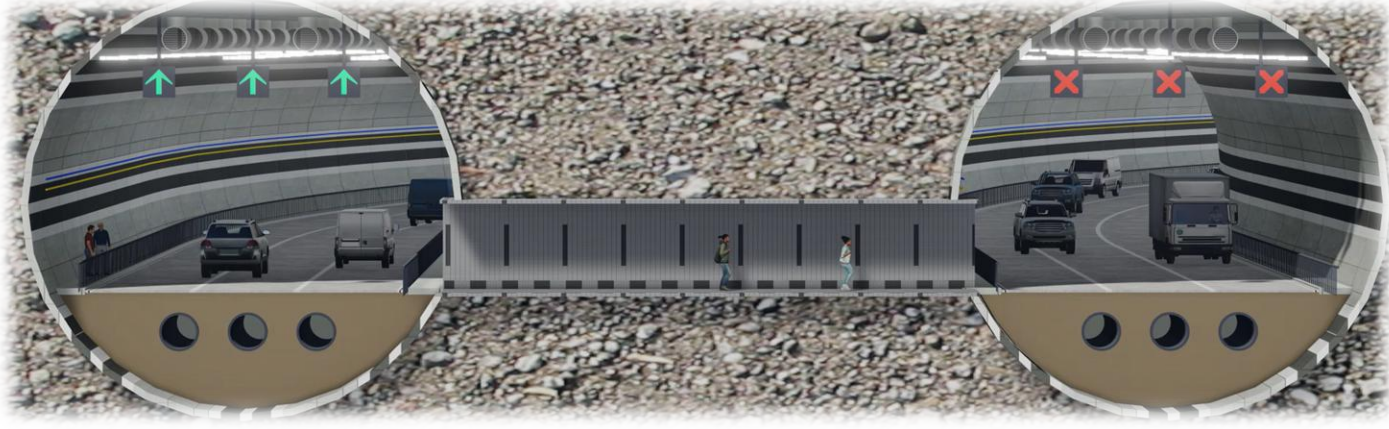
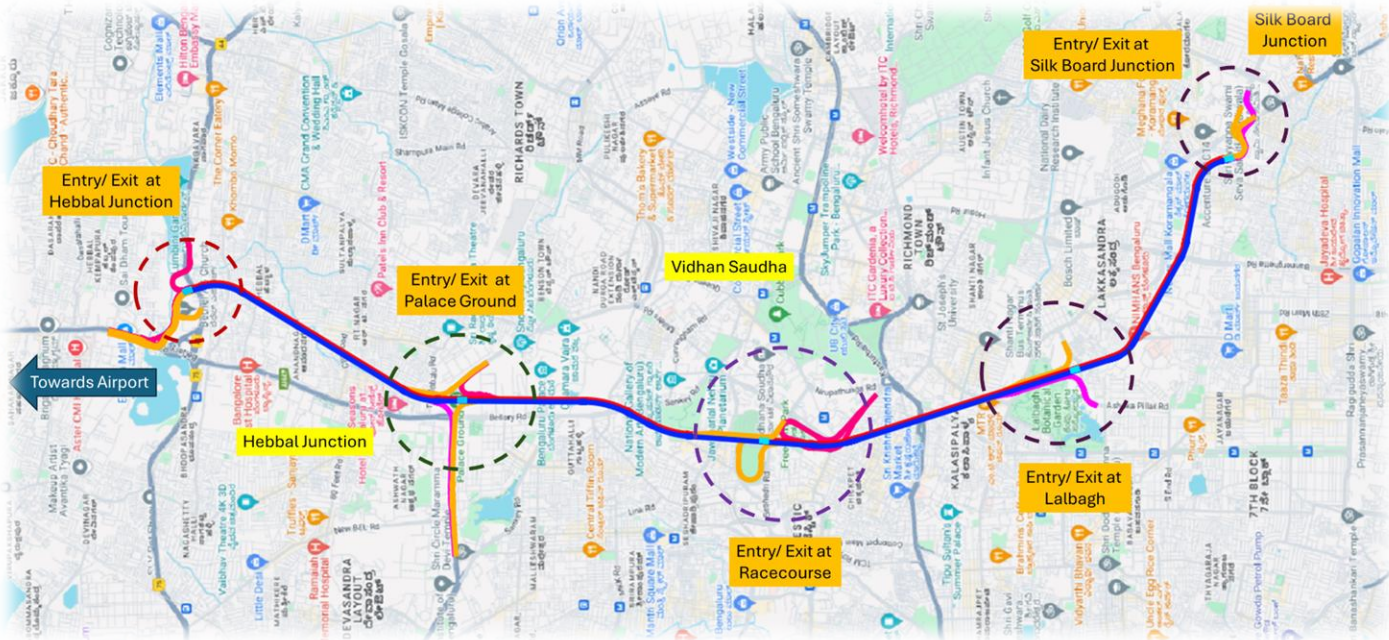




GOVERNMENT OF KARNATAKA



CONSULTANCY SERVICES FOR PREPARATION OF DPR FOR THE WORK OF CONSTRUCTION OF UNDERGROUND VEHICULAR TUNNEL FROM HEBBAL ESTEEM MALL JUNCTION TO SILK BOARD KSRP JUNCTION



FINAL DETAILED PROJECT REPORT

VOLUME - II C ELECTRICAL DESIGN REPORT

February 2025





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1. REFERENCE DOCUMENTS

1.1 Referred documents

The following documents were referred to for the development of this report.

- BBMP-Inception Report
- Fluidyn's Ventilation Design report

1.2 Codes and Standards

For codes and standards used please refer to the individual sections of this report.

2. ELECTRICAL SYSTEM

2.1 Codes and standards:

- IRC SP91-2019
- NFPA 502- 2017
- PIARC 2019R02EN
- IE Rules-1956
- CIE 88:2004 "Guide for the lighting of road tunnels and underpasses
- IS/IEC standards.
- Conditions of Supply of Electricity Of Distribution Licensees in The State of Karnataka (KERC)

2.2 EHV Power Supply

The preliminary load assessment for the underground Vehicular Tunnel from Hebbal Esteem mall junction to Silk Board KSRP junction is estimated to approximately 29.1 MW or 30.6 MVA. For this electrical power requirement KERC has classified the voltage as EHT supply ,3-phase, 50 c/s at 110KV. The excerpt of the guideline is appended below:

(f) E H T SUPPLY, 3PHASE, 50 C/S, 110KV

All installations with a contract demand above 7,500 KVA and up to and inclusive of 35,000 KVA

Therefore, the client will have to provide a 110KV power station/grid station stepped down to 33KV of capacity suitable to meet the desired demand. The location of the power station as well as the availability of this demand will have to be ascertained by the client from the supply authority. SITC and design of this works will not be considered in this study.

This DPR will therefore present only the onward distribution from 33kV voltage supply and not cover 110 KV grid station.

The general power supply of the tunnel is shown in **Figure 1**.

2.3 Load Assessment

A load assessment in **Table 1** below is carried out to present a tentative proposal for the sizing of major equipment.

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Table 1: Load Assessment

BBMP							
TENTATIVE LOAD ASSESSMENT							
Sl No	Description	Load in w/m	No of fans	Load per fans	Length of Tunnels (m) excluding ramps	Total load (in Kw)	Remarks
1	Lighting	30			46567	1397.01	30 w/m based on past projects
2	Ventilation		810	30	46567	24300	Based on distance b/w fans of 115m (with two fans at a section)- Fluidyn
3	Firefighting & FFFS					2430	Based on assumptions provided by Fluidyn
4	ELV load	6			46567	279.402	6 w/m based on past projects
5	Misc Loads	15			46567	698.505	15 w/m based on past projects
6	Total Load					29104.92	KW
7	Power factor					0.95	
8	Load in KVA					30636.75	MVA

The total power requirement for all tunnels under emergency and normal scenario is approximately 29.1 MW.

2.4 Primary, Secondary and LT Distribution

The power to the entire tunnel will be supplied vide primary distribution which will be at 33 KV, the secondary distribution at 11 KV and the LT distribution at 415V.

2.4.1 Primary Distribution

The 33KV supply from the EHV grid station will feed into the 33/11 KV primary substations which are being proposed at each ventilation station. Independent parallel feeders of 33KV per primary substation will be adopted which will increase the reliability of supply. The maximum capacity of power to be considered for the feeders is between 5MVA to 10 MVA.

Each of the primary substation will cover the following spans of tunnel:

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Table 2: Primary Substation covering spans of Tunnel

33/11 KV Sub station	Structure/Name	Span of Sub-station(in m)	
		South bound Tube-Tube-01	North bound Tube-Tube-02
S/Sn-1	Entry Ramp-02	674.0	
	Exit Ramp-07		320.0
	Exit Ramp-08		150.0
	Cut and Cover	942.0	930.0
	TBM Tunnel-1	1779.0	1785.0
S/Sn-2	TBM Tunne-1	1779.0	1785.0
	Exit Ramp-5 (PG Exit)	940.0	
	Entry Ramp-4 (CV Raman)		1685.0
	TBM Tunnel-2	1812.5	1812.5
	Entry Ramp-03 (PG Entry)	701.0	
	Exit Ramp-06 (CV Raman)		1682.00
S/Sn-3	TBM Tunnel-2	1812.5	1812.5
	TBM Tunnel-3	1900	1900
	Exit Ramp-4	1140.000	
	Exit Ramp-3		1465.000
	Entry Ramp-05		1197.000
	Entry Ramp-06	1621.000	
S/Sn-4	TBM Tunnel-3	1900	1900
	TBM Tunnel-4	1633	1633
	Entry Ramp-07 LB Entry		1286
	Exit Ramp-02 (LB Exit)	1081.000	
S/Sn-5	TBM Tunnel-4	1633	1633
	Tube-2 Entry		480
	Entry Ramp-08		654
	Tube-01 Exit	654	
	Exit Ramp-01	455	
Total Tunnel Length excl. Ramps and Retrieval shaft		22457.00	24110.00

Based on the load assessment in **Table 1** and the span of the tunnel covered under each substation in **Table 2** the possible transformer configurations for primary substation are as given below in **Table 3**:





Table 3: Primary Substation capacity

LOAD CALCULATION												
Electrical Assumptions									TRANSFORMER			
33/11 KV Sub station	Structure/Name	Span of Sub- station(in m)		Ventilation load per S/sn	Lighting @ 30W/m(in KW)	ELV Load @ 6 W/m(in KW)	Misc Loads @ 15W/m(in KW)	FFFS	Total Load/S/sn in KW	Load in KVA @ 0.95 pf	%ge loading of Transformer @90%	Selected 33/11KV Transformer
S/Sn-1	Entry Ramp-02	674.0		3433.04	197.40	39.48	98.70	500.00	4268.62	4493.29	4992.54	1 x 5 MVA
	Exit Ramp-07		320.0									
	Exit Ramp-08		150.0									
	Cut and Cover	942.0	930.0									
	TBM Tunnel-1	1779.0	1785.0									
S/Sn-2	TBM Tunne-1	1779.0	1785.0	6363.65	365.91	73.18	182.96	500.00	7485.70	7879.68	8755.20	1 x 10 MVA
	Exit Ramp-5 (PG Exit)	940.0										
	Entry Ramp-4 (CV Raman)		1685.0									
	TBM Tunnel-2	1812.5	1812.5									
	Entry Ramp-03 (PG Entry)	701.0										
	Exit Ramp-06 (CV Raman)		1682.00									
S/Sn-3	TBM Tunnel-2	1812.5	1812.5	6703.30	385.44	77.09	192.72	500.00	7858.55	8272.16	9191.29	1 x 10 MVA
	TBM Tunnel-3	1900	1900									
	Exit Ramp-4	1140.000										
	Exit Ramp-3		1465.000									
	Entry Ramp-05		1197.000									
	Entry Ramp-06	1621.000										





LOAD CALCULATION												
Electrical Assumptions										TRANSFORMER		
33/11 KV Sub station	Structure/Name	Span of Sub- station(in m)		Ventilation load per S/sn	Lighting @ 30W/m(in KW)	ELV Load @ 6 W/m(in KW)	Misc Loads @ 15W/m(in KW)	FFFS	Total Load/S/sn in KW	Load in KVA @ 0.95 pf	%ge loading of Transformer @90%	Selected 33/11KV Transformer
S/Sn-4	TBM Tunnel-3	1900	1900	4921.57	282.99	56.60	141.50	500.00	5902.65	6213.31	6903.68	1 x 8 MVA
	TBM Tunnel-4	1633	1633									
	Entry Ramp-07 LB Entry		1286									
	Exit Ramp-02 (LB Exit)	1081.000										
S/Sn-5	TBM Tunnel-4	1633	1633	2874.26	165.27	33.05	82.64	500.00	3655.22	3847.60	4275.11	1 x 5 MVA
	Tube-2 Entry		480									
	Entry Ramp-08		654									
	Tube-01 Exit	654										
	Exit Ramp-01	455										

A typical 33KV Grid station layout is shown in **Figure 5**.

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2.4.1.1 Power Transformer

The power transformer will have the minimum stipulated parameters as enumerated below:

Table 4: Power Transformer

Voltage (primary side)	33 kV
Voltage (secondary side)	11 kV
Nominal Frequency	50 Hz
Cooling	ONAN
Tapping	16 steps (+5% to -15% @ 1.25%)
Core design	Boltless
Oil	Natural ester vegetable oil as per IEC 62770, IS-1180
Winding insulation	Thermally upgraded paper (Insulation class-A / conductor Inter turn insulation class-E)
Vector Group	Dyn11
Location	Ventilation station
Primary connection	Totally insulated plug-in connector
Secondary connection	Connection safe to touch with connecting lug and insulating cover

2.4.1.2 33KV Gas Insulated Switchgears

The insulated, medium voltage switch gears shall be designed to equip indoor HV/MV, MV/MV or MV/LV Substations. The switchgear shall meet the criteria for indoor metal enclosed metallic partitioning, LSC2 accessibility GIS switchgear and control-gear for rated voltages above 1kV and up to and including 52kV, in compliance with the IEC 62271-200. In principle, the arrangement shall follow the latest modern engineering practice, to ensure optimum continuity and reliability of supply, as well as the safety of the operating staff. Design shall consider minimum space requirements, no maintenance in medium voltage part and minimized maintenance in the mechanisms. The switchgear shall be of modular design and minimized dimension gas insulated type (SF6).

The switchgear shall be designed for continuous operation under all system operating conditions including sudden change of load and voltage and short circuits within its ratings. The equipment shall be designed to withstand normal operating voltage even if the isolating gas pressure decreases to atmospheric pressure. All switchgears and material provided with them shall be the standard products of the manufacturer, which are regularly designed, manufactured, tested and serviced for at least 15 years.

