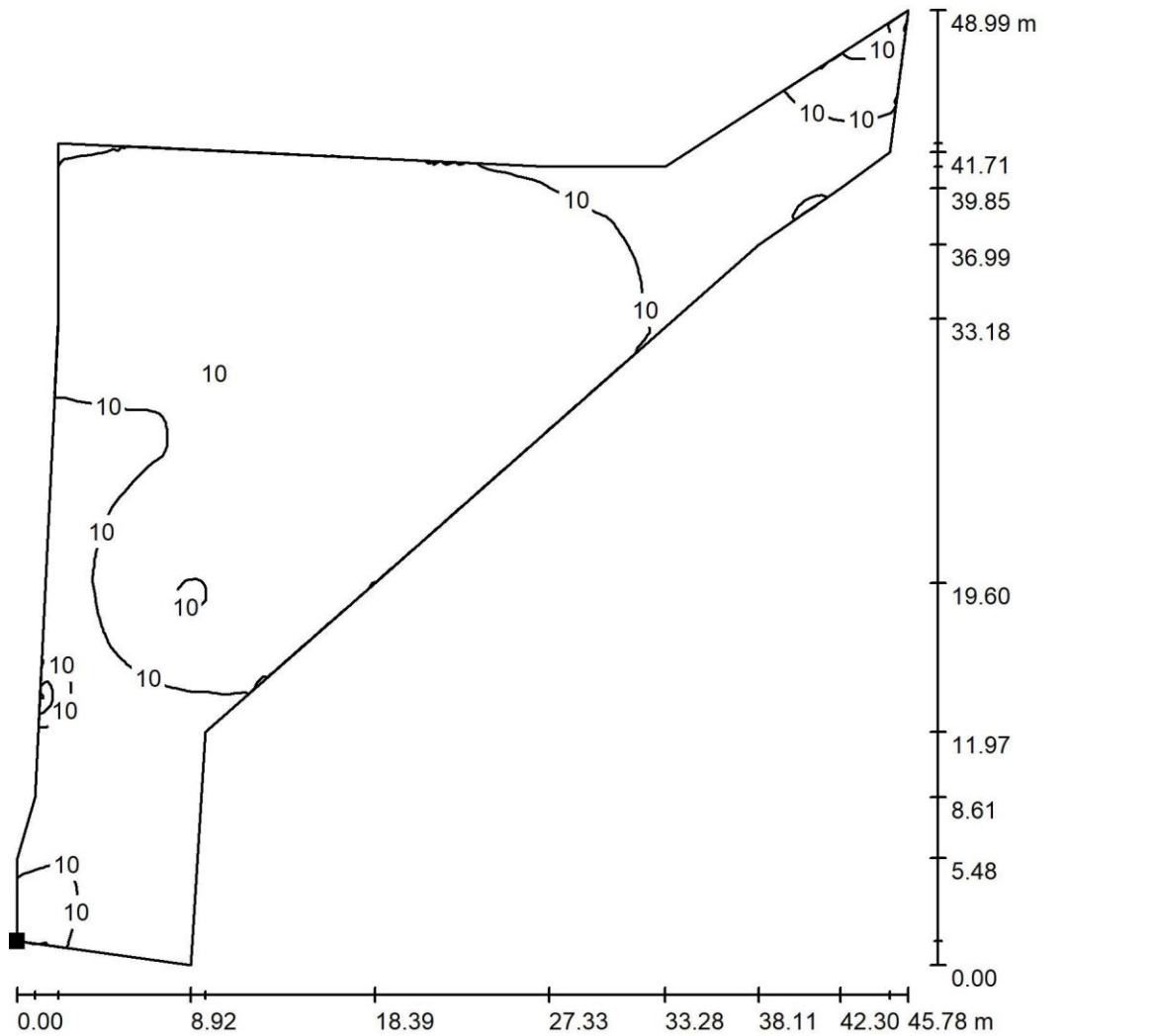


2.23 Waterfront South Central Lighting / False Colour Rendering



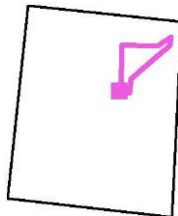
1 2.75 4.50 6.25 8 9.75 11.50 13.25 15 lx

