

Project : Lighting Calculation for Road 7M , H-7M @25m

มาตรฐานความสว่างไฟถนนกรมทางหลวง

เพื่อเพิ่มความปลอดภัยและให้แสงสว่างในแต่ละพื้นที่เหมาะสมกับการใช้งานจริง

กรมทางหลวงจึงได้กำหนดมาตรฐานความสว่างไฟถนนกรมทางหลวงตามตารางด้านล่างนี้

ประเภทถนน	ความเข้มแสงเฉลี่ยในแนวราบต่ำสุด		
	lux (cd / m ²)		
	พื้นที่ในเมือง	พื้นที่ชานเมือง	พื้นที่นอกเมือง
ทางหลวงพิเศษ	21.5 lux (1.43 cd/m ²)	15.0 lux (1.00 cd/m ²)	10.75 lux (0.72 cd/m ²)
ทางแยก	21.5 lux (1.43 cd/m ²)	21.5 lux (1.43 cd/m ²)	15.0 lux (1.00 cd/m ²)
ทางหลวงสายหลัก	21.5 lux (1.43 cd/m ²)	13.0 lux (0.87 cd/m ²)	9.7 lux (0.65 cd/m ²)
ทางหลวงสายรอง	13.0 lux (0.87 cd/m ²)	9.7 lux (0.65 cd/m ²)	6.5 lux (0.43 cd/m ²)
ถนนท้องถิ่น	9.7 lux (0.65 cd/m ²)	6.5 lux (0.43 cd/m ²)	2.1 lux (0.14 cd/m ²)

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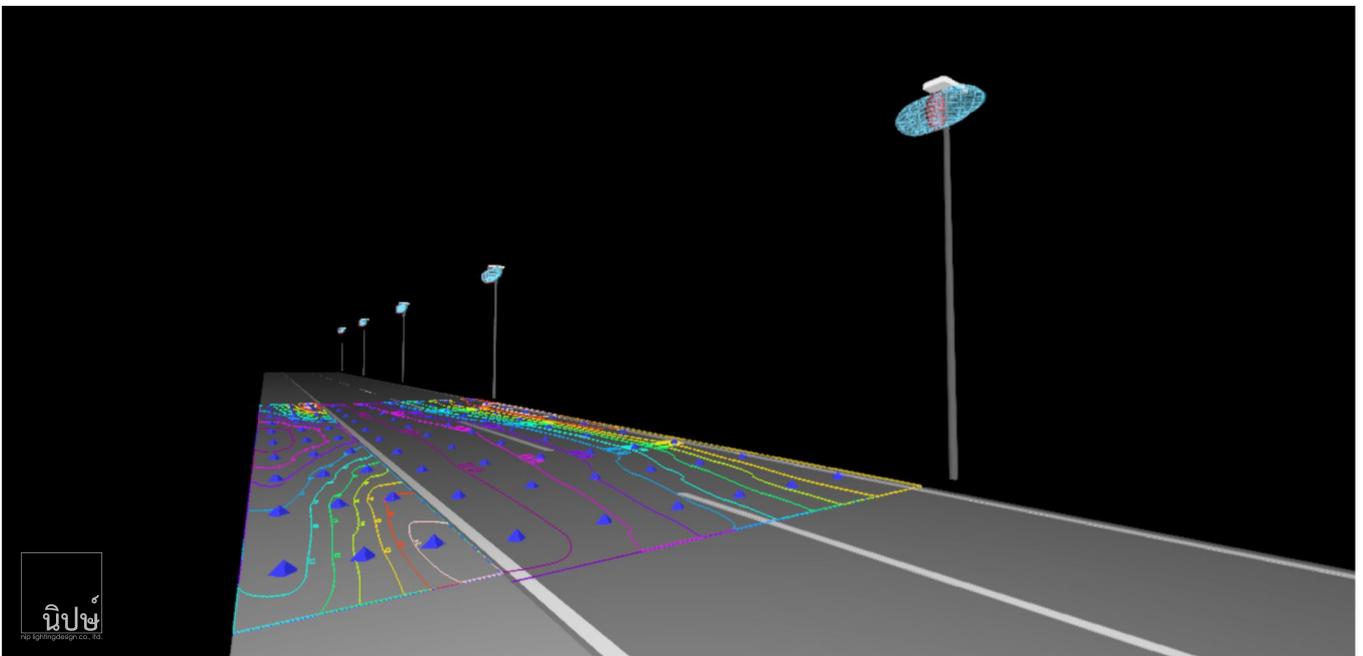
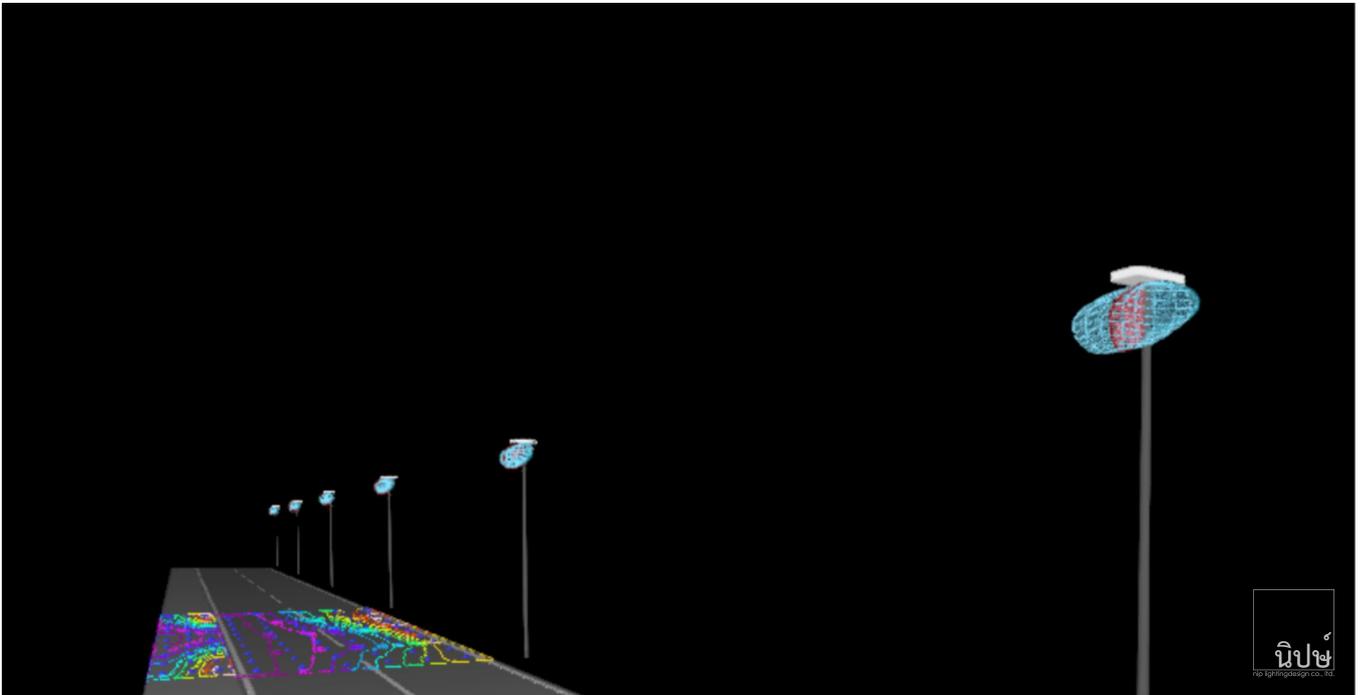
Table of Contents