➤ System Parameters:

Rated Voltage (System Highest Voltage)	36kV
Rated Power frequency withstand voltage	70kV
Rated lightning impulse withstand voltage	170kV
Frequency	50Hz
No. of phases	3
System fault current	25KA for 3 secs

2.4.1.3 11KV Gas Insulated Switchgears

A metal-enclosed, gas-insulated switchgear according to the currently applicable standards and provisions, prefabricated and type-tested, as single busbar system with stationary switching devices is to be implemented.

The switchgear shall consist of modules, to be aligned side by side, in order to minimize the number of components subject to high electrical loads. The individual modules correspond to the single line, and the function units described below. The modules must also be connected so that the entire busbar assembly is completely enclosed in SF6 gas atmosphere. Possible extension: on both sides. The IEC classes of the applicable standards and regulations must be specified in the offer and proved by test records.

2.4.2 Secondary Distribution

The secondary distribution network is based on the following parameters:

- 1) The Substation capacity should be less than or equal to 2500 KVA as Dry type transformers in 11/0.433





KV are not available above 2500 KVA.

- 2) The maximum span of coverage for each secondary substation should be kept at 2000m i.e. 1000 metres on either side so that the LT voltage drop is within the permissible limits of $\pm 5\%$.
- 3) The maximum capacity of the 11KV feeders should not exceed 5000 KVA.

The 11KV supply from the primary substation will serve the secondary substations in a ring arrangement i.e. each 11 KV HT RMU's in the secondary substation is fed with two feeders but in different paths such that in the event of a fault in any section of the feeder, the continuity of the supply is ensured from the alternative path. Refer Fig 1.

The proposed numbers of secondary substations covered by each primary substation are listed below:

Table 5: No. of Secondary substations

Primary Substation (33/11KV)	No of secondary substations (11/0.433 KV)
Substation-1	2
Substation-2	6
Substation-3	4
Substation-4	3
Substation-5	2

2.4.2.1 Secondary Substations (11/0.433KV)

Based on the placement of jet fans and to minimize the voltage drop within $\pm 5\%$,the substations are tentatively proposed at the following locations (Refer Table 5 and Figure-4) :

Table 6: Location of Secondary substations

Substation No.	Proposed chainages/Location	Remarks
S/Sn-9	1342	In Ventilation station-1 (near Hebbal)
S/Sn-1	2331	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-2	4110	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-3	6006	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-11	5150	In Niche at Exit Ramp-06(CV Raman)
S/Sn-12	5450	In Niche at Entry Ramp-03(PG Entry Tunnel)
S/Sn-4	7819	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-5	9775	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-13	9250	In Niche at Hudson circle/KG Entry
S/Sn-14	7975	In Niche at Freedom Park/Sesadri Exit
S/Sn-15	4700	In Niche at Entry Ramp-04(CV Raman)
S/Sn-6	11675	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-7	13541	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-16	11725	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-17	4350	In Niche at Exit Ramp-05(PG Exit)
S/Sn-8	15114	Inside tunnel in a dedicated section connecting two tubes of x-section equivalent to x-section of vehicular cross passage
S/Sn-10	16091	In Ventilation station-5 (near SEBJ)





Each of these substations will be interconnected in a ring arrangement from their respective primary substations to ensure continuity of supply in the event of fault in any section of the feeder (Refer Figure 1). The substations will comprise of a high voltage room and two transformer rooms. Two transformers in each substation will guarantee power supply in case of a failure or during maintenance works. Each transformer will be able to supply the whole substation and all systems which are supplied by the substation.

A typical substation layout inside the tunnel and in niches is shown in **Figure 2 and Figure 3** .

The substations in the tunnel will receive power via an 11 kV cable.

Based on the load assessment in **Table 1** and **Table 3**, the possible distribution transformer configurations at the proposed locations have been described below in

.

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Table 7: Secondary substation capacity

Tunnel Specifics				Electrical Assumption						DISTRIBUTION TRANSFORMER		
33/11 KV Sub station	Structure/Name	Span of Sub- station(in m)		11/0.433KV Sub Station	Ventilation load per S/sn	Lighting @ 30W/m(in KW)	ELV Load @ 6 W/m(in KW)	Misc Loads @ 15W/m(in KW)	Total Load/S/sn in KW	Load in KVA @ 0.95 pf	%ge loading of Transformer @90%	Selected 11/0.433KV Transformer
S/Sn-1	Entry Ramp-02	674.0		S/Sn 9	1573.6	90.5	18.1	45.2	1727.4	1818.3	2020.33	2 x 2000 KVA
	Exit Ramp-07		320.0									
	Exit Ramp-08		150.0									
	Cut and Cover	942.0	930.0									
	TBM Tunnel-1	1779.0	1785.0	S/Sn-1	1859.5	106.9	21.4	53.5	2041.2	2148.7	2387.42	2 x 2500 KVA
S/Sn-2	TBM Tunnel-1	1779.0	1785.0	S/Sn-2	1859.5	106.9	21.4	53.5	2041.2	2148.7	2387.42	2 x 2500 KVA
	Exit Ramp-5 (PG Exit)	940.0		S/Sn-17	490.4	28.2	5.6	14.1	538.4	566.7	629.68	2x630 KVA
	Entry Ramp-4 (CV Raman)		1685.0	S/Sn-15	879.1	50.6	10.1	25.3	965.1	1015.9	1128.73	2x 1250 KVA
	TBM Tunnel-2	1812.5	1812.5	S/Sn-3	1891.3	108.8	21.8	54.4	2076.2	2185.5	2428.28	2 x 2500 KVA
	Entry Ramp-03 (PG Entry)	701.0		S/Sn-12	365.7	21.0	4.2	10.5	401.5	422.6	469.58	2x630 KVA
	Exit Ramp-06 (CV Raman)		1682.00	S/Sn-11	877.6	50.5	10.1	25.2	963.3	1014.0	1126.72	2x 1250 KVA
S/Sn-3	TBM Tunnel-2	1812.5	1812.5	S/Sn-4	1891.3	108.8	21.8	54.4	2076.2	2185.5	2428.28	2 x 2500 KVA
	TBM Tunnel-3	1900	1900	S/Sn-5	1982.6	114.0	22.8	57.0	2176.4	2291.0	2545.51	2 x 2500 KVA
	Exit Ramp-4	1140.000		S/Sn-14	1359.130	78.15	15.63	39.08	1491.99	1570.51	1745.01	2 x 2000 KVA
	Exit Ramp-3		1465.000									
	Entry Ramp-05		1197.000	S/Sn-13	1470.261	84.54	16.91	42.27	1613.98	1698.93	1887.69	2 x 2000 KVA
	Entry Ramp-06	1621.000										





Tunnel Specifics				Electrical Assumption						DISTRIBUTION TRANSFORMER		
33/11 KV Sub station	Structure/Name	Span of Sub- station(in m)		11/0.433KV Sub Station	Ventilation load per S/sn	Lighting @ 30W/m(in KW)	ELV Load @ 6 W/m(in KW)	Misc Loads @ 15W/m(in KW)	Total Load/S/sn in KW	Load in KVA @ 0.95 pf	%ge loading of Transformer @90%	Selected 11/0.433KV Transformer
S/Sn-4	TBM Tunnel-3	1900	1900	S/Sn-6	1982.6	114.0	22.8	57.0	2176.4	2291.0	2545.51	2 x 2500 KVA
	TBM Tunnel-4	1633	1633	S/Sn-7	1704.0	98.0	19.6	49.0	1870.6	1969.0	2187.80	2 x 2500 KVA
	Entry Ramp-07 LB Entry		1286	S/Sn-16	1234.957	71.01	14.202	35.505	1355.674	1427.025	1585.583	2x 1600 KVA
	Exit Ramp-02 (LB Exit)	1081.000										
S/Sn-5	TBM Tunnel-4	1633	1633	S/Sn-8	1704.0	98.0	19.6	49.0	1870.6	1969.0	2187.80	2 x 2500 KVA
	Tube-2 Entry		480	S/Sn-10	1170.3	67.29	13.458	33.645	1284.7	1352.267	1502.519	2x1600 KVA
	Entry Ramp-08		654									
	Tube-01 Exit	654										
	Exit Ramp-01	455										

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The Main equipment within the substation will generally comprise of the following:

Table 8: Main equipment

Sl No	Description of item	Unit	Qty
1	11 kV HT RMU (2 nos Switch disconnector + 1 no Outgoing VCB for Transformer feeder)	each	1
2	11/0.433 kV Distribution Transformer	each	2
3	MDB Panel	each	1
4	Lighting Panel	each	1
5	Ventilation Panel	each	1
6	APFCR Panel	each	1
7	UPS	each	2
8	UPS Outgoing Panel	each	2

The Distribution transformer will have the minimum parameters as enumerated below:

Table 9: Distribution

Voltage (primary side):	11 kV
Voltage (secondary side):	0.433 kV
Nominal frequency:	50 Hz
Cooling:	ANAN
Tapping range:	+5 %, +2.5 %, $\pm$ 0 %, -2.5 %, -5 %
Vector Group:	Dyn11
Location:	At Niches , along cross passage in the tunnel
Primary connection:	Totally insulated plug-in connector
Secondary connection:	Connection safe to touch with connecting lug and insulating cover

2.4.2.2 11kV HT RMU

The 11 KV RMU switchgear shall be provided with all required metering equipment, CBs and load-break Isolators/switches, including CTs, VTs, kWh meters, cabinets, fuse gear and switchgear as required.

Under normal operating conditions, the two RMUs are provided. The RMU shall have one outgoing dedicated for 1 transformer.

The RMU shall be provided with all necessary CBs and accessories, controls and interlocking facilities and equipment to allow automatic control and operation of circuit breakers and switches to ensure automatic restoration of supply if one of the incoming feeders should fail.

2.4.2.3 HT Cables

HT Underground cables of Voltage range 33 kV and 11kV will be used in the project. 33kV cables are planned as source supply to the Primary substation. 11 KV underground cables are planned for internal substations of tunnel. The cables are XLPE insulated, Aluminium conductor, flat armored with flame proof insulation.

2.4.3 LT Power Distribution

The general power supply of the 433 / 230 Volt-level to the different equipment inside the tunnel occurs from the main power supply (Niche substation / inside substation) to the E & M Niches/ as applicable and then further to the ultimate equipments.

All power and control units shall be installed into distribution panels, all different voltages (e.g., main power, UPS power, safety extra-low voltages, different control units and so on) shall be placed in separated or comprehensive different distribution panels.

Grounding and protection cables shall be colored yellow green as per standards compliance.

The inlet of the cables into the distributors generally shall be made from bottom up (raised floor) with a degree of protection of IP 54 in EM Niches and IP 43 in the Service Buildings / control room.





The Niches also shall have cable inlets on top. This is necessary to lead the cables from the Niche to the cable tray along the tunnel wall.

Switches, push buttons, pilot lamps and measuring instruments shall be installed into the distribution panels' front doors.

All electrical equipment, inside distribution panels / boards shall be labelled. Also, the distribution panels themselves shall be labelled with a combination of letters and numbers, which shall be engraved into an aluminium-plate. Equipment inside the tunnel, measuring instruments, etc. shall be labelled with stainless steel-boards.

Each distribution panel shall be provided with a pocket for the drawings, this pocket shall be fixed on the inside of the distribution panels' door (fixed with screws or rivets, the use of glue is not allowed). All distribution panels shall be grounded.

Distribution panels shall have surge arrestors to protect all facilities from voltages higher than 433 V. All distribution panels, situated in the main tunnel tube, as well as in the Accesses (tunnel and shaft) shall be equipped with anti-condensation heating.

Circuit breakers and fuses shall be discriminating to each other facilities (discriminating ratio) in direction of the power / current flow.

The Main LV boards shall be modular, extendable and shall have maintenance friendly construction. It shall be of metal clad sheet steel enclosed cubicle, fully compartmentalized, floor mounting type suitable for indoor installations.

All LT outgoings will be Cu. Conductor, FRLS, armored, PVC insulated, XLPE cables.

A capacitor bank of suitable capacity for maintaining the power factor of 0.95 at the 433 V bus shall be provided.

2.4.3.1 LT Cables

Following cables will be used:

- Cabling for jet fans, tunnel lighting and safety equipment will be Fire resistant cables capable of withstanding 950 deg C for 3 hours (CWZ specification).
- All other cables entering the open space of the tunnel will be Low Smoke Zero Halogen (LSZH) withstanding 250 deg C for 3 hours.
- Cables, which are laid outside the tunnel, are of FRLS Cross Linked Polyethylene (FRLS-XLPE).

Each electrical circuit will have a separate cable.

Only cables with the same voltage will be installed within one conduit/duct.

Accessibility of the cables is given by cable pits and recesses.

2.4.3.2 Cables outside the tunnels

Outside the tunnel, extreme geological movement may be experienced between the Portals and the facilities building. Therefore, all cables shall be laid in Pre-cast concrete troughs/trenches conforming to the standards of the supply authority.

The troughs shall be composed of reinforced cement mortar.

The trench system shall consist of precast glass reinforced concrete, one piece channel sections, and removable cover sections assembled to form a completely enclosed trench on a 200mm sand bed. The trench shall be 800mm deep overall (including cover), with an interior clear width cross 600 mm. Its design shall be such that the channel is self-supporting and can be set above grade if required.

The one-piece channel designed trench system shall be furnished in standard 1500mm or 2000mm lengths.

The precast trench covers shall be furnished in sections of the same material as the trough, and each shall have slots or internal lugs for lifting tools.





Provision shall be made to allow for the inclusion of 33KV and 11kV SWA cables and segregation suitable for inclusion of both copper and optic control and communications cables within the same trough.

All cable covers will bear on both sides the inscription "DANGER - ELECTRIC CABLES".

2.4.3.3 Cables inside the tunnels

In the Main Tunnel the LT Power, Control and ELV (Extra Low voltage) cables shall be laid on cable trays mounted on both sides of the tunnel wall.

The 33KV and 11 KV HT cables on the other hand will be carried in the utility tunnel under the road. From the utility tunnel cable trenches/ducts to carry 11KV cables would be laid up to the secondary substations located at cross passage and niches. 33KV and 11KV cables to the ventilation station from the utility tunnel or vice versa shall be routed vide a vertical shaft running along the tunnel wall and then carried up to the utility tunnel through cable ducts/trenches. Cable pull pits shall be provided at regular intervals in the utility tunnel.