2.24 Waterfront South Central Lighting / Top Right Walkway / Surface 1 / Isolines (E)



Values in Lux

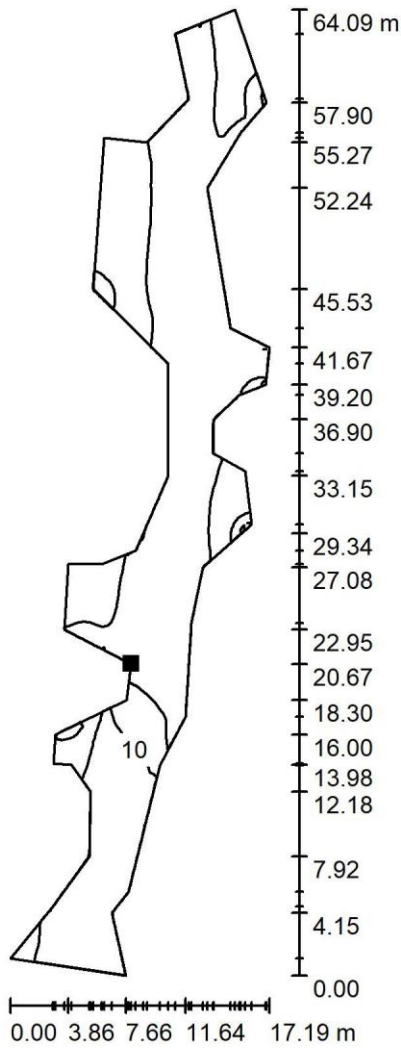
Position of surface in external scene:
Marked point:
(191.356 m, 121.213 m, 0.050 m)



Grid: 128 x 128 Points

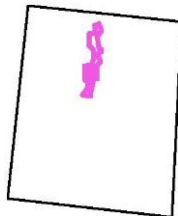
| | | | | |
|---------------|----------------|----------------|-------|-------------|
| E_{av} [lx] | E_{min} [lx] | E_{max} [lx] | u_0 | $E_{min} /$ |
| E_{max} 12 | 2.42 | 31 | 0.211 | 0.078 |

2.25 Waterfront South Central Lighting / Top Left Walkway / Isolines (E, Perpendicular)



Values in Lux

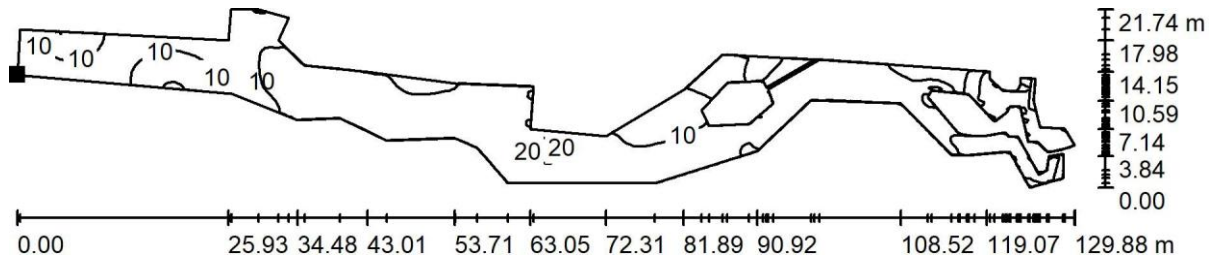
Position of surface in external scene:
Marked point:
(166.070 m, 137.469 m, 0.050 m)



Grid: 128 x 128 Points

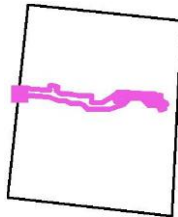
| | | | | |
|---------------|----------------|----------------|-------|-------------|
| E_{av} [lx] | E_{min} [lx] | E_{max} [lx] | u_0 | $E_{min} /$ |
| E_{max} 12 | 2.68 | 28 | 0.233 | 0.096 |