Cover	1
Table of Contents	2

Street 1 · Alternative 1

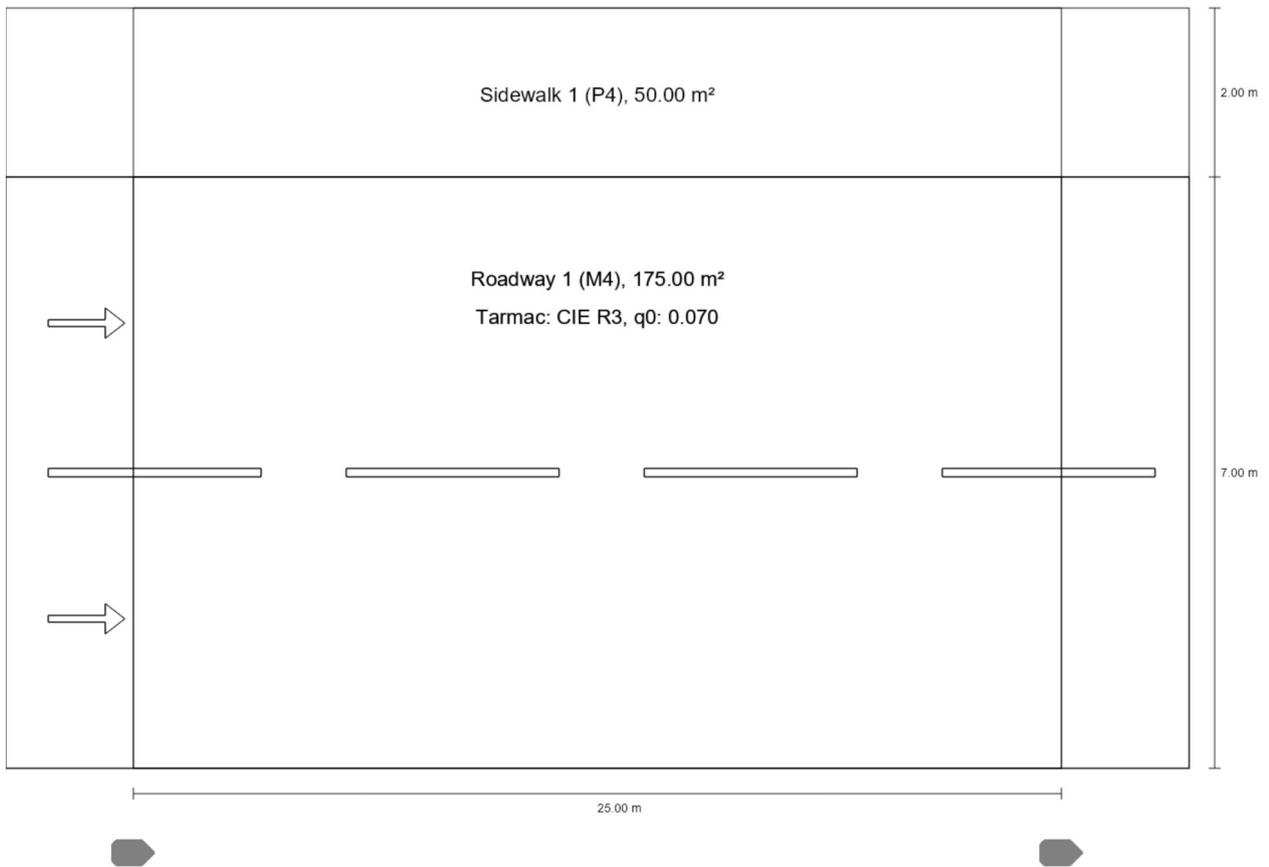
Images	3
Summary (according to EN 13201:2015)	4
Sidewalk 1 (P4)	7
Roadway 1 (M4)	9

Street 1
Images



Street 1

Summary (according to EN 13201:2015)



Street 1

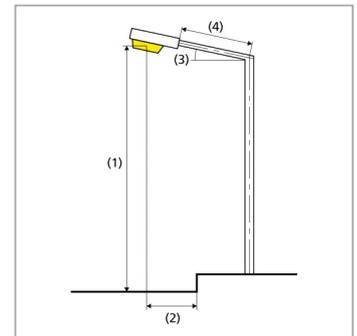
Summary (according to EN 13201:2015)