The technical parameters of 1.1kV XLPE cables shall be as follows:

Table 10: Technical Parameters

i.	Cable Type	A2XWY/ 2XWY
ii.	No. of Cores	3/3.5/4
iii.	Voltage Level	1.1kV
iv.	System Grounding	Solidly Grounded
v.	Nominal System voltage	400V $\pm$ 10%
vi.	Nominal System Frequency	50Hz $\pm$ 3%
vii.	Maximum conductor temperature at rated current	90oC
viii.	Maximum conductor temperature at Short-circuit	250oC
ix.	Conductor	
	Conductor Material	Electrolytic grade Copper, Purity > 99.97%
	Conductor type	Stranded with number of strands as per IS 8130 (Part-I) 1984
x.	Insulating material	Cross-Linked-Polyethylene (XLPE) Compound
xi.	Core Identification Strips	Red, Yellow, Blue & Black (for neutral)
xii.	Material of Inner Sheath	FRLS, PVC ST-2 Compound
xiii.	Armour	Single layer of Galvanized Steel Round Wire according to IS-3975
xiv.	Outer Sheath	FRLS, PVC ST-2 Compound according to IS-5831

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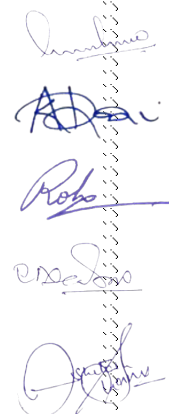


Figure 1 : General Power Supply Scheme

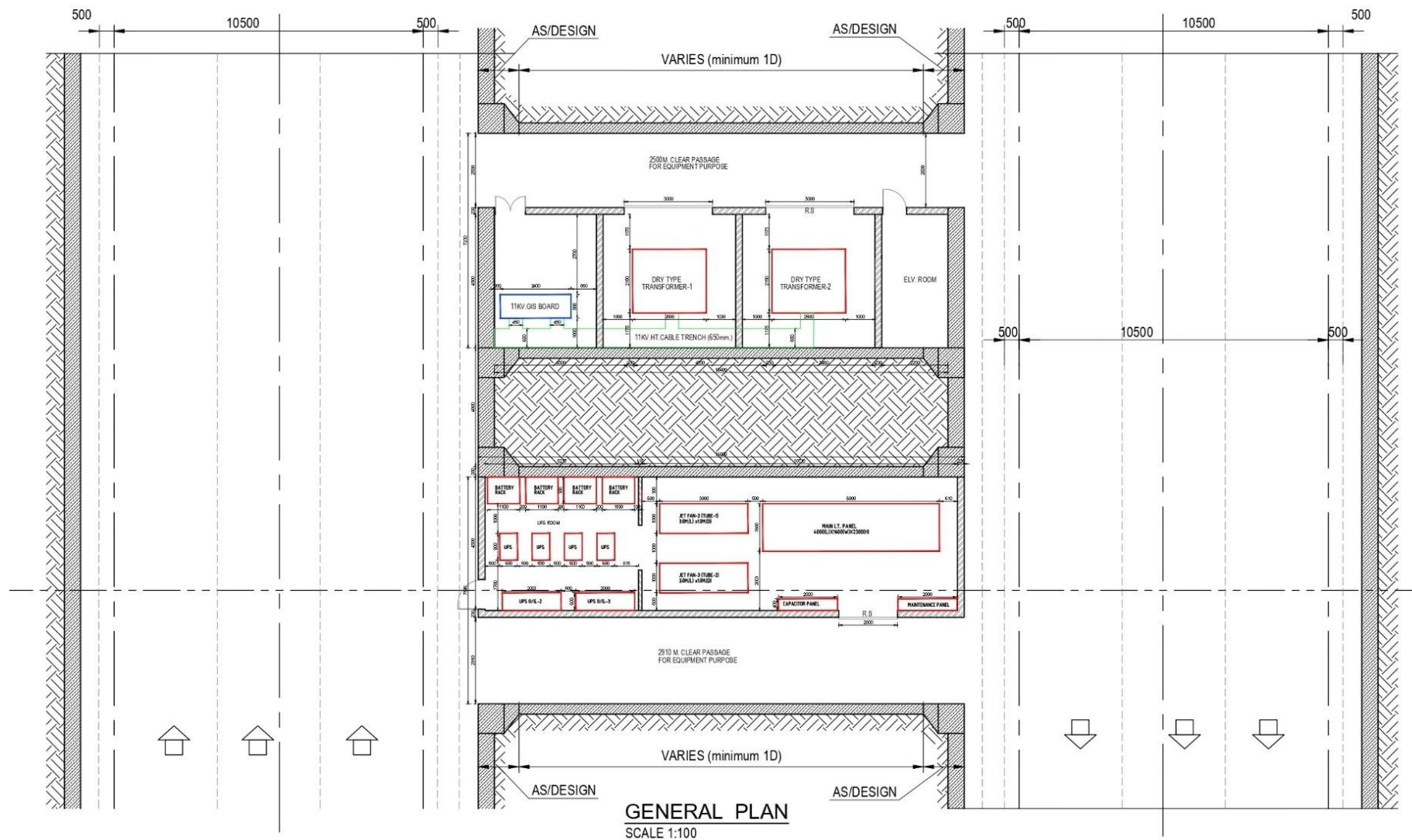


Figure 2 : Substation Layout Inside Tunnel



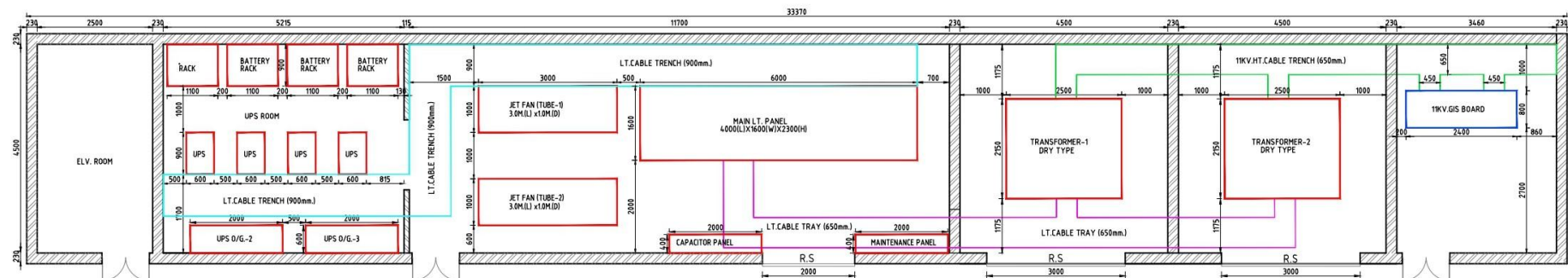


Figure 3: Substation Layout In Niches

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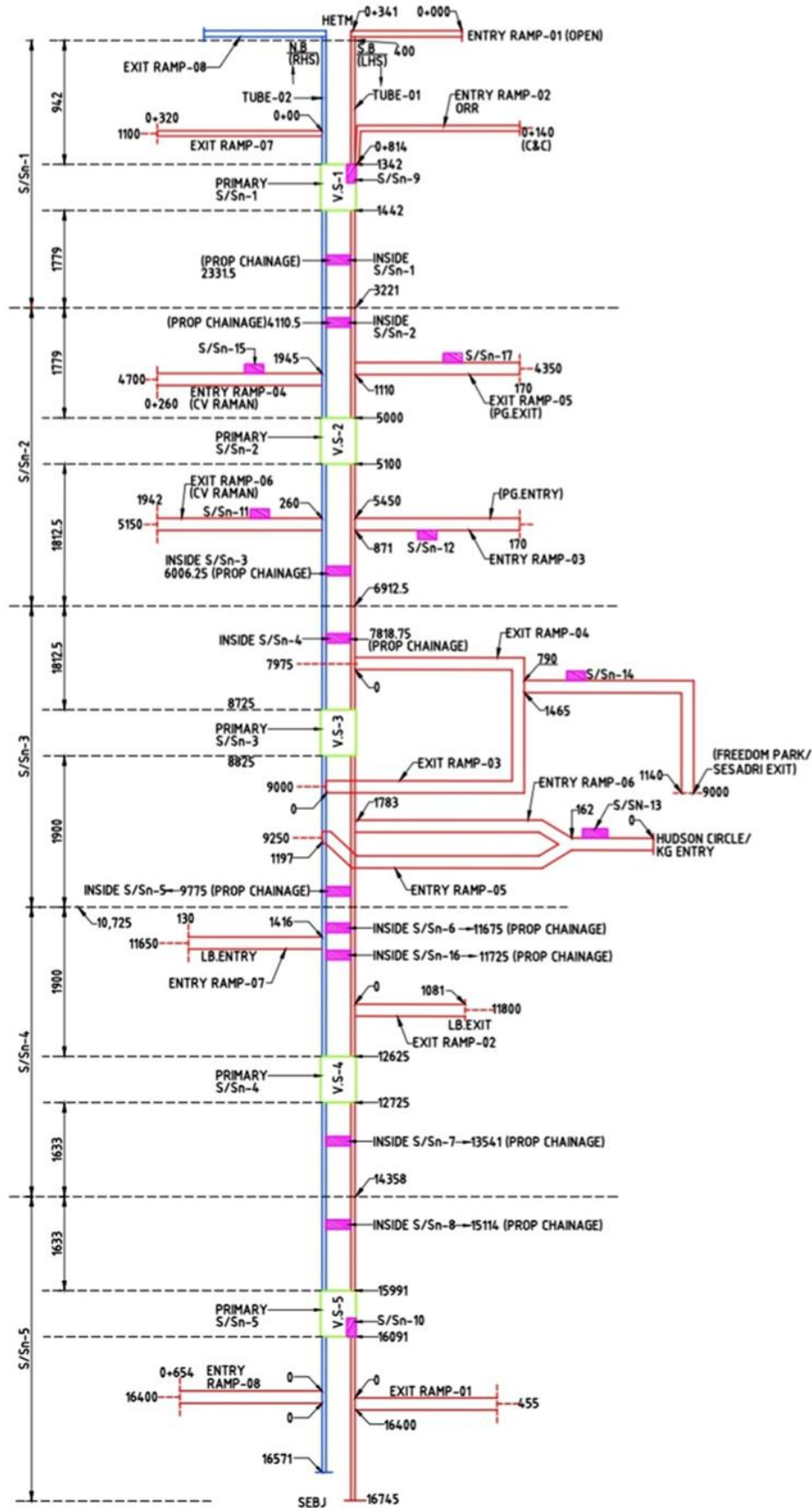


Figure 4 : Substation Location Inside Tunnel

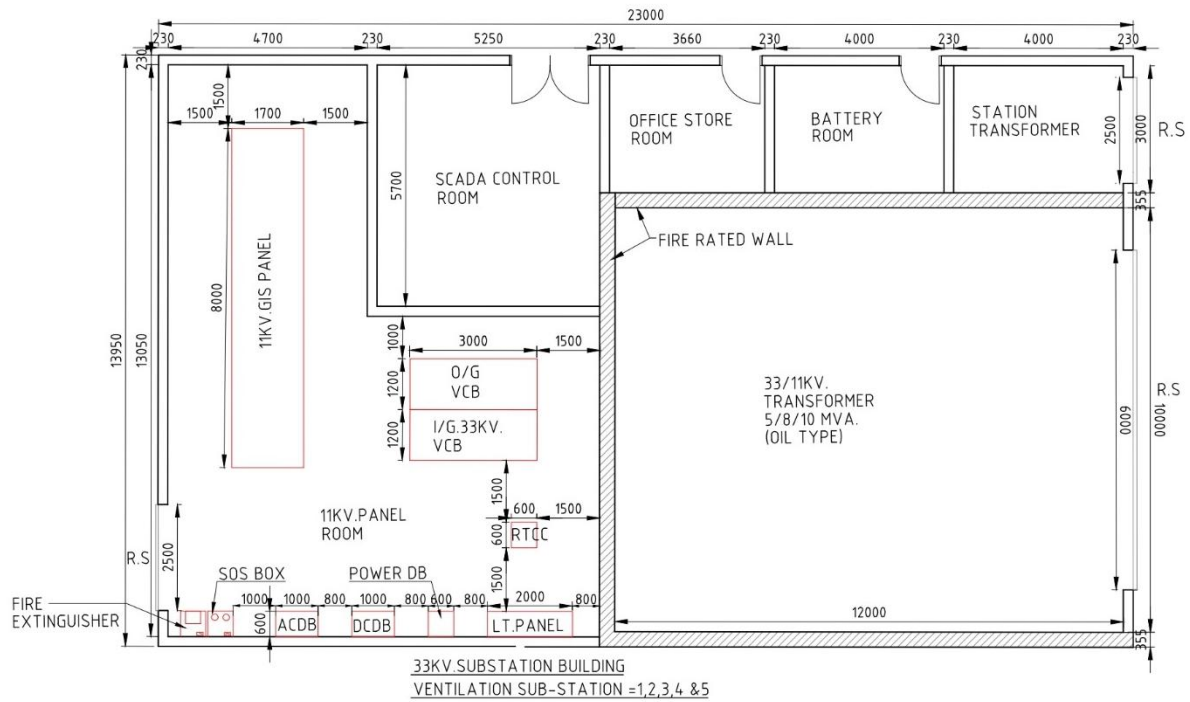


Figure 5 : 33KV Grid Layout

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2.4.4 DG Set

DG sets shall be sufficiently sized to cater for the tunnel load during emergency conditions and/or loss of external supply from the authority.

Supplying generator power over extended lengths of cables in long tunnels at 400V is not very viable as for curbing down the voltage drop and power losses it leads to a significant increase in the number of LT power cables, which is both expensive and challenging to manage. Hence, it would be prudent to supply generator power at 11KV. There are two possible ways of generating 11KV voltages:

- Option-I: By selecting 11kV Generator which are available with all major manufacturers.
- Option-II: By selecting 400V generator and stepping up the terminal voltage to 11kV by using step up transformer.

Option-I is desirable since the output voltage from the generator can be directly connected to the 11KV system bus at primary substation thereby eliminating the need for additional major equipment like the step-up transformer considered in Option-II.

The DG sets are proposed to be located in the ventilation station in close proximity to the primary substation. Since the ventilation station is located on the top of the main tubes it will prevent unsafe conditions inside the tunnels due to fuel handling and exhaust fumes. The DG set shall be of silent type and will be supported with adequate exhaust piping.

The capacity of the DG sets shall be assessed based on the load demand of each primary substation.

The tentative capacity of the DG set required for the tunnel in **Table 7** is derived based on the load analysis in Table 11.