2.26 Waterfront South Central Lighting / Centre Walkway / Isolines (E, Perpendicular)



Values in Lux

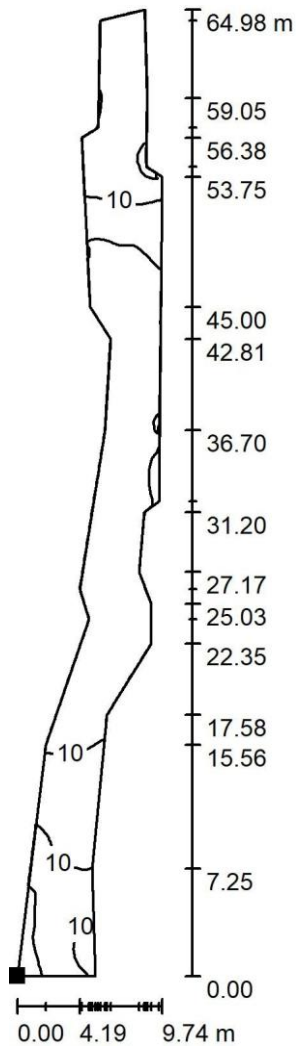
Position of surface in external scene:
Marked point:
(102.971 m, 117.530 m, 0.050 m)



Grid: 128 x 64 Points

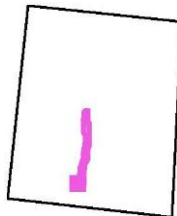
| | | | | |
|---------------|----------------|----------------|-------|-------------|
| E_{av} [lx] | E_{min} [lx] | E_{max} [lx] | u0 | $E_{min} /$ |
| E_{max} 14 | 3.13 | 31 | 0.230 | 0.101 |

2.27 Waterfront South Central Lighting / South Centre Walkway / Isolines (E, Perpendicular)



Values in Lux

Position of surface in external scene:
Marked point:
(154.399 m, 39.448 m, 0.050 m)



Grid: 128 x 32 Points

E_{av} [lx]
 E_{max} 12

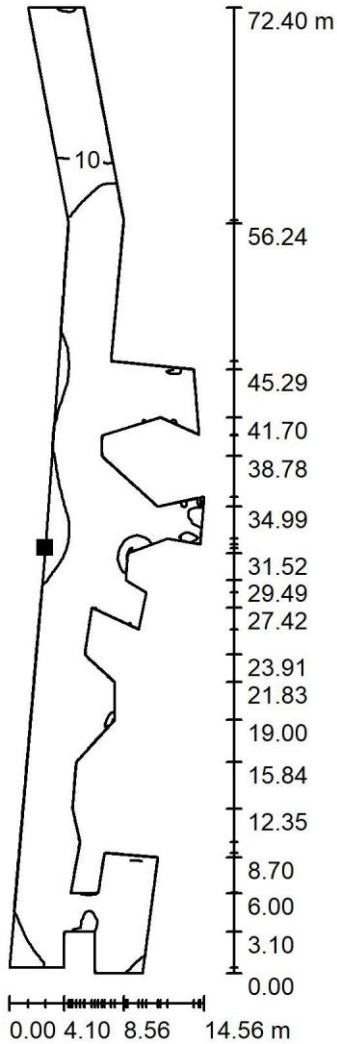
E_{min} [lx]
4.43

E_{max} [lx]
31

u_0
0.369

$E_{min} /$
0.143

2.28 Waterfront South Central Lighting / South Right Walkway / Isolines (E, Perpendicular)



Values in Lux

Position of surface in external scene:
Marked point:
(191.100 m, 67.200 m, 0.001 m)

Grid: 128 x 128 Points

| | | | |
|---------------|------------------------|----------------|------|
| E_{av} [lx] | E_{min} [lx] | E_{max} [lx] | $u0$ |
| | E_{min} / E_{max} 13 | 6.33 | 33 |
| | 0.484 | 0.193 | |