Manufacturer	-	P	60.0 W
Article No.	289.400.3.060.860.00	Φ_{Lamp}	7200 lm
Article name	LED Solar Street Light, 60W 6000K	$\Phi_{Luminaire}$	7200 lm
Fitting	1x 3 LED Module	η	100.00 %

LED Solar Street Light, 60W 6000K (single side bottom)

Pole distance	25.000 m
(1) Light spot height	7.000 m
(2) Light point overhang	-1.000 m
(3) Boom inclination	0.0°
(4) Boom length	0.000 m
Annual operating hours	4000 h: 100.0 %, 60.0 W
Wattage / route	2400.0 W/km
ULR / ULOR	0.00 / 0.00
Max. luminous intensities	≥ 70°: 301 cd/klm
Any direction forming the specified angle from the downward vertical, with the luminaire installed for use.	≥ 80°: 84.0 cd/klm ≥ 90°: 0.00 cd/klm
Luminous intensity class	G*6
The luminous intensity values in [cd/klm] for calculation of the luminous intensity class refer to the luminaire luminous flux according to EN 13201:2015.	
Glare index class	D.5
MF	0.80



Street 1

Summary (according to EN 13201:2015)

Results for valuation fields

A maintenance factor of 0.80 was used for calculating for the installation.

	Symbol	Calculated	Target	Check
Sidewalk 1 (P4)	E_{av}	6.99 lx	[5.00 - 7.50] lx	✓
	E_{min}	5.14 lx	≥ 1.00 lx	✓
Roadway 1 (M4)	L_{av}	0.75 cd/m ²	≥ 0.75 cd/m ²	✓
	U_o	0.48	≥ 0.40	✓
	U_l	0.74	≥ 0.60	✓
	TI	10 %	≤ 15 %	✓
	R_{EI}	0.79	≥ 0.30	✓

Results for energy efficiency indicators

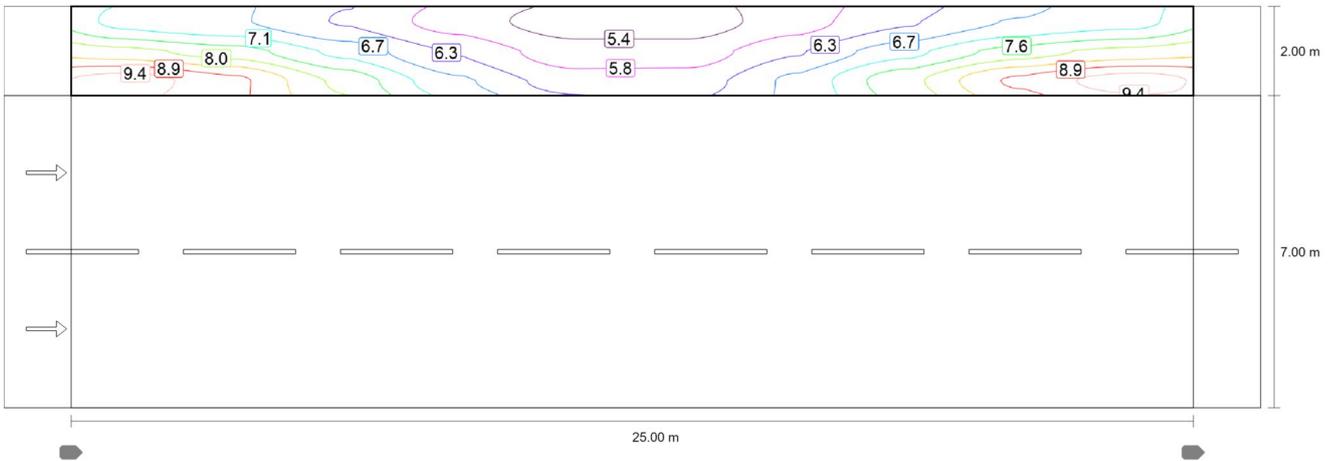
	Symbol	Calculated	Energy Consumption
Street 1	D_p	0.021 W/lx*m ²	-
LED Solar Street Light, 60W 6000K (single side bottom)	D_e	1.1 kWh/m ² yr	240.0 kWh/yr

Street 1

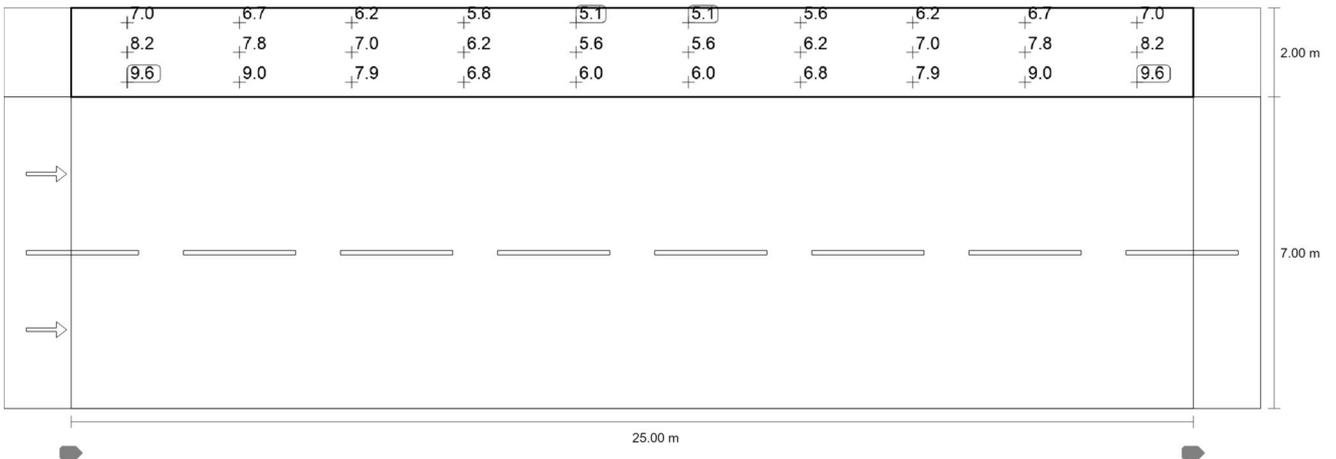
Sidewalk 1 (P4)