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Table 11: Tentative Load assessment of DG sets

Electrical Assumptions										11 KV DG SET		
33/11 KV Sub station	Structure/Name	Span of Sub- station (in m)		Ventilation load per S/sn	Lighting @ 30W/m(in KW)	ELV Load @ 6 W/m(in KW)	Misc Loads @ 15W/m(in KW)	FFFS	Total Load/S/sn in KW	Load in KVA @ 0.8 pf	%ge loading of DG Set @90%	Selected 11KV DG Set
		South bound tube- Tube-01	North bound Tube- Tube-02									
S/Sn-1	Entry Ramp-02	674.0		3433.04	197.40	39.48	98.70	500.00	4268.62	5335.78	5928.64	3 x 2000KVA
	Exit Ramp-07		320.0									
	Exit Ramp-08		150.0									
	Cut and Cover	942.0	930.0									
	TBM Tunnel-1	1779.0	1785.0									
S/Sn-2	TBM Tunne-1	1779.0	1785.0	6363.65	365.91	73.18	182.96	500.00	7485.70	9357.12	10396.80	5 x 2000 KVA
	Exit Ramp-5 (PG Exit)	940.0										
	Entry Ramp-4 (CV Raman)		1685.0									
	TBM Tunnel-2	1812.5	1812.5									
	Entry Ramp-03 (PG Entry)	701.0										
	Exit Ramp-06 (CV Raman)		1682.00									
S/Sn-3	TBM Tunnel-2	1812.5	1812.5	6703.30	385.44	77.09	192.72	500.00	7858.55	9823.19	10914.66	6 x 2000 KVA
	TBM Tunnel-3	1900	1900									
	Exit Ramp-4	1140.000										
	Exit Ramp-3		1465.000									
	Entry Ramp-05		1197.000									
	Entry Ramp-06	1621.000										





Electrical Assumptions											11 KV DG SET	
33/11 KV Sub station	Structure/Name	Span of Sub- station(in m)		Ventilation load per S/sn	Lighting @ 30W/m(in KW)	ELV Load @ 6 W/m(in KW)	Misc Loads @ 15W/m(in KW)	FFFS	Total Load/S/sn in KW	Load in KVA @ 0.8 pf	%ge loading of DG Set @90%	Selected 11KV DG Set
S/Sn-4	TBM Tunnel-3	1900	1900	4921.57	282.99	56.60	141.50	500.00	5902.65	7378.31	8198.12	4 x 2000 KVA
	TBM Tunnel-4	1633	1633									
	Entry Ramp-07 LB Entry		1286									
	Exit Ramp-02 (LB Exit)	1081.000										
S/Sn-5	TBM Tunnel-4	1633	1633	2874.26	165.27	33.05	82.64	500.00	3655.22	4569.02	5375.32	3 x 2000KVA
	Tube-2 Entry		480									
	Entry Ramp-08		654									
	Tube-01 Exit	654										
	Exit Ramp-01	455										



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The DG sets will operate under both emergency and normal conditions.

The 11 KV DG set shall be complete with radiator cooled system, fuel system, lubricating system, air intake system, exhaust system, governing system, standby system, engine protection safety system with microprocessor-based power control command generator set monitoring, metering, protection, and control system to meet demands of engine driven generator sets.

The alternator shall be rated voltage 11 kV, power factor 0.8 11 kV, with voltage regulation $\pm 0.5\%$ for all loads between no load to full load conditions of insulation with soundproof enclosure, weatherproof enclosure Prime Power Rating (PRP) conforming to ISO 8528 part - I as per environment noise level norms 75 Db (decibels) as at one meter.

The alternator shall be self-excited, self-regulator, self-ventilated in brushless design processed with suitable AVR and shall conform to BS: 2613 or BS:5000 and shall give rated output at NTP conditions.

To run DG sets at full capacity, adequate capacity of fuel storage shall be required. The capacity of fuel storage is computed based on the following conditions:

1. No Grid supply
2. Emergency condition for 8 hours continuously.
3. 1 day storage

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Table 12: DG fuel consumption

DG Fuel Consumption										
S/Sn No	Selected 11KV DG Set Size considered	No of DG Sets	Fuel @ 100% loading in ltrs/hr/DG	Assumed Hours of operation	Fuel @ 100% loading in 8 hrs continous running (litres)/DG	1st fill in day tank/DG	Total litres of fuel/day/DG	Total litres of fuel/day in litres	Considering a 1 day storage (in Litres)	Bulk fuel storage tank considered (in KL)
S/Sn-1	2000	3	390	8	3120	990	4110	12330	12330	15
S/Sn-2	2000	5	390	8	3120	990	4110	20550	20550	20
S/Sn-3	2000	6	390	8	3120	990	4110	24660	24660	30
S/Sn-4	2000	4	390	8	3120	990	4110	16440	16440	20
S/Sn-5	2000	3	390	8	3120	990	4110	12330	12330	15



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From the above computation in

the HSD Bulk fuel storage tank per primary substation will need to be planned. An approval from the Department of Explosives shall be required to install the tanks.

For Exhaust stack, as per the notification by CPCB, DG sets with rating 1000 kVA and above will be installed to stand at 30m above the ground.

2.4.5 UPS system

Uninterrupted Power Supply system shall maintain uninterrupted power to equipment continuously and during power failure. UPS shall be provided to supply the following equipment:

- Emergency tunnel lighting, exit signages, strobe lights.
- Critical loads comprising of:
 - i. All Computer systems
 - ii. SCADA System including remote control units, sensors etc
 - iii. CCTV/surveillance systems
 - iv. Public Address Systems
 - v. Motorist Emergency Telephones
 - vi. Radio rebroadcast System
 - vii. Traffic lights, Variable Message signs
 - viii. Fire detection and Alarms systems.
 - ix. Access control

The UPS for emergency tunnel lighting, exit sign shall ensure uninterrupted power for a minimum period of 90 mins while for critical loads a minimum period of 30mins.

UPS shall be installed at control centres and all electric substations.

The rating of the different UPS shall be sufficient to supply the connected loads for the specified back-up period. The UPS system shall consist of a single UPS module, or the appropriate number of UPS module connected in parallel for operation in capacity or in N+n redundancy mode.

Based on the load assessment in **Table 1** above the possible UPS configurations at the proposed locations have been described below in Table 13.

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Table 13: UPS Sizing

11/0.433KV Sub Station	UPS for Emergency Lighting(90 mins)					UPS for Critical Systems(30 mins)				
	Emergency Lighting @ 10W/m(in KW)	Emergency Lighting (90 min) in KVA @ 0.8 pf	Considering 90% loading	UPS Size considered in KVA	No of UPS in (N+n) mode	ELV Load @ 6 W/m(in KW)	ELV Load (30 min) in KVA @ 0.8 pf	Considering 90% loading	UPS Size considered in KVA	No of UPS in (N+n) mode
S/Sn 9	30.2	37.70	41.9	40	1+1	18.1	22.62	25.1	30	1+1
S/Sn-1	35.6	44.55	49.5	60	1+1	21.4	26.73	29.7	35	1+1
S/Sn-2	35.6	44.55	49.5	60	1+1	21.4	26.73	29.7	35	1+1
S/Sn-17	9.4	11.75	13.1	20	1+1	5.6	7.05	7.8	10	1+1
S/Sn-15	16.9	21.06	23.4	30	1+1	10.1	12.64	14.0	15	1+1
S/Sn-3	36.3	45.31	50.3	60	1+1	21.8	27.19	30.2	35	1+1
S/Sn-12	7.0	8.76	9.7	15	1+1	4.2	5.26	5.8	10	1+1
S/Sn-11	16.8	21.03	23.4	30	1+1	10.1	12.62	14.0	15	1+1
S/Sn-4	36.3	45.31	50.3	60	1+1	21.8	27.19	30.2	35	1+1
S/Sn-5	38.0	47.50	52.8	60	1+1	22.8	28.50	31.7	35	1+1
S/Sn-14	26.1	32.56	36.2	40	1+1	15.6	19.54	21.7	20	1+1
S/Sn-13	28.2	35.23	39.1	40	1+1	16.9	21.14	23.5	30	1+1
S/Sn-6	38.0	47.50	52.8	60	1+1	22.8	28.50	31.7	40	1+1
S/Sn-7	32.7	40.83	45.4	60	1+1	19.6	24.50	27.2	30	1+1
S/Sn-16	23.7	29.59	32.9	40	1+1	14.2	17.75	19.7	20	1+1
S/Sn-8	32.7	40.83	51.0	60	1+1	19.6	24.50	30.6	30	1+1
S/Sn-10	22.4	28.04	31.2	30	1+1	13.5	16.82	18.7	20	1+1





The UPS system will be complete with inverter battery bank, rectifier charging unit, inverter units, protective devices, filter circuits, system static transfer switches/bypass switches, auxiliary equipments etc. All the characteristics of UPS (like THD, overload, etc.) shall be as per IEC/EN 62040.

The UPS will be fed from the main power supply (433 / 250 V, 50 Hz) and shall supply the connected equipment via rectifier, battery and inverter.

In the event of a main power supply failure the equipment will be fed to the battery and inverter system without any interruption.

The UPS shall be equipped with an inclusive bypass switch and an interface for Telecontrol System/ SCADA.

2.4.6 Earthing

A suitable size of earth conductor/ wire will run throughout the tunnel. All the electrical equipment like panels, distributions boards, lighting DB, power DB, Jet fans etc. will be connected to the earth conductor. The earth conductor will connect to the earth grid provided at the ventilation stations.

The whole installation shall be grounded efficiently, that is the resistance from the ground to any point does not exceed the value specified by the operative codes of practice, which is less than 1 Ohm of its main protective ground system and less than 10 Ohm for all the lightning protection system. The whole installation shall be efficiently bounded.

1. Tunnel Lighting
2. Lighting Concept

The design of the tunnel lighting system is based on the tunnel lighting design recommendations of the "Guide for the lighting of road tunnels and underpasses of the CIE 88:2004" (luminance level, uniformity ratio, depreciation factor, etc.).

The lighting system consists basically of:

- Tunnel lighting (entrance lighting, interior lighting)
- Emergency lighting.
- Night Time lighting
- Parting zone lighting
- Building lighting in the Service Buildings and in the niches

The tunnel lighting will be fully controlled automatically by the SCADA system according to measurements of the light sensors situated outside and inside the tunnel. A manual control of the entire lighting system will remain possible at any time.

Refer Relux simulation of the tunnel enclosed as Appendix-1,2,3 and Appendix-4 of the report.

2.5 Zones in tunnel

It is practical to distinguish different zones in the tunnel in order to determine the longitudinal lighting level at daytime lighting: the access zone, the threshold zone, the transition zone, the interior zone and the exit zone.

2.5.1 Access zone

In access zone the number of light fixtures is calculated according to the required luminance level and design accordingly. It is the part of the open road immediately outside (in front of) the tunnel portal, covering the distance over which an approaching driver must be able to see into the tunnel. The access zone begins at the stopping distance point ahead of the portal and it ends at the portal

2.5.2 Threshold zone and Transition zone

Threshold and transition zone lighting fixtures of the tunnel accommodation sections are situated on the roof of the tunnel tube in a line passing over the middle of an access traffic lane, the quantity and capacity of the light fitting is designed as per the detailed luminous calculation.





- Lighting fixture specifications;
- Nominal power of light sources;
- Execution of the tunnel tube;
- Elevation and lateral location of lighting fixtures inside the tunnel tube;
- Spacing of lighting fixtures;
- Over switching regulation of lighting fixtures.

2.5.3 Interior zone

Very long tunnel's interior zone consists of two different sub zones.

The first sub zone corresponds to the length which is covered in 30 seconds and should be illuminated with the "long tunnel " levels. The second sub zone corresponds to the remaining length and should be illuminated with the "Very long tunnels" levels.

Lighting fixtures are situated in the centre line of the tunnel tube on the roof the quantity and capacity of the light fitting will be designed as per the detailed luminous calculation.

Luminance values in cd/m² in the interior zone (long tunnels)

Stopping Distance (m)	LONG TUNNELS Traffic flow [vehicles/hour/lane]	
	Low	Heavy
160 m	6	10
60 m	3	6

Luminance values in cd/m² in the interior zone (very long tunnels)

Stopping Distance (m)	VERY LONG TUNNELS Traffic flow [vehicles/hour/lane]	
	Low	Heavy
160 m	2,5	4,5
60 m	1	2

2.5.4 Exit zone

The exit zone lighting provides visual contact for the driver still in the tunnel with the open road beyond the tunnel the quantity and capacity of the light fitting will be designed as per the detailed luminous calculation. In exit zone the Lighting is gradually increased to 5 times the interior lux.

2.5.5 Emergency Lighting

Emergency lighting is important part of road tunnel technical accessories. It consists of an emergency lighting of unprotected escape ways (for lay-bays, emergency exits, SOS boxes, FF niches and tunnel sidewalks) and an emergency lighting of escape ways in the tunnel complex (for escape tunnel, escape ways in technology buildings and rooms). Power supply of all the emergency lighting fixtures must be executed by on-line uninterruptible power sources (UPS).

According to CIE 88:2004 for emergency lighting the illuminance values must not fall below 10lx.

2.5.6 Night-Time Lighting

If the tunnel is on a section of an illuminated road, the quality of the lighting inside the tunnel should be at least equal to the level, uniformity and glare of the access road. The uniformity at night of tunnels shall fulfil the same requirements as the daytime lighting.

2.5.7 Parting zone lighting

Parting Zone is first part of the open road directly after the exit portal of a tunnel. In case the tunnel is





part of an unlit road and the speed of driving is higher than 50 km/h, night-time lighting of the parting zone is recommended:

- if the night-time lighting level in the tunnel is more than 1 cd/m²;
- if different weather conditions are likely to appear at the entrance and at the exit of the tunnel.

Road lighting in the parting zone shall be provided over the length of two stopping distances with road luminance not lower than 1/3 of the night-time luminance in the interior zone of the tunnel.

2.5.8 Building Lighting System

Conventional lighting according to local standards will be provided in the Service Buildings, electrical rooms, emergency call recesses and the Control Centre(s).

The illumination (in lux) for following rooms is:

1. Control room: 500 lux
2. Corridor: 100 lux
3. Distributing room (like server, LV, HV etc.): 150 lux
4. Office room: 400 lux
5. Common room (like kitchen, toilets, etc.): 100 lux
6. Workshop: 150 lux

2.6 CCTV Network

All the cameras monitoring one traffic direction will be oriented in the same direction. The cameras will be mounted on a height of approximately 5 m on the side of the emergency lane.

Every access door to the cross passage will be monitored by a separate camera, which will be installed on the opposite tunnel wall. Also, cameras will be installed in the cross-passage.

The tunnel video camera network will be completed with pole mounted video cameras located outside of the tunnel. These cameras will monitor the traffic on the tunnel access road and tunnel access ramps. They will be equipped with pan/ tilt and zoom devices.

All the video pictures from the video cameras will be transmitted in real time to the Tunnel Control Centre and continuously recorded on HDD digital recording system.

The video pictures will be transmitted from the video camera to electrical substations via single optical fiber and then to the control centre via the main tunnel optical fiber network. The main tunnel optical fiber network is designed as a ring for redundancy.

The CCTV network will be connected to the Control Centre, by which the pictures can be seen, or cameras can be controlled.

2.6.1 Video Automatic Incident Detection

The tunnel CCTV system will be associated with an Automatic Incident Detection system.

The Automatic Incident Detection system can detect and transmit alarms concerning:

- Stopped and/or slow vehicles
- Vehicles travelling in the wrong direction (contra flow)
- Pedestrians in the tunnels
- Traffic congestion and queues

After an alarm is generated by the system, the system will be able to isolate the corresponding event on the HDD digital recording system for analyses.

The Video Automatic Incident Detection is connected to the Control Centre, by which the pictures can be seen, or cameras can be controlled.

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2.7 Emergency Call Network

An emergency call telephone will be installed at a distance of 100m as stipulated in IRC 91:2019.

A dedicated workstation (Emergency Roadside Telephone Workstation) will be in the Tunnel Control Centre to allow the operator full control of the system.

The architecture of the communication network of the emergency roadside telephones will consist of an optical fiber loop controlled from an emergency roadside telephone network interface located in the tunnel technical room. All the emergency roadside telephones in the northbound tube will be connected to one branch and all of the emergency roadside telephones in the southbound tube will be connected to the other branch.

For redundancy an emergency roadside telephone network interface is located at every portals of the tunnel.

2.7.1 Service Telephone System

A telephone network will be installed for the entire tunnel project. The telephone network will consist of telephone sets in:

- Tunnel Control Centers
Control Rooms and Technical Rooms
- Service Buildings
At least one telephone
- ESS in tunnel and the ventilation building
In the Technical Rooms

2.7.2 PA System

A Public Address system has been planned in order to allow the broadcast of messages in case of an emergency, this is why the sound pressure must be enough to overcome the existing noise levels and obtain a correct degree of intelligibility of the message.

The system is composed by a uniform distribution of adequately rated exponential loudspeakers, which are installed in the sidewalls or hanging from the electric trays. The distance between the loudspeakers in each tunnel will be approximately 60 meters.

The public address central unit will be placed in the Control Center, while the amplifiers will be distributed in the different cross - passages, depending on the location of the loudspeakers they must supply.

The loudspeakers will be connected in parallel, thus, the public address (PA) system in the Tunnels will be divided into several sections with the purpose of transmitting different messages in each zone of the tunnel, being able to indicate the procedure that must be followed in case of an emergency depending on the location of each user. Thereby, in the tubes, each stretch located between two cross - passages will be considered as a public address section, the same as the stretches located between a cross - passage and one tunnel portal.

On the other hand, each cross - passage will be a different zone with two speakers connected to one amplifier that will be located in the cross - passage itself.

The connection between the public address system and the amplifiers will be made using the tunnel's general communications infrastructure. Therefore, the public address system will operate with TCP/IP protocol, so that the amplifiers shall be directly connected to the switches of the technical rooms. This connection will allow bringing the audio signal of the messages and the control contacts to the different emission zones.

The public address wiring will be protected in a tube for the general line and under a polycarbonate LSZH tube until reaching each loudspeaker.

There will be several pre-recorded messages that will be automatically broadcasted depending on the





received alarm. These messages will be transmitted in English and local languages.

The amplifiers' power supply will be made from the nearest low-voltage distribution board.

Some of the speakers will be located in the lay-bys to make sure that, in case there are people waiting, they receive emergency messages.

2.7.3 Tunnel Radio System

The radio transmission will be performed through radio leaky cable mounted below the intermediate ceiling of the tunnel. The tunnel will have a Radio Rebroadcast System for the emergency services. This system will consist of main racks with antennas in the outdoor Technical Rooms. These main racks will be connected between them and with the signal amplifiers, installed in the Technical Rooms, by single – mode fiber optic in order to transmit the data and state of the equipment of the tunnel. Furthermore, these main racks will be communicated by radiant cable, installed along the tunnel at both sides, to all the signal amplifiers. The connection between the main rack and the radiant cable will be done by a coaxial cable. The amplifiers will communicate between them by radiant cable.

The single – mode fiber optic will go along the tubes of the tunnel making a ring. This fiber allows the connection of the main racks with the Control Center. The tunnel will also have a radio frequency for emergency communications with the users of the tunnel. The radio frequency will be specified at the entrance of the tunnel. The communications of the radio channel will be by radiant cable and connecting the signal amplifiers and main racks, as described above.

The radio system will be used by

- Fire brigade
- Traffic police
- Ambulance service
- Maintenance staff
- Operation

Every service has its own channel (one channel for reserve).

Refer Appendix-5 for more information.

2.8 SCADA System and Data Processing and Transmission

The data processing and data transmission will be realized by using a fiber optic cable ring (over both tunnel tubes interconnecting to the all the entry and exit tunnels) where the local PLCs (at Niche Substation, Cross passage substation, etc.) will be connected to the fiber optic cable ring by using optical link modules. The use of a ring structure gives additional security, since in case of a failure or cable break on one side of the ring, the data transmission will be done over the other side of the ring. The control of the tunnel will be designed in such a way, that the tunnel will operate fully automatic with the possibility of manual intervention if needed. In the control centers (main CC resp. sub CC) the supervision and manual control of the tunnel's electrical and safety installation can be managed (automatic/remote/local mode, supervision interface, SCADA-workstations, etc.).

The complete architecture of the data processing and data transmission as well as the SCADA system is designed redundant - so the power supply units, the data transmission rings (two rings are designed), etc. are designed in such a way, that the breakdown of a PLC, tunnel ring, etc. does not result in a breakdown of a part of the system resp. the complete system.

2.8.1 Control Centre (main CC and back-up CC)

The main Control Centre will be situated at the Ventilation station-2.

The back-up Control Centre will be situated at the Ventilation station-4.

The control centre will include the control rooms for tunnels traffic operation all the necessary technical rooms, the operation and maintenance buildings and the administrative facilities.





The Tunnel Control Centre is an essential part of the tunnel safety system. It controls the traffic flow in the tunnel and co-ordinates the initial interventions in the event of an incident or emergency in the tunnel. The necessary rescue equipment and vehicles must be in the immediate vicinity of the tunnel portals.

The tunnel control centre will be associated with the following functions:

- Monitoring the traffic conditions in the tunnel and its accesses
- Monitoring the emergency call systems
- Receiving any alarms and alerts associated with the tunnel equipment systems
- Receiving and displaying the images transmitted from the CCTV cameras
- Supervising the operation of the tunnel ventilation, traffic control and lighting systems and other safety equipment

The equipment of the Control Centres includes the supervisor workstation, two traffic controller workstations, CCTV monitors, emergency call control equipment, tunnel radio control equipment, PA control equipment, etc.

The control room will contain:

- The supervisor's workstation
- The two traffic controller's workstations
- The tunnel CCTV monitors and control boards
- The main synoptic panel display
- The emergency telephone control station
- The radio communication
- All other equipment necessary for the tunnel

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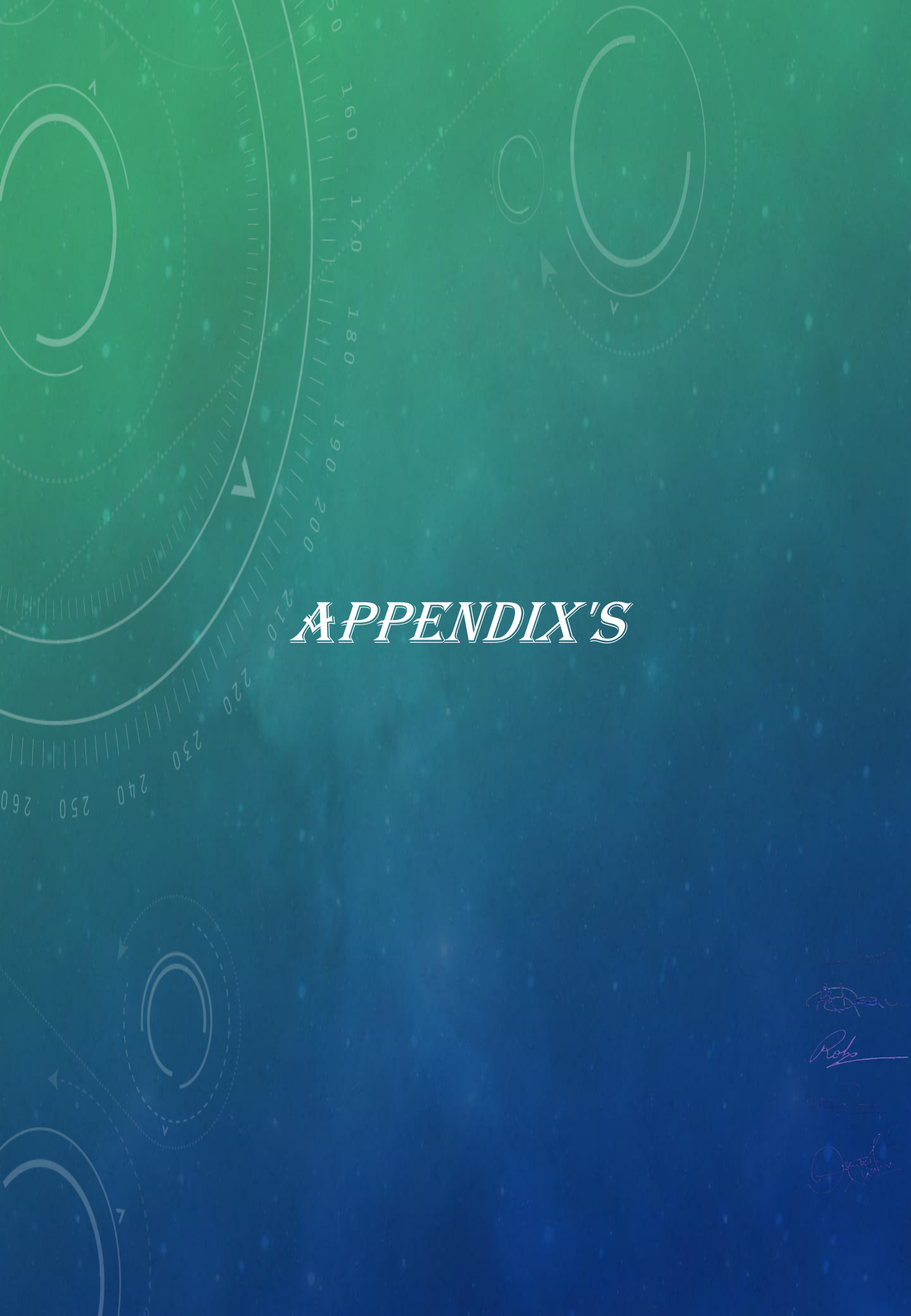
Amelia

Adri

Rob

Emma

James



APPENDIX'S

Appendix's

Appendix's

Appendix's

Appendix's

Appendix's

Amelia

Adri

Rob

Emma

James



APPENDIX - 1

Signature

Signature

Signature

Signature

Signature

Amelia

Adri

Rob

Emma

James

BBMP ROAD TUNNEL PROJECT

Installation : MAIN TUNNEL 16.32KM

Project number : 81942

Customer :

Processed by : BAJAJ

Date : 21.09.2024

Project description:

Tunnel designed

BOTH TBM CUT AND COVER - 16.32KM MAIN TUNNEL

Tunnel Main Road Width assumed - 10.5m Main Carriageway + 0.5m FOOTPATH + 1.25m FOOTPATH

BOTTOM OF LIGHT - 6.5m from road level

Total Length of the Tunnel - 16.32m

SPEED - 100KMPH

ROAD - CONCRETE ROAD R1 - 0.10

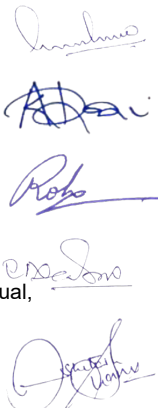
THRESHOLD -400cd/m², TRANSITION - 160cd/m², INTERIOR 1 - 10 cd/m², INTERIOR 2 - 6 cd/m². EXIT - 30 cd/m²

NIGHT TIME - 6.0cd/m²

EMERGENCY - MIN 2 LUX AND AVG 10

The following values are based on precise calculations performed on calibrated lamps and luminaires, and their configurations, whereby gradual, unavoidable deviations can occur in practice. All guarantee claims are excluded for the specified data.

This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.



Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



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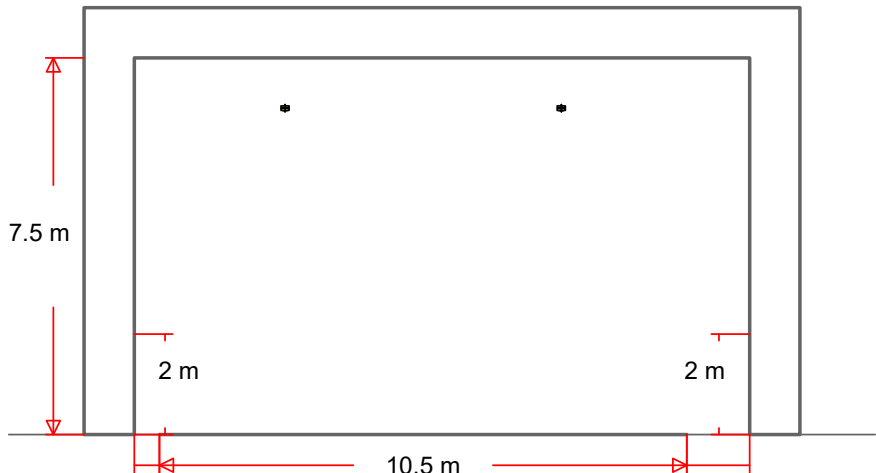
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
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1 Tunnel

1.1 Description, Tunnel

1.1.1 Project data



Geometry tunnel

Length of the tunnel : 16325 m
 Length of the tunnel (calculation model) : 800 m
 Height of the tunnel : 7.5 m

Width of the carriageway : 10.5 m
 Number of lanes : 3
 Covering / material : R1, q0 = 0.09

Marginal strip left : 0.5 m

Height of the wall (right) : 2 m
 Covering / material : diffus 30%

Marginal strip right : 1.25 m

Height of the wall (left) : 2 m
 Covering / material : diffus 30%

Calculation specifications

Speed : 100 km/h
 Length of the threshold zone : 168 m
 Luminance threshold zone : 400 cd/m²
 Luminance interior zone : 6 cd/m²

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Object : BBMP ROAD TUNNEL PROJECT
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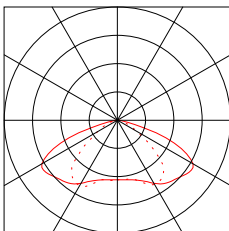
1 Tunnel

1.1 Description, Tunnel

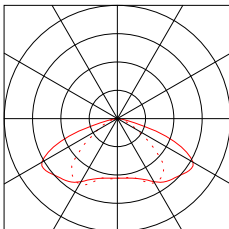
1.1.1 Project data

LDC in use

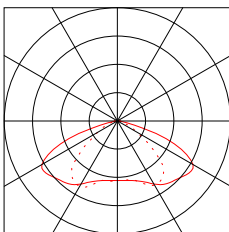
1 **Bajaj**
Order No. : s
Luminaire name : E230315 BJTU S 390L NW SYM PC
Equipment : 1 x Unknown 300.1 W / 37053 lm
Maintenance factor: 0.85