Results for valuation field

	Symbol	Calculated	Target	Check
Sidewalk 1 (P4)	E_{av}	6.99 lx	[5.00 - 7.50] lx	✓
	E_{min}	5.14 lx	≥ 1.00 lx	✓



Maintenance value, horizontal illuminance [lx] (Iso-illuminance curves)



Maintenance value, horizontal illuminance [lx] (Value grid)

m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
8.667	6.99	6.74	6.20	5.61	5.14	5.14	5.61	6.20	6.74	6.99
8.000	8.19	7.80	7.01	6.21	5.58	5.58	6.21	7.01	7.80	8.19

Street 1

Sidewalk 1 (P4)

m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
7.333	9.58	9.01	7.90	6.79	6.04	6.04	6.79	7.90	9.01	9.58

Maintenance value, horizontal illuminance [lx] (Value chart)

	E_{av}	E_{min}	E_{max}	$U_o (g_1)$	g_2
Maintenance value, horizontal illuminance	6.99 lx	5.14 lx	9.58 lx	0.74	0.54

Street 1

Roadway 1 (M4)

Results for valuation field

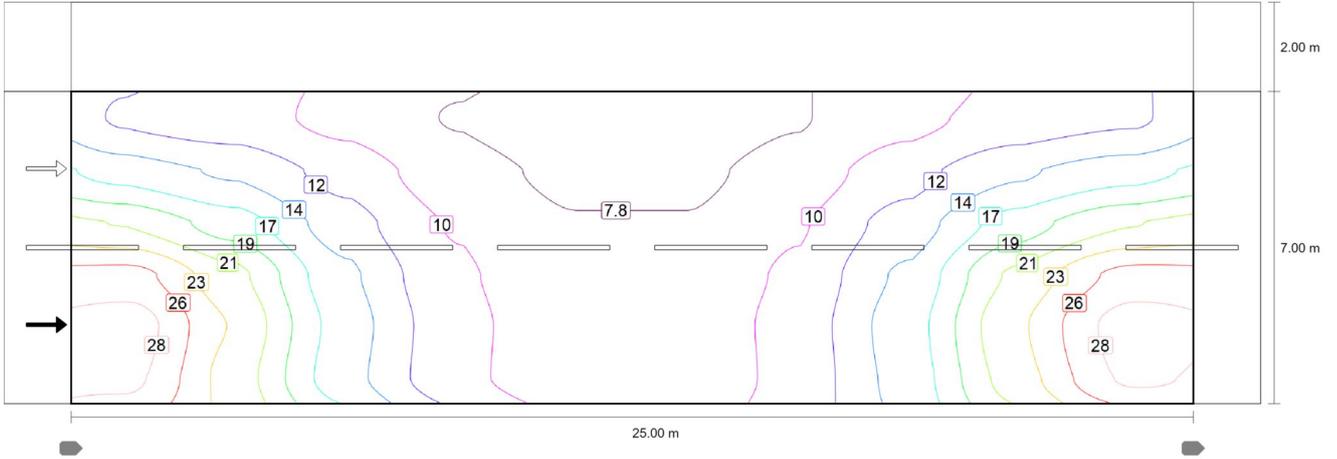
	Symbol	Calculated	Target	Check
Roadway 1 (M4)	L_{av}	0.75 cd/m ²	≥ 0.75 cd/m ²	✓
	U_o	0.48	≥ 0.40	✓
	U_l	0.74	≥ 0.60	✓
	TI	10 %	≤ 15 %	✓
	R_{El}	0.79	≥ 0.30	✓

Results for observer

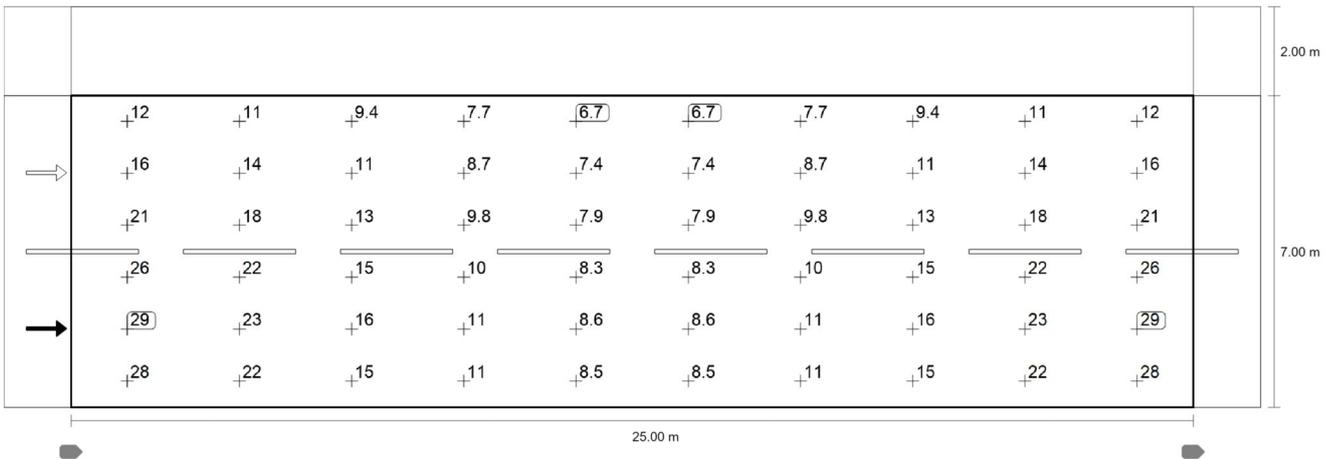
	Symbol	Calculated	Target	Check
Observer 1 Position: -60.000 m, 1.750 m, 1.500 m	L_{av}	0.75 cd/m ²	≥ 0.75 cd/m ²	✓
	U_o	0.51	≥ 0.40	✓
	U_l	0.74	≥ 0.60	✓
	TI	10 %	≤ 15 %	✓
Observer 2 Position: -60.000 m, 5.250 m, 1.500 m	L_{av}	0.83 cd/m ²	≥ 0.75 cd/m ²	✓
	U_o	0.48	≥ 0.40	✓
	U_l	0.88	≥ 0.60	✓
	TI	5 %	≤ 15 %	✓