2
Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3
Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

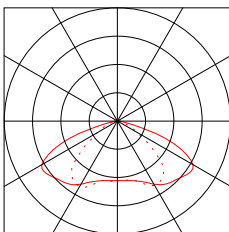
RELUX®

1 Tunnel

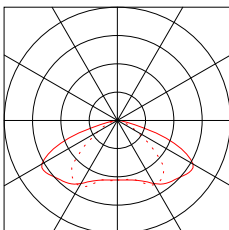
1.1 Description, Tunnel

1.1.1 Project data

7 Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



8 Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
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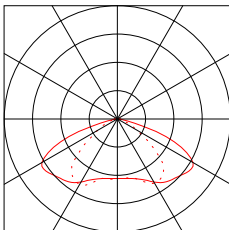
1.1 Description, Tunnel

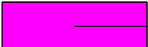
1.1.2 Luminaire list

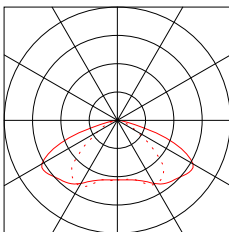
Adaptation LDC in use

Bajaj

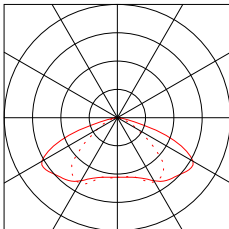
1 383 x  Order No. : s
Luminaire name : E230315 BJTU S 390L NW SYM PC
Equipment : 1 x Unknown 300.1 W / 37053 lm
Maintenance factor: 0.85



2 34 x  Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3 26 x  Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85









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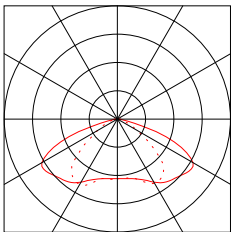
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

7 50 x Order No. : s
 Luminaire name : E230315 BJTU S 162L NW SYM PC
 Equipment : 1 x Unknown 120 W / 14964 lm
 Maintenance factor: 0.85



Row of luminaires: Row 3.1

Number of luminaires: 246
 Basic position: x=1.00m y=2.50m, z=6.50m
 Rotation: z=180.0° C0=0.0° C90=0.0°

System power (total): 66.7kW
 -variable distances-

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.00	300.1W / 37.05kln1	100%	0%
2	1.80	300.1W / 37.05kln1	100%	0%
3	2.50	300.1W / 37.05kln1	100%	0%
4	3.30	300.1W / 37.05kln1	100%	0%
5	4.10	300.1W / 37.05kln1	100%	0%
6	4.90	300.1W / 37.05kln1	100%	0%
7	5.60	300.1W / 37.05kln1	100%	0%
8	6.40	300.1W / 37.05kln1	100%	0%
9	7.20	300.1W / 37.05kln1	100%	0%
10	7.90	300.1W / 37.05kln1	100%	0%
11	8.70	300.1W / 37.05kln1	100%	0%
12	9.50	300.1W / 37.05kln1	100%	0%
13	10.20	300.1W / 37.05kln1	100%	0%
14	11.00	300.1W / 37.05kln1	100%	0%
15	11.80	300.1W / 37.05kln1	100%	0%
16	12.60	300.1W / 37.05kln1	100%	0%
17	13.30	300.1W / 37.05kln1	100%	0%
18	14.10	300.1W / 37.05kln1	100%	0%
19	14.90	300.1W / 37.05kln1	100%	0%
20	15.60	300.1W / 37.05kln1	100%	0%
21	16.40	300.1W / 37.05kln1	100%	0%
22	17.20	300.1W / 37.05kln1	100%	0%
23	17.90	300.1W / 37.05kln1	100%	0%
24	18.70	300.1W / 37.05kln1	100%	0%
25	19.50	300.1W / 37.05kln1	100%	0%
26	20.30	300.1W / 37.05kln1	100%	0%
27	21.00	300.1W / 37.05kln1	100%	0%
28	21.80	300.1W / 37.05kln1	100%	0%
29	22.60	300.1W / 37.05kln1	100%	0%
30	23.30	300.1W / 37.05kln1	100%	0%
31	24.10	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

32	24.90	300.1W / 37.05kln1	100%	0%
33	25.60	300.1W / 37.05kln1	100%	0%
34	26.40	300.1W / 37.05kln1	100%	0%
35	27.20	300.1W / 37.05kln1	100%	0%
36	28.00	300.1W / 37.05kln1	100%	0%
37	28.70	300.1W / 37.05kln1	100%	0%
38	29.50	300.1W / 37.05kln1	100%	0%
39	30.30	300.1W / 37.05kln1	100%	0%
40	31.00	300.1W / 37.05kln1	100%	0%
41	31.80	300.1W / 37.05kln1	100%	0%
42	32.60	300.1W / 37.05kln1	100%	0%
43	33.30	300.1W / 37.05kln1	100%	0%
44	34.10	300.1W / 37.05kln1	100%	0%
45	34.90	300.1W / 37.05kln1	100%	0%
46	35.70	300.1W / 37.05kln1	100%	0%
47	36.40	300.1W / 37.05kln1	100%	0%
48	37.20	300.1W / 37.05kln1	100%	0%
49	38.00	300.1W / 37.05kln1	100%	0%
50	38.70	300.1W / 37.05kln1	100%	0%
51	39.50	300.1W / 37.05kln1	100%	0%
52	40.30	300.1W / 37.05kln1	100%	0%
53	41.00	300.1W / 37.05kln1	100%	0%
54	41.80	300.1W / 37.05kln1	100%	0%
55	42.60	300.1W / 37.05kln1	100%	0%
56	43.40	300.1W / 37.05kln1	100%	0%
57	44.10	300.1W / 37.05kln1	100%	0%
58	44.90	300.1W / 37.05kln1	100%	0%
59	45.70	300.1W / 37.05kln1	100%	0%
60	46.40	300.1W / 37.05kln1	100%	0%
61	47.20	300.1W / 37.05kln1	100%	0%
62	48.00	300.1W / 37.05kln1	100%	0%
63	48.70	300.1W / 37.05kln1	100%	0%
64	49.50	300.1W / 37.05kln1	100%	0%
65	50.30	300.1W / 37.05kln1	100%	0%
66	51.10	300.1W / 37.05kln1	100%	0%
67	51.80	300.1W / 37.05kln1	100%	0%
68	52.60	300.1W / 37.05kln1	100%	0%
69	53.40	300.1W / 37.05kln1	100%	0%
70	54.10	300.1W / 37.05kln1	100%	0%
71	54.90	300.1W / 37.05kln1	100%	0%
72	55.70	300.1W / 37.05kln1	100%	0%
73	56.40	300.1W / 37.05kln1	100%	0%
74	57.20	300.1W / 37.05kln1	100%	0%
75	58.00	300.1W / 37.05kln1	100%	0%
76	58.80	300.1W / 37.05kln1	100%	0%
77	59.50	300.1W / 37.05kln1	100%	0%
78	60.30	300.1W / 37.05kln1	100%	0%
79	61.10	300.1W / 37.05kln1	100%	0%
80	61.80	300.1W / 37.05kln1	100%	0%
81	62.60	300.1W / 37.05kln1	100%	0%

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

82	63.40	300.1W / 37.05kln1	100%	0%
83	64.10	300.1W / 37.05kln1	100%	0%
84	64.90	300.1W / 37.05kln1	100%	0%
85	65.70	300.1W / 37.05kln1	100%	0%
86	66.50	300.1W / 37.05kln1	100%	0%
87	67.20	300.1W / 37.05kln1	100%	0%
88	68.00	300.1W / 37.05kln1	100%	0%
89	68.80	300.1W / 37.05kln1	100%	0%
90	69.50	300.1W / 37.05kln1	100%	0%
91	70.30	300.1W / 37.05kln1	100%	0%
92	71.10	300.1W / 37.05kln1	100%	0%
93	71.80	300.1W / 37.05kln1	100%	0%
94	72.60	300.1W / 37.05kln1	100%	0%
95	73.40	300.1W / 37.05kln1	100%	0%
96	74.20	300.1W / 37.05kln1	100%	0%
97	74.90	300.1W / 37.05kln1	100%	0%
98	75.70	300.1W / 37.05kln1	100%	0%
99	76.50	300.1W / 37.05kln1	100%	0%
100	77.20	300.1W / 37.05kln1	100%	0%
101	78.00	300.1W / 37.05kln1	100%	0%
102	78.80	300.1W / 37.05kln1	100%	0%
103	79.50	300.1W / 37.05kln1	100%	0%
104	80.30	300.1W / 37.05kln1	100%	0%
105	81.10	300.1W / 37.05kln1	100%	0%
106	81.90	300.1W / 37.05kln1	100%	0%
107	82.60	300.1W / 37.05kln1	100%	0%
108	83.40	300.1W / 37.05kln1	100%	0%
109	84.20	300.1W / 37.05kln1	100%	0%
110	84.90	300.1W / 37.05kln1	100%	0%
111	85.70	300.1W / 37.05kln1	100%	0%
112	86.50	300.1W / 37.05kln1	100%	0%
113	87.20	300.1W / 37.05kln1	100%	0%
114	88.00	300.1W / 37.05kln1	100%	0%
115	88.80	300.1W / 37.05kln1	100%	0%
116	89.60	300.1W / 37.05kln1	100%	0%
117	90.30	300.1W / 37.05kln1	100%	0%
118	91.10	300.1W / 37.05kln1	100%	0%
119	91.90	300.1W / 37.05kln1	100%	0%
120	92.70	300.1W / 37.05kln1	100%	0%
121	93.50	300.1W / 37.05kln1	100%	0%
122	94.30	300.1W / 37.05kln1	100%	0%
123	95.10	300.1W / 37.05kln1	100%	0%
124	95.90	300.1W / 37.05kln1	100%	0%
125	96.70	300.1W / 37.05kln1	100%	0%
126	97.50	300.1W / 37.05kln1	100%	0%
127	98.40	300.1W / 37.05kln1	100%	0%
128	99.20	300.1W / 37.05kln1	100%	0%
129	100.00	300.1W / 37.05kln1	100%	0%
130	100.90	300.1W / 37.05kln1	100%	0%
131	101.70	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

132	102.60	300.1W / 37.05kln1	100%	0%
133	103.40	300.1W / 37.05kln1	100%	0%
134	104.30	300.1W / 37.05kln1	100%	0%
135	105.20	300.1W / 37.05kln1	100%	0%
136	106.10	300.1W / 37.05kln1	100%	0%
137	106.90	300.1W / 37.05kln1	100%	0%
138	107.80	300.1W / 37.05kln1	100%	0%
139	108.70	300.1W / 37.05kln1	100%	0%
140	109.60	300.1W / 37.05kln1	100%	0%
141	110.60	300.1W / 37.05kln1	100%	0%
142	111.50	300.1W / 37.05kln1	100%	0%
143	112.40	300.1W / 37.05kln1	100%	0%
144	113.30	300.1W / 37.05kln1	100%	0%
145	114.30	300.1W / 37.05kln1	100%	0%
146	115.20	300.1W / 37.05kln1	100%	0%
147	116.20	300.1W / 37.05kln1	100%	0%
148	117.20	300.1W / 37.05kln1	100%	0%
149	118.10	300.1W / 37.05kln1	100%	0%
150	119.10	300.1W / 37.05kln1	100%	0%
151	120.10	300.1W / 37.05kln1	100%	0%
152	121.10	300.1W / 37.05kln1	100%	0%
153	122.10	300.1W / 37.05kln1	100%	0%
154	123.20	300.1W / 37.05kln1	100%	0%
155	124.20	300.1W / 37.05kln1	100%	0%
156	125.20	300.1W / 37.05kln1	100%	0%
157	126.30	300.1W / 37.05kln1	100%	0%
158	127.30	300.1W / 37.05kln1	100%	0%
159	128.40	300.1W / 37.05kln1	100%	0%
160	129.50	300.1W / 37.05kln1	100%	0%
161	130.60	300.1W / 37.05kln1	100%	0%
162	131.70	300.1W / 37.05kln1	100%	0%
163	132.90	300.1W / 37.05kln1	100%	0%
164	134.00	300.1W / 37.05kln1	100%	0%
165	135.20	300.1W / 37.05kln1	100%	0%
166	136.30	300.1W / 37.05kln1	100%	0%
167	137.50	300.1W / 37.05kln1	100%	0%
168	138.70	300.1W / 37.05kln1	100%	0%
169	139.90	300.1W / 37.05kln1	100%	0%
170	141.20	300.1W / 37.05kln1	100%	0%
171	142.40	300.1W / 37.05kln1	100%	0%
172	143.70	300.1W / 37.05kln1	100%	0%
173	145.00	300.1W / 37.05kln1	100%	0%
174	146.30	300.1W / 37.05kln1	100%	0%
175	147.60	300.1W / 37.05kln1	100%	0%
176	149.00	300.1W / 37.05kln1	100%	0%
177	150.40	300.1W / 37.05kln1	100%	0%
178	151.80	300.1W / 37.05kln1	100%	0%
179	153.20	300.1W / 37.05kln1	100%	0%
180	154.70	300.1W / 37.05kln1	100%	0%
181	156.20	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

182	157.70	300.1W / 37.05kln1	100%	0%
183	159.30	300.1W / 37.05kln1	100%	0%
184	160.90	300.1W / 37.05kln1	100%	0%
185	162.50	300.1W / 37.05kln1	100%	0%
186	164.20	300.1W / 37.05kln1	100%	0%
187	165.90	300.1W / 37.05kln1	100%	0%
188	167.70	300.1W / 37.05kln1	100%	0%
189	169.50	300.1W / 37.05kln1	100%	0%
190	171.40	300.1W / 37.05kln1	100%	0%
191	173.40	300.1W / 37.05kln1	100%	0%
192	175.10	240W / 31.12klm 1	100%	0%
193	176.90	240W / 31.12klm 1	100%	0%
194	178.70	240W / 31.12klm 1	100%	0%
195	180.70	240W / 31.12klm 1	100%	0%
196	182.70	240W / 31.12klm 1	100%	0%
197	184.90	240W / 31.12klm 1	100%	0%
198	187.10	240W / 31.12klm 1	100%	0%
199	189.50	240W / 31.12klm 1	100%	0%
200	192.00	240W / 31.12klm 1	100%	0%
201	194.70	240W / 31.12klm 1	100%	0%
202	197.40	240W / 31.12klm 1	100%	0%
203	200.40	240W / 31.12klm 1	100%	0%
204	203.50	240W / 31.12klm 1	100%	0%
205	206.80	240W / 31.12klm 1	100%	0%
206	210.30	240W / 31.12klm 1	100%	0%
207	214.00	240W / 31.12klm 1	100%	0%
208	218.00	240W / 31.12klm 1	100%	0%
209	221.10	180.3W / 22.56kln1	100%	0%
210	224.20	180.3W / 22.56kln1	100%	0%
211	227.60	180.3W / 22.56kln1	100%	0%
212	231.10	180.3W / 22.56kln1	100%	0%
213	234.80	180.3W / 22.56kln1	100%	0%
214	238.70	180.3W / 22.56kln1	100%	0%
215	242.80	180.3W / 22.56kln1	100%	0%
216	247.10	180.3W / 22.56kln1	100%	0%
217	251.70	180.3W / 22.56kln1	100%	0%
218	256.50	180.3W / 22.56kln1	100%	0%
219	261.70	180.3W / 22.56kln1	100%	0%
220	267.10	180.3W / 22.56kln1	100%	0%
221	273.00	180.3W / 22.56kln1	100%	0%
222	277.10	120W / 14.96klm 1	100%	0%
223	281.40	120W / 14.96klm 1	100%	0%
224	285.80	120W / 14.96klm 1	100%	0%
225	290.50	120W / 14.96klm 1	100%	0%
226	295.50	120W / 14.96klm 1	100%	0%
227	300.60	120W / 14.96klm 1	100%	0%
228	306.10	120W / 14.96klm 1	100%	0%
229	311.80	120W / 14.96klm 1	100%	0%
230	317.90	120W / 14.96klm 1	100%	0%
231	324.40	120W / 14.96klm 1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

232	331.20	120W / 14.96klm	1	100%	0%
233	338.50	120W / 14.96klm	1	100%	0%
234	346.30	120W / 14.96klm	1	100%	0%
235	354.60	120W / 14.96klm	1	100%	0%
236	363.60	120W / 14.96klm	1	100%	0%
237	373.30	120W / 14.96klm	1	100%	0%
238	383.80	120W / 14.96klm	1	100%	0%
239	395.30	120W / 14.96klm	1	100%	0%
240	408.10	120W / 14.96klm	1	100%	0%
241	422.20	120W / 14.96klm	1	100%	0%
242	437.20	120W / 14.96klm	1	100%	0%
243	452.20	120W / 14.96klm	1	100%	0%
244	467.20	120W / 14.96klm	1	100%	0%
245	482.20	120W / 14.96klm	1	100%	0%
246	497.20	120W / 14.96klm	1	100%	0%

Row of luminaires: Row 4.1

Number of luminaires: 247

System power (total): 67.0kW

Basic position: x=1.00m y=8.00m, z=6.50m

-variable distances-

Rotation: z=180.0° C0=0.0° C90=0.0°

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.20	300.1W / 37.05klm	1	100% 0%
2	1.00	300.1W / 37.05klm	1	100% 0%
3	1.80	300.1W / 37.05klm	1	100% 0%
4	2.50	300.1W / 37.05klm	1	100% 0%
5	3.30	300.1W / 37.05klm	1	100% 0%
6	4.10	300.1W / 37.05klm	1	100% 0%
7	4.90	300.1W / 37.05klm	1	100% 0%
8	5.60	300.1W / 37.05klm	1	100% 0%
9	6.40	300.1W / 37.05klm	1	100% 0%
10	7.20	300.1W / 37.05klm	1	100% 0%
11	7.90	300.1W / 37.05klm	1	100% 0%
12	8.70	300.1W / 37.05klm	1	100% 0%
13	9.50	300.1W / 37.05klm	1	100% 0%
14	10.20	300.1W / 37.05klm	1	100% 0%
15	11.00	300.1W / 37.05klm	1	100% 0%
16	11.80	300.1W / 37.05klm	1	100% 0%
17	12.60	300.1W / 37.05klm	1	100% 0%
18	13.30	300.1W / 37.05klm	1	100% 0%
19	14.10	300.1W / 37.05klm	1	100% 0%
20	14.90	300.1W / 37.05klm	1	100% 0%
21	15.60	300.1W / 37.05klm	1	100% 0%
22	16.40	300.1W / 37.05klm	1	100% 0%
23	17.20	300.1W / 37.05klm	1	100% 0%
24	17.90	300.1W / 37.05klm	1	100% 0%
25	18.70	300.1W / 37.05klm	1	100% 0%
26	19.50	300.1W / 37.05klm	1	100% 0%
27	20.30	300.1W / 37.05klm	1	100% 0%
28	21.00	300.1W / 37.05klm	1	100% 0%

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Object : BBMP ROAD TUNNEL PROJECT
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1.1 Description, Tunnel

1.1.2 Luminaire list

29	21.80	300.1W / 37.05kln1	100%	0%
30	22.60	300.1W / 37.05kln1	100%	0%
31	23.30	300.1W / 37.05kln1	100%	0%
32	24.10	300.1W / 37.05kln1	100%	0%
33	24.90	300.1W / 37.05kln1	100%	0%
34	25.60	300.1W / 37.05kln1	100%	0%
35	26.40	300.1W / 37.05kln1	100%	0%
36	27.20	300.1W / 37.05kln1	100%	0%
37	28.00	300.1W / 37.05kln1	100%	0%
38	28.70	300.1W / 37.05kln1	100%	0%
39	29.50	300.1W / 37.05kln1	100%	0%
40	30.30	300.1W / 37.05kln1	100%	0%
41	31.00	300.1W / 37.05kln1	100%	0%
42	31.80	300.1W / 37.05kln1	100%	0%
43	32.60	300.1W / 37.05kln1	100%	0%
44	33.30	300.1W / 37.05kln1	100%	0%
45	34.10	300.1W / 37.05kln1	100%	0%
46	34.90	300.1W / 37.05kln1	100%	0%
47	35.70	300.1W / 37.05kln1	100%	0%
48	36.40	300.1W / 37.05kln1	100%	0%
49	37.20	300.1W / 37.05kln1	100%	0%
50	38.00	300.1W / 37.05kln1	100%	0%
51	38.70	300.1W / 37.05kln1	100%	0%
52	39.50	300.1W / 37.05kln1	100%	0%
53	40.30	300.1W / 37.05kln1	100%	0%
54	41.00	300.1W / 37.05kln1	100%	0%
55	41.80	300.1W / 37.05kln1	100%	0%
56	42.60	300.1W / 37.05kln1	100%	0%
57	43.40	300.1W / 37.05kln1	100%	0%
58	44.10	300.1W / 37.05kln1	100%	0%
59	44.90	300.1W / 37.05kln1	100%	0%
60	45.70	300.1W / 37.05kln1	100%	0%
61	46.40	300.1W / 37.05kln1	100%	0%
62	47.20	300.1W / 37.05kln1	100%	0%
63	48.00	300.1W / 37.05kln1	100%	0%
64	48.70	300.1W / 37.05kln1	100%	0%
65	49.50	300.1W / 37.05kln1	100%	0%
66	50.30	300.1W / 37.05kln1	100%	0%
67	51.10	300.1W / 37.05kln1	100%	0%
68	51.80	300.1W / 37.05kln1	100%	0%
69	52.60	300.1W / 37.05kln1	100%	0%
70	53.40	300.1W / 37.05kln1	100%	0%
71	54.10	300.1W / 37.05kln1	100%	0%
72	54.90	300.1W / 37.05kln1	100%	0%
73	55.70	300.1W / 37.05kln1	100%	0%
74	56.40	300.1W / 37.05kln1	100%	0%
75	57.20	300.1W / 37.05kln1	100%	0%
76	58.00	300.1W / 37.05kln1	100%	0%
77	58.80	300.1W / 37.05kln1	100%	0%
78	59.50	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
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 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

79	60.30	300.1W / 37.05kln1	100%	0%
80	61.10	300.1W / 37.05kln1	100%	0%
81	61.80	300.1W / 37.05kln1	100%	0%
82	62.60	300.1W / 37.05kln1	100%	0%
83	63.40	300.1W / 37.05kln1	100%	0%
84	64.10	300.1W / 37.05kln1	100%	0%
85	64.90	300.1W / 37.05kln1	100%	0%
86	65.70	300.1W / 37.05kln1	100%	0%
87	66.50	300.1W / 37.05kln1	100%	0%
88	67.20	300.1W / 37.05kln1	100%	0%
89	68.00	300.1W / 37.05kln1	100%	0%
90	68.80	300.1W / 37.05kln1	100%	0%
91	69.50	300.1W / 37.05kln1	100%	0%
92	70.30	300.1W / 37.05kln1	100%	0%
93	71.10	300.1W / 37.05kln1	100%	0%
94	71.80	300.1W / 37.05kln1	100%	0%
95	72.60	300.1W / 37.05kln1	100%	0%
96	73.40	300.1W / 37.05kln1	100%	0%
97	74.20	300.1W / 37.05kln1	100%	0%
98	74.90	300.1W / 37.05kln1	100%	0%
99	75.70	300.1W / 37.05kln1	100%	0%
100	76.50	300.1W / 37.05kln1	100%	0%
101	77.20	300.1W / 37.05kln1	100%	0%
102	78.00	300.1W / 37.05kln1	100%	0%
103	78.80	300.1W / 37.05kln1	100%	0%
104	79.50	300.1W / 37.05kln1	100%	0%
105	80.30	300.1W / 37.05kln1	100%	0%
106	81.10	300.1W / 37.05kln1	100%	0%
107	81.90	300.1W / 37.05kln1	100%	0%
108	82.60	300.1W / 37.05kln1	100%	0%
109	83.40	300.1W / 37.05kln1	100%	0%
110	84.20	300.1W / 37.05kln1	100%	0%
111	84.90	300.1W / 37.05kln1	100%	0%
112	85.70	300.1W / 37.05kln1	100%	0%
113	86.50	300.1W / 37.05kln1	100%	0%
114	87.20	300.1W / 37.05kln1	100%	0%
115	88.00	300.1W / 37.05kln1	100%	0%
116	88.80	300.1W / 37.05kln1	100%	0%
117	89.60	300.1W / 37.05kln1	100%	0%
118	90.30	300.1W / 37.05kln1	100%	0%
119	91.10	300.1W / 37.05kln1	100%	0%
120	91.90	300.1W / 37.05kln1	100%	0%
121	92.70	300.1W / 37.05kln1	100%	0%
122	93.50	300.1W / 37.05kln1	100%	0%
123	94.30	300.1W / 37.05kln1	100%	0%
124	95.10	300.1W / 37.05kln1	100%	0%
125	95.90	300.1W / 37.05kln1	100%	0%
126	96.70	300.1W / 37.05kln1	100%	0%
127	97.50	300.1W / 37.05kln1	100%	0%
128	98.40	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

129	99.20	300.1W / 37.05kln1	100%	0%
130	100.00	300.1W / 37.05kln1	100%	0%
131	100.90	300.1W / 37.05kln1	100%	0%
132	101.70	300.1W / 37.05kln1	100%	0%
133	102.60	300.1W / 37.05kln1	100%	0%
134	103.40	300.1W / 37.05kln1	100%	0%
135	104.30	300.1W / 37.05kln1	100%	0%
136	105.20	300.1W / 37.05kln1	100%	0%
137	106.10	300.1W / 37.05kln1	100%	0%
138	106.90	300.1W / 37.05kln1	100%	0%
139	107.80	300.1W / 37.05kln1	100%	0%
140	108.70	300.1W / 37.05kln1	100%	0%
141	109.60	300.1W / 37.05kln1	100%	0%
142	110.60	300.1W / 37.05kln1	100%	0%
143	111.50	300.1W / 37.05kln1	100%	0%
144	112.40	300.1W / 37.05kln1	100%	0%
145	113.30	300.1W / 37.05kln1	100%	0%
146	114.30	300.1W / 37.05kln1	100%	0%
147	115.20	300.1W / 37.05kln1	100%	0%
148	116.20	300.1W / 37.05kln1	100%	0%
149	117.20	300.1W / 37.05kln1	100%	0%
150	118.10	300.1W / 37.05kln1	100%	0%
151	119.10	300.1W / 37.05kln1	100%	0%
152	120.10	300.1W / 37.05kln1	100%	0%
153	121.10	300.1W / 37.05kln1	100%	0%
154	122.10	300.1W / 37.05kln1	100%	0%
155	123.20	300.1W / 37.05kln1	100%	0%
156	124.20	300.1W / 37.05kln1	100%	0%
157	125.20	300.1W / 37.05kln1	100%	0%
158	126.30	300.1W / 37.05kln1	100%	0%
159	127.30	300.1W / 37.05kln1	100%	0%
160	128.40	300.1W / 37.05kln1	100%	0%
161	129.50	300.1W / 37.05kln1	100%	0%
162	130.60	300.1W / 37.05kln1	100%	0%
163	131.70	300.1W / 37.05kln1	100%	0%
164	132.90	300.1W / 37.05kln1	100%	0%
165	134.00	300.1W / 37.05kln1	100%	0%
166	135.20	300.1W / 37.05kln1	100%	0%
167	136.30	300.1W / 37.05kln1	100%	0%
168	137.50	300.1W / 37.05kln1	100%	0%
169	138.70	300.1W / 37.05kln1	100%	0%
170	139.90	300.1W / 37.05kln1	100%	0%
171	141.20	300.1W / 37.05kln1	100%	0%
172	142.40	300.1W / 37.05kln1	100%	0%
173	143.70	300.1W / 37.05kln1	100%	0%
174	145.00	300.1W / 37.05kln1	100%	0%
175	146.30	300.1W / 37.05kln1	100%	0%
176	147.60	300.1W / 37.05kln1	100%	0%
177	149.00	300.1W / 37.05kln1	100%	0%
178	150.40	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