Street 1

Roadway 1 (M4)



Maintenance value, horizontal illuminance [lx] (Iso-illuminance curves)



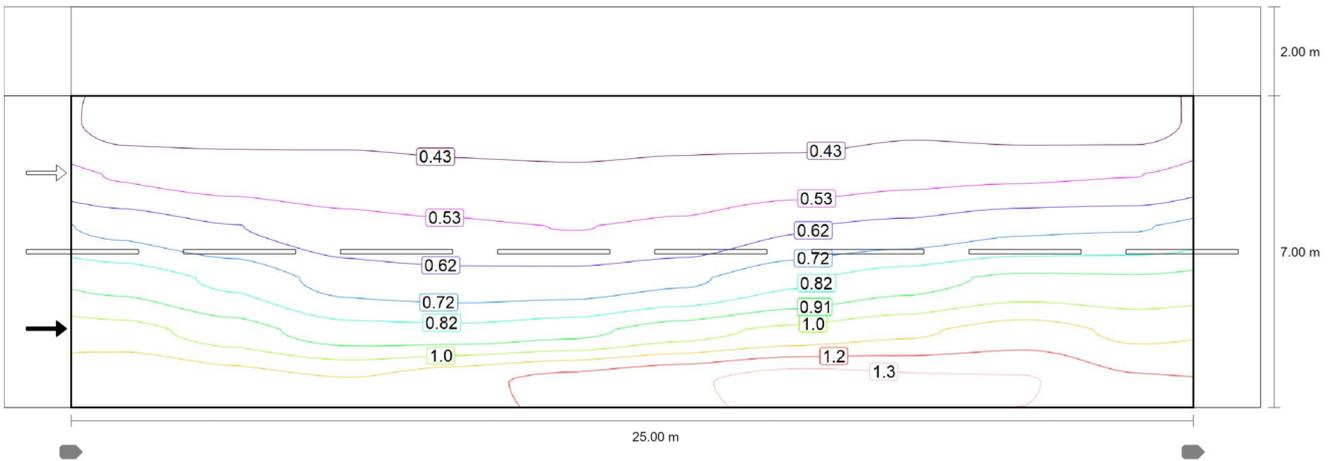
Maintenance value, horizontal illuminance [lx] (Value grid)

Street 1
Roadway 1 (M4)

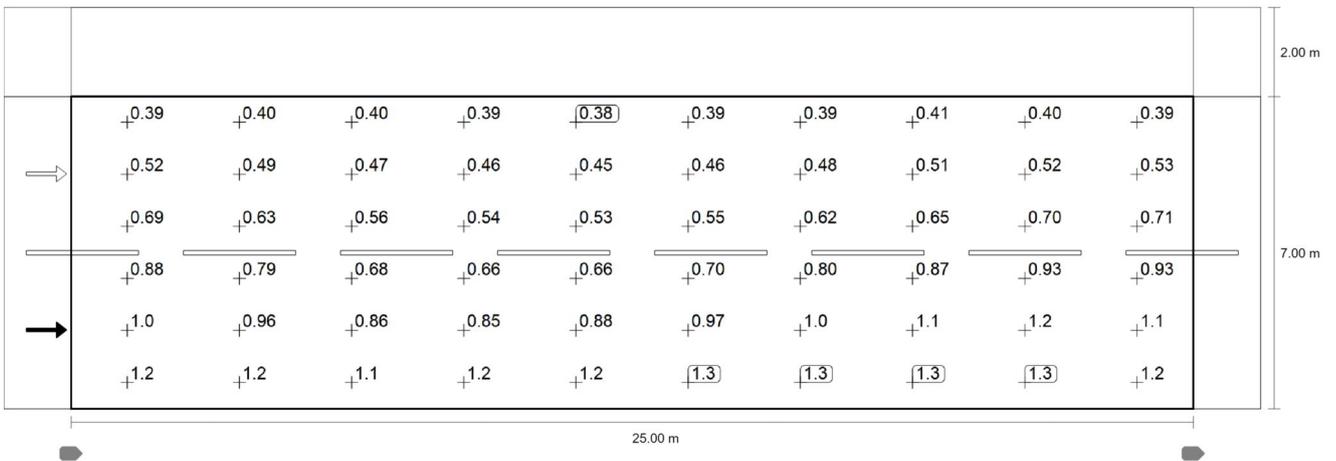
m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
6.417	11.92	11.01	9.35	7.66	6.71	6.71	7.66	9.35	11.01	11.92
5.250	15.83	14.11	11.39	8.73	7.41	7.41	8.73	11.39	14.11	15.83
4.083	20.95	17.81	13.22	9.79	7.94	7.94	9.79	13.22	17.81	20.95
2.917	26.28	21.64	14.89	10.46	8.35	8.35	10.46	14.89	21.64	26.28
1.750	28.82	23.09	15.64	10.86	8.56	8.56	10.86	15.64	23.09	28.82
0.583	28.17	22.31	15.29	10.77	8.51	8.51	10.77	15.29	22.31	28.17

Maintenance value, horizontal illuminance [lx] (Value chart)

	E_{av}	E_{min}	E_{max}	$U_o (g_1)$	g_2
Maintenance value, horizontal illuminance	14.2 lx	6.71 lx	28.8 lx	0.47	0.23



Observer 1: Maintenance value, luminance with dry roadway [cd/m^2] (Iso-illuminance curves)



Street 1

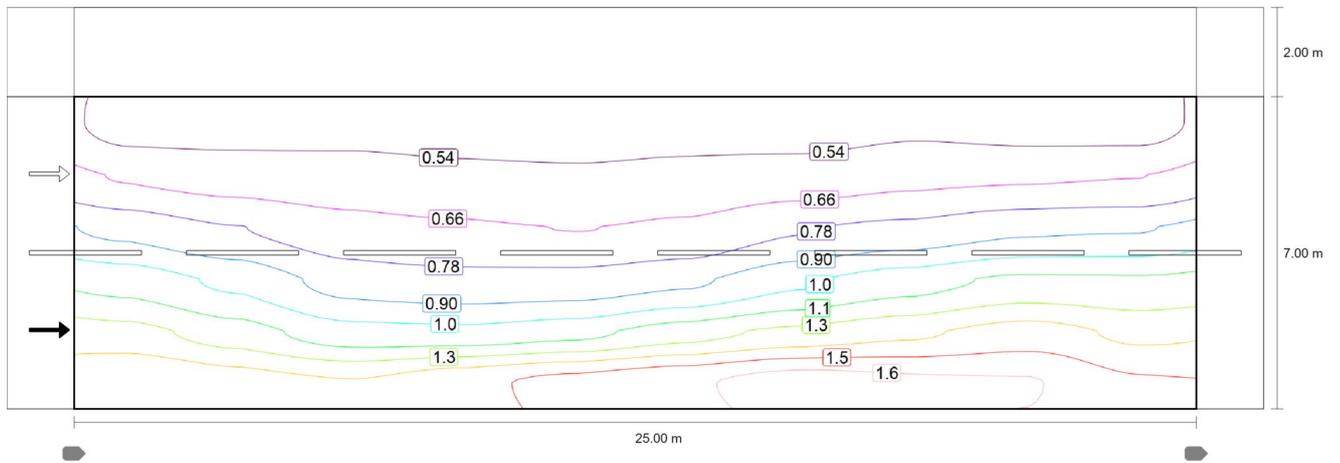
Roadway 1 (M4)

Observer 1: Maintenance value, luminance with dry roadway [cd/m²] (Value grid)

m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
6.417	0.39	0.40	0.40	0.39	0.38	0.39	0.39	0.41	0.40	0.39
5.250	0.52	0.49	0.47	0.46	0.45	0.46	0.48	0.51	0.52	0.53
4.083	0.69	0.63	0.56	0.54	0.53	0.55	0.62	0.65	0.70	0.71
2.917	0.88	0.79	0.68	0.66	0.66	0.70	0.80	0.87	0.93	0.93
1.750	1.04	0.96	0.86	0.85	0.88	0.97	1.04	1.09	1.15	1.09
0.583	1.20	1.15	1.12	1.17	1.24	1.29	1.35	1.32	1.31	1.22

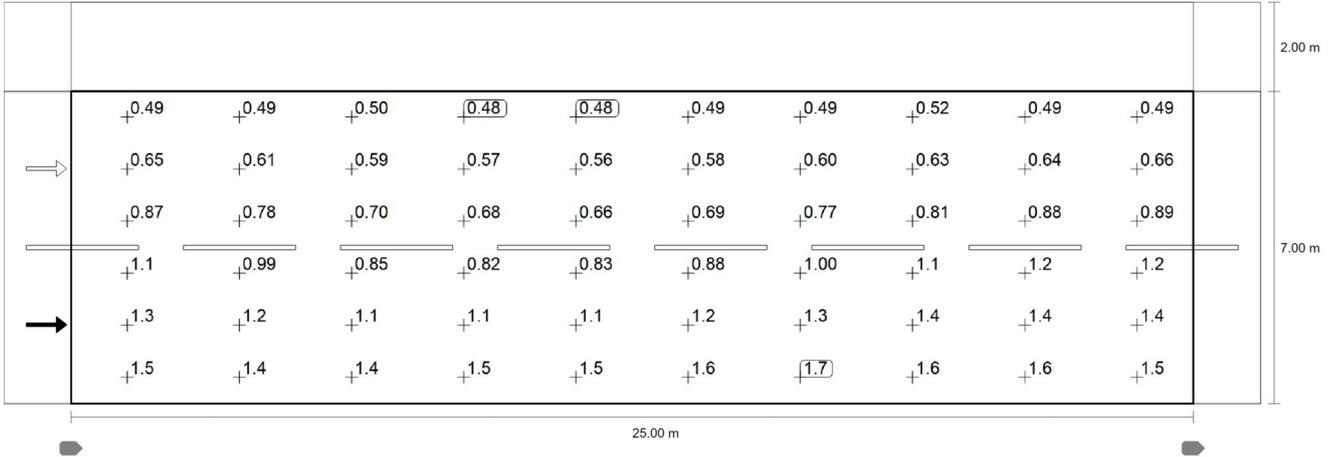
Observer 1: Maintenance value, luminance with dry roadway [cd/m²] (Value chart)

	L _{av}	L _{min}	L _{max}	U _o (g ₁)	g ₂
Observer 1: Maintenance value, luminance with dry roadway	0.75 cd/m ²	0.38 cd/m ²	1.35 cd/m ²	0.51	0.28



Observer 1: Luminance with new installation [cd/m²] (Iso-illuminance curves)

Street 1
Roadway 1 (M4)

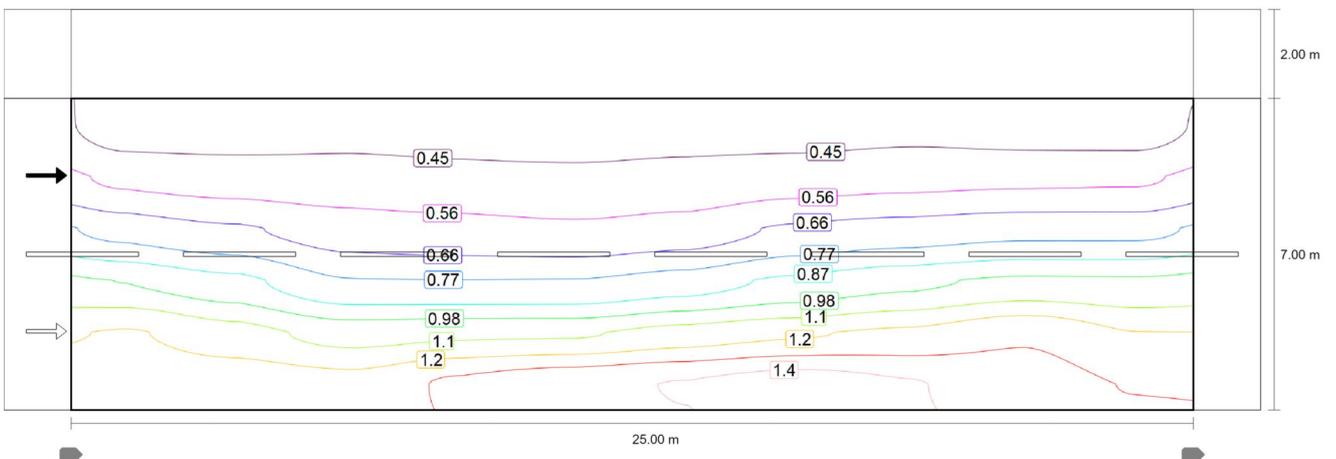


Observer 1: Luminance with new installation [cd/m²] (Value grid)

m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
6.417	0.49	0.49	0.50	0.48	0.48	0.49	0.49	0.52	0.49	0.49
5.250	0.65	0.61	0.59	0.57	0.56	0.58	0.60	0.63	0.64	0.66
4.083	0.87	0.78	0.70	0.68	0.66	0.69	0.77	0.81	0.88	0.89
2.917	1.10	0.99	0.85	0.82	0.83	0.88	1.00	1.09	1.17	1.16
1.750	1.31	1.20	1.07	1.06	1.10	1.21	1.29	1.36	1.44	1.36
0.583	1.50	1.44	1.40	1.47	1.54	1.61	1.69	1.65	1.64	1.53

Observer 1: Luminance with new installation [cd/m²] (Value chart)

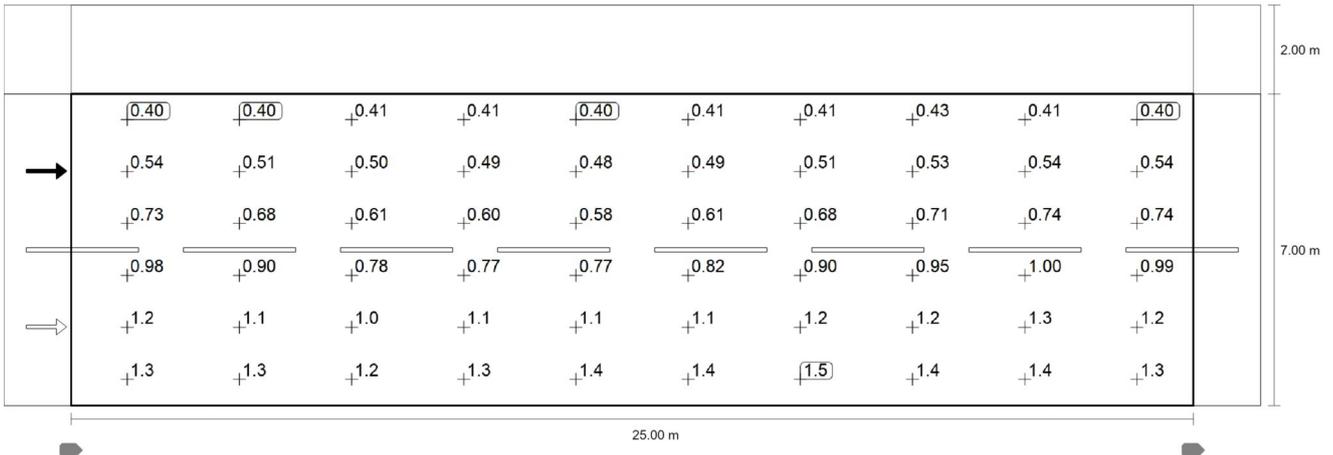
	L _{av}	L _{min}	L _{max}	U _o (g ₁)	g ₂
Observer 1: Luminance with new installation	0.94 cd/m²	0.48 cd/m²	1.69 cd/m²	0.51	0.28



Street 1

Roadway 1 (M4)

Observer 2: Maintenance value, luminance with dry roadway [cd/m²] (Iso-illuminance curves)



Observer 2: Maintenance value, luminance with dry roadway [cd/m²] (Value grid)

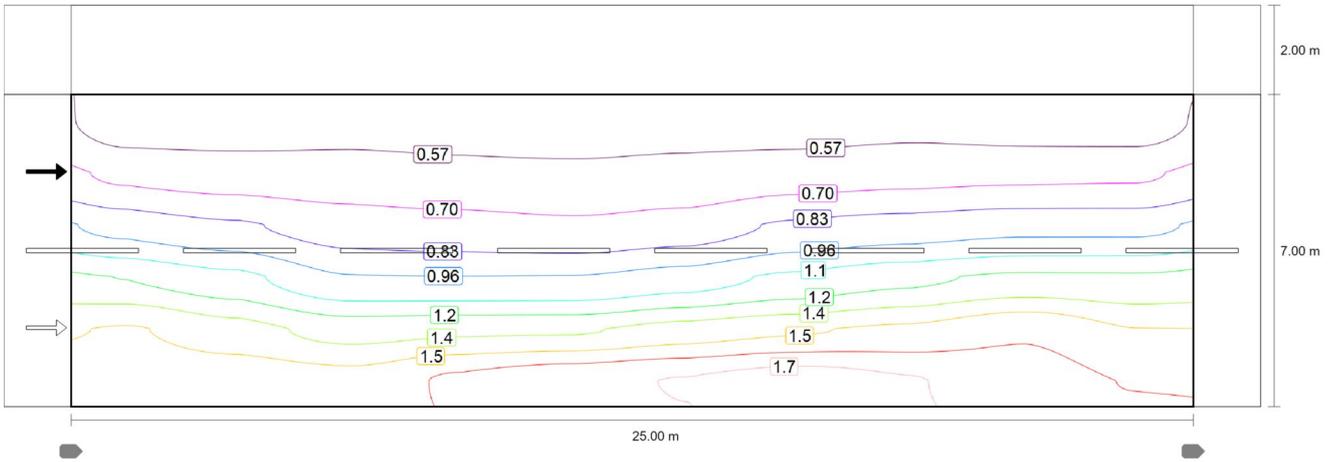
m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
6.417	0.40	0.40	0.41	0.41	0.40	0.41	0.41	0.43	0.41	0.40
5.250	0.54	0.51	0.50	0.49	0.48	0.49	0.51	0.53	0.54	0.54
4.083	0.73	0.68	0.61	0.60	0.58	0.61	0.68	0.71	0.74	0.74
2.917	0.98	0.90	0.78	0.77	0.77	0.82	0.90	0.95	1.00	0.99
1.750	1.20	1.13	1.05	1.07	1.07	1.13	1.17	1.21	1.27	1.19
0.583	1.25	1.25	1.23	1.31	1.37	1.40	1.45	1.41	1.37	1.29

Observer 2: Maintenance value, luminance with dry roadway [cd/m²] (Value chart)

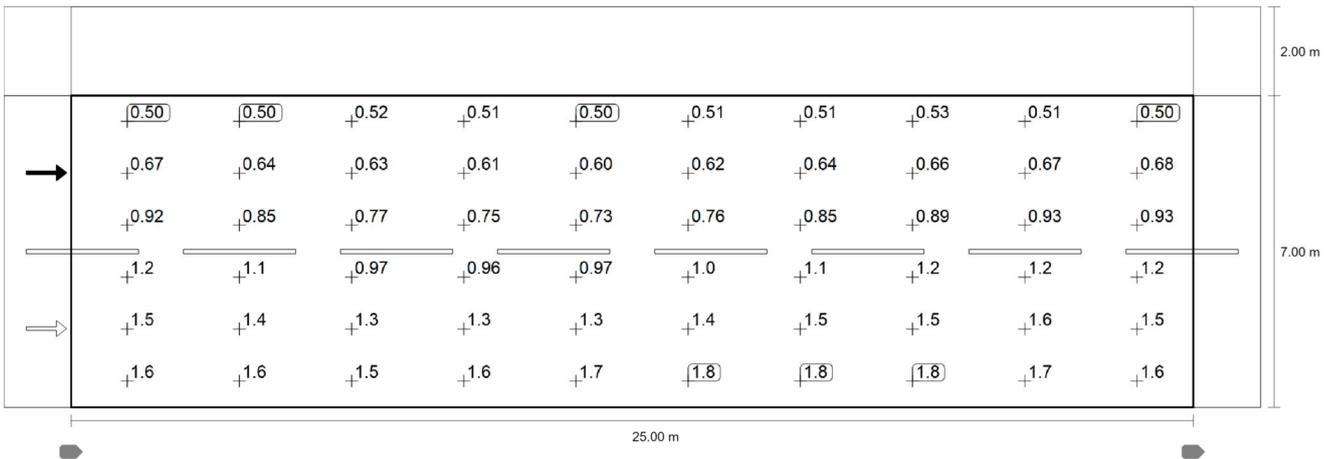
	L _{av}	L _{min}	L _{max}	U _o (g ₁)	g ₂
Observer 2: Maintenance value, luminance with dry roadway	0.83 cd/m ²	0.40 cd/m ²	1.45 cd/m ²	0.48	0.28

Street 1

Roadway 1 (M4)



Observer 2: Luminance with new installation [cd/m²] (Iso-illuminance curves)



Observer 2: Luminance with new installation [cd/m²] (Value grid)

Street 1

Roadway 1 (M4)

m	1.250	3.750	6.250	8.750	11.250	13.750	16.250	18.750	21.250	23.750
6.417	0.50	0.50	0.52	0.51	0.50	0.51	0.51	0.53	0.51	0.50
5.250	0.67	0.64	0.63	0.61	0.60	0.62	0.64	0.66	0.67	0.68
4.083	0.92	0.85	0.77	0.75	0.73	0.76	0.85	0.89	0.93	0.93
2.917	1.22	1.13	0.97	0.96	0.97	1.03	1.12	1.19	1.25	1.24
1.750	1.50	1.41	1.31	1.33	1.34	1.41	1.47	1.51	1.59	1.49
0.583	1.57	1.57	1.54	1.64	1.71	1.75	1.81	1.76	1.71	1.61

Observer 2: Luminance with new installation [cd/m²] (Value chart)

	L _{av}	L _{min}	L _{max}	U _o (g ₁)	g ₂
Observer 2: Luminance with new installation	1.03 cd/m ²	0.50 cd/m ²	1.81 cd/m ²	0.48	0.28