179	151.80	300.1W / 37.05kln1	100%	0%
180	153.20	300.1W / 37.05kln1	100%	0%
181	154.70	300.1W / 37.05kln1	100%	0%
182	156.20	300.1W / 37.05kln1	100%	0%
183	157.70	300.1W / 37.05kln1	100%	0%
184	159.30	300.1W / 37.05kln1	100%	0%
185	160.90	300.1W / 37.05kln1	100%	0%
186	162.50	300.1W / 37.05kln1	100%	0%
187	164.20	300.1W / 37.05kln1	100%	0%
188	165.90	300.1W / 37.05kln1	100%	0%
189	167.70	300.1W / 37.05kln1	100%	0%
190	169.50	300.1W / 37.05kln1	100%	0%
191	171.40	300.1W / 37.05kln1	100%	0%
192	173.40	300.1W / 37.05kln1	100%	0%
193	175.10	240W / 31.12klm 1	100%	0%
194	176.90	240W / 31.12klm 1	100%	0%
195	178.70	240W / 31.12klm 1	100%	0%
196	180.70	240W / 31.12klm 1	100%	0%
197	182.70	240W / 31.12klm 1	100%	0%
198	184.90	240W / 31.12klm 1	100%	0%
199	187.10	240W / 31.12klm 1	100%	0%
200	189.50	240W / 31.12klm 1	100%	0%
201	192.00	240W / 31.12klm 1	100%	0%
202	194.70	240W / 31.12klm 1	100%	0%
203	197.40	240W / 31.12klm 1	100%	0%
204	200.40	240W / 31.12klm 1	100%	0%
205	203.50	240W / 31.12klm 1	100%	0%
206	206.80	240W / 31.12klm 1	100%	0%
207	210.30	240W / 31.12klm 1	100%	0%
208	214.00	240W / 31.12klm 1	100%	0%
209	218.00	240W / 31.12klm 1	100%	0%
210	221.10	180.3W / 22.56kln1	100%	0%
211	224.20	180.3W / 22.56kln1	100%	0%
212	227.60	180.3W / 22.56kln1	100%	0%
213	231.10	180.3W / 22.56kln1	100%	0%
214	234.80	180.3W / 22.56kln1	100%	0%
215	238.70	180.3W / 22.56kln1	100%	0%
216	242.80	180.3W / 22.56kln1	100%	0%
217	247.10	180.3W / 22.56kln1	100%	0%
218	251.70	180.3W / 22.56kln1	100%	0%
219	256.50	180.3W / 22.56kln1	100%	0%
220	261.70	180.3W / 22.56kln1	100%	0%
221	267.10	180.3W / 22.56kln1	100%	0%
222	273.00	180.3W / 22.56kln1	100%	0%
223	277.10	120W / 14.96klm 1	100%	0%
224	281.40	120W / 14.96klm 1	100%	0%
225	285.80	120W / 14.96klm 1	100%	0%
226	290.50	120W / 14.96klm 1	100%	0%
227	295.50	120W / 14.96klm 1	100%	0%
228	300.60	120W / 14.96klm 1	100%	0%

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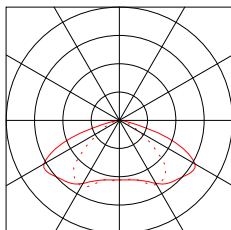
1.1 Description, Tunnel

1.1.2 Luminaire list

229	306.10	120W / 14.96klm	1	100%	0%
230	311.80	120W / 14.96klm	1	100%	0%
231	317.90	120W / 14.96klm	1	100%	0%
232	324.40	120W / 14.96klm	1	100%	0%
233	331.20	120W / 14.96klm	1	100%	0%
234	338.50	120W / 14.96klm	1	100%	0%
235	346.30	120W / 14.96klm	1	100%	0%
236	354.60	120W / 14.96klm	1	100%	0%
237	363.60	120W / 14.96klm	1	100%	0%
238	373.30	120W / 14.96klm	1	100%	0%
239	383.80	120W / 14.96klm	1	100%	0%
240	395.30	120W / 14.96klm	1	100%	0%
241	408.10	120W / 14.96klm	1	100%	0%
242	422.20	120W / 14.96klm	1	100%	0%
243	437.20	120W / 14.96klm	1	100%	0%
244	452.20	120W / 14.96klm	1	100%	0%
245	467.20	120W / 14.96klm	1	100%	0%
246	482.20	120W / 14.96klm	1	100%	0%
247	497.20	120W / 14.96klm	1	100%	0%

Interior LDC in use

Bajaj
 8 Order No. : s
 Luminaire name : E230315 BJTU S 162L NW SYM PC
 Equipment : 1 x Unknown 120 W / 14964 lm
 Maintenance factor: 0.85



Row of luminaires: Row 1.1

Number of luminaires: 817
 Basic position: x=0.00m y=2.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°
 System power (total): 98.0kW (16.33 km)
 Constant distance: 20.00m
 Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	120W / 14.96klm	2	100% 100%
2	20.00	120W / 14.96klm	2	100% 100%
3	40.00	120W / 14.96klm	2	100% 100%
4	60.00	120W / 14.96klm	2	100% 100%
5	80.00	120W / 14.96klm	2	100% 100%
6	100.00	120W / 14.96klm	2	100% 100%
7	120.00	120W / 14.96klm	2	100% 100%

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1.1 Description, Tunnel

1.1.2 Luminaire list

8	140.00	120W / 14.96klm 2	100%	100%
9	160.00	120W / 14.96klm 2	100%	100%
10	180.00	120W / 14.96klm 2	100%	100%
11	200.00	120W / 14.96klm 2	100%	100%
12	220.00	120W / 14.96klm 2	100%	100%
13	240.00	120W / 14.96klm 2	100%	100%
14	260.00	120W / 14.96klm 2	100%	100%
15	280.00	120W / 14.96klm 2	100%	100%
16	300.00	120W / 14.96klm 2	100%	100%
17	320.00	120W / 14.96klm 2	100%	100%
18	340.00	120W / 14.96klm 2	100%	100%
19	360.00	120W / 14.96klm 2	100%	100%
20	380.00	120W / 14.96klm 2	100%	100%
21	400.00	120W / 14.96klm 2	100%	100%
22	420.00	120W / 14.96klm 2	100%	100%
23	440.00	120W / 14.96klm 2	100%	100%
24	460.00	120W / 14.96klm 2	100%	100%
25	480.00	120W / 14.96klm 2	100%	100%
26	500.00	120W / 14.96klm 2	100%	100%
27	520.00	120W / 14.96klm 2	100%	100%
28	540.00	120W / 14.96klm 2	100%	100%
29	560.00	120W / 14.96klm 2	100%	100%
30	580.00	120W / 14.96klm 2	100%	100%
31	600.00	120W / 14.96klm 2	100%	100%
32	620.00	120W / 14.96klm 2	100%	100%
33	640.00	120W / 14.96klm 2	100%	100%
34	660.00	120W / 14.96klm 2	100%	100%
35	680.00	120W / 14.96klm 2	100%	100%
36	700.00	120W / 14.96klm 2	100%	100%
37	720.00	120W / 14.96klm 2	100%	100%
38	740.00	120W / 14.96klm 2	100%	100%
39	760.00	120W / 14.96klm 2	100%	100%
40	780.00	120W / 14.96klm 2	100%	100%
:	:	:	:	:
813	16240.00	120W / 14.96klm 2	100%	100%
814	16260.00	120W / 14.96klm 2	100%	100%
815	16280.00	120W / 14.96klm 2	100%	100%
816	16300.00	120W / 14.96klm 2	100%	100%
817	16320.00	120W / 14.96klm 2	100%	100%

Row of luminaires: Row 5.1

Number of luminaires: 791

Basic position: x=510.00m y=2.50m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 94.9kW (16.33 km)

Constant distance: 20.00m

Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	510.00	120W / 14.96klm 2	100%	100%
2	530.00	120W / 14.96klm 2	100%	100%
3	550.00	120W / 14.96klm 2	100%	100%
4	570.00	120W / 14.96klm 2	100%	100%

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 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

5	590.00	120W / 14.96klm	2	100%	100%
6	610.00	120W / 14.96klm	2	100%	100%
7	630.00	120W / 14.96klm	2	100%	100%
8	650.00	120W / 14.96klm	2	100%	100%
9	670.00	120W / 14.96klm	2	100%	100%
10	690.00	120W / 14.96klm	2	100%	100%
11	710.00	120W / 14.96klm	2	100%	100%
12	730.00	120W / 14.96klm	2	100%	100%
13	750.00	120W / 14.96klm	2	100%	100%
14	770.00	120W / 14.96klm	2	100%	100%
15	790.00	120W / 14.96klm	2	100%	100%
16	810.00	120W / 14.96klm	2	100%	100%
:	:	:	:	:	:
787	16230.00	120W / 14.96klm	2	100%	100%
788	16250.00	120W / 14.96klm	2	100%	100%
789	16270.00	120W / 14.96klm	2	100%	100%
790	16290.00	120W / 14.96klm	2	100%	100%
791	16310.00	120W / 14.96klm	2	100%	100%

Row of luminaires: Row 2.1

Number of luminaires: 816
 Basic position: x=10.00m y=8.00m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 97.9kW (16.33 km)
 Constant distance: 20.00m
 Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	10.00	120W / 14.96klm	2	100% 100%
2	30.00	120W / 14.96klm	2	100% 100%
3	50.00	120W / 14.96klm	2	100% 100%
4	70.00	120W / 14.96klm	2	100% 100%
5	90.00	120W / 14.96klm	2	100% 100%
6	110.00	120W / 14.96klm	2	100% 100%
7	130.00	120W / 14.96klm	2	100% 100%
8	150.00	120W / 14.96klm	2	100% 100%
9	170.00	120W / 14.96klm	2	100% 100%
10	190.00	120W / 14.96klm	2	100% 100%
11	210.00	120W / 14.96klm	2	100% 100%
12	230.00	120W / 14.96klm	2	100% 100%
13	250.00	120W / 14.96klm	2	100% 100%
14	270.00	120W / 14.96klm	2	100% 100%
15	290.00	120W / 14.96klm	2	100% 100%
16	310.00	120W / 14.96klm	2	100% 100%
17	330.00	120W / 14.96klm	2	100% 100%
18	350.00	120W / 14.96klm	2	100% 100%
19	370.00	120W / 14.96klm	2	100% 100%
20	390.00	120W / 14.96klm	2	100% 100%
21	410.00	120W / 14.96klm	2	100% 100%
22	430.00	120W / 14.96klm	2	100% 100%
23	450.00	120W / 14.96klm	2	100% 100%
24	470.00	120W / 14.96klm	2	100% 100%
25	490.00	120W / 14.96klm	2	100% 100%

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 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

26	510.00	120W / 14.96klm 2	100%	100%
27	530.00	120W / 14.96klm 2	100%	100%
28	550.00	120W / 14.96klm 2	100%	100%
29	570.00	120W / 14.96klm 2	100%	100%
30	590.00	120W / 14.96klm 2	100%	100%
31	610.00	120W / 14.96klm 2	100%	100%
32	630.00	120W / 14.96klm 2	100%	100%
33	650.00	120W / 14.96klm 2	100%	100%
34	670.00	120W / 14.96klm 2	100%	100%
35	690.00	120W / 14.96klm 2	100%	100%
36	710.00	120W / 14.96klm 2	100%	100%
37	730.00	120W / 14.96klm 2	100%	100%
38	750.00	120W / 14.96klm 2	100%	100%
39	770.00	120W / 14.96klm 2	100%	100%
40	790.00	120W / 14.96klm 2	100%	100%
:	:	:	:	:
812	16230.00	120W / 14.96klm 2	100%	100%
813	16250.00	120W / 14.96klm 2	100%	100%
814	16270.00	120W / 14.96klm 2	100%	100%
815	16290.00	120W / 14.96klm 2	100%	100%
816	16310.00	120W / 14.96klm 2	100%	100%

Row of luminaires: Row 6.1

Number of luminaires: 791

Basic position: x=520.00m y=8.00m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 94.9kW (16.33 km)

Constant distance: 20.00m

Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	520.00	120W / 14.96klm 2	100%	100%
2	540.00	120W / 14.96klm 2	100%	100%
3	560.00	120W / 14.96klm 2	100%	100%
4	580.00	120W / 14.96klm 2	100%	100%
5	600.00	120W / 14.96klm 2	100%	100%
6	620.00	120W / 14.96klm 2	100%	100%
7	640.00	120W / 14.96klm 2	100%	100%
8	660.00	120W / 14.96klm 2	100%	100%
9	680.00	120W / 14.96klm 2	100%	100%
10	700.00	120W / 14.96klm 2	100%	100%
11	720.00	120W / 14.96klm 2	100%	100%
12	740.00	120W / 14.96klm 2	100%	100%
13	760.00	120W / 14.96klm 2	100%	100%
14	780.00	120W / 14.96klm 2	100%	100%
15	800.00	120W / 14.96klm 2	100%	100%
:	:	:	:	:
787	16240.00	120W / 14.96klm 2	100%	100%
788	16260.00	120W / 14.96klm 2	100%	100%
789	16280.00	120W / 14.96klm 2	100%	100%
790	16300.00	120W / 14.96klm 2	100%	100%
791	16320.00	120W / 14.96klm 2	100%	100%

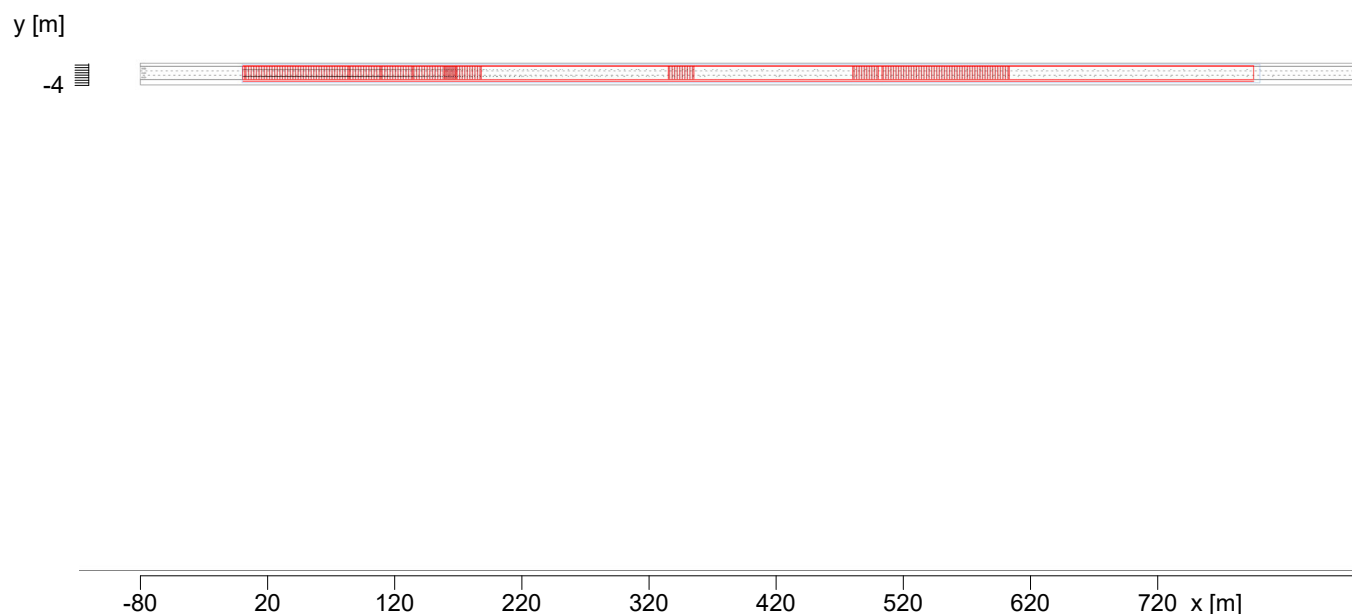
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Date : 23.09.2024

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1.1 Description, Tunnel

1.1.3 Floor plan



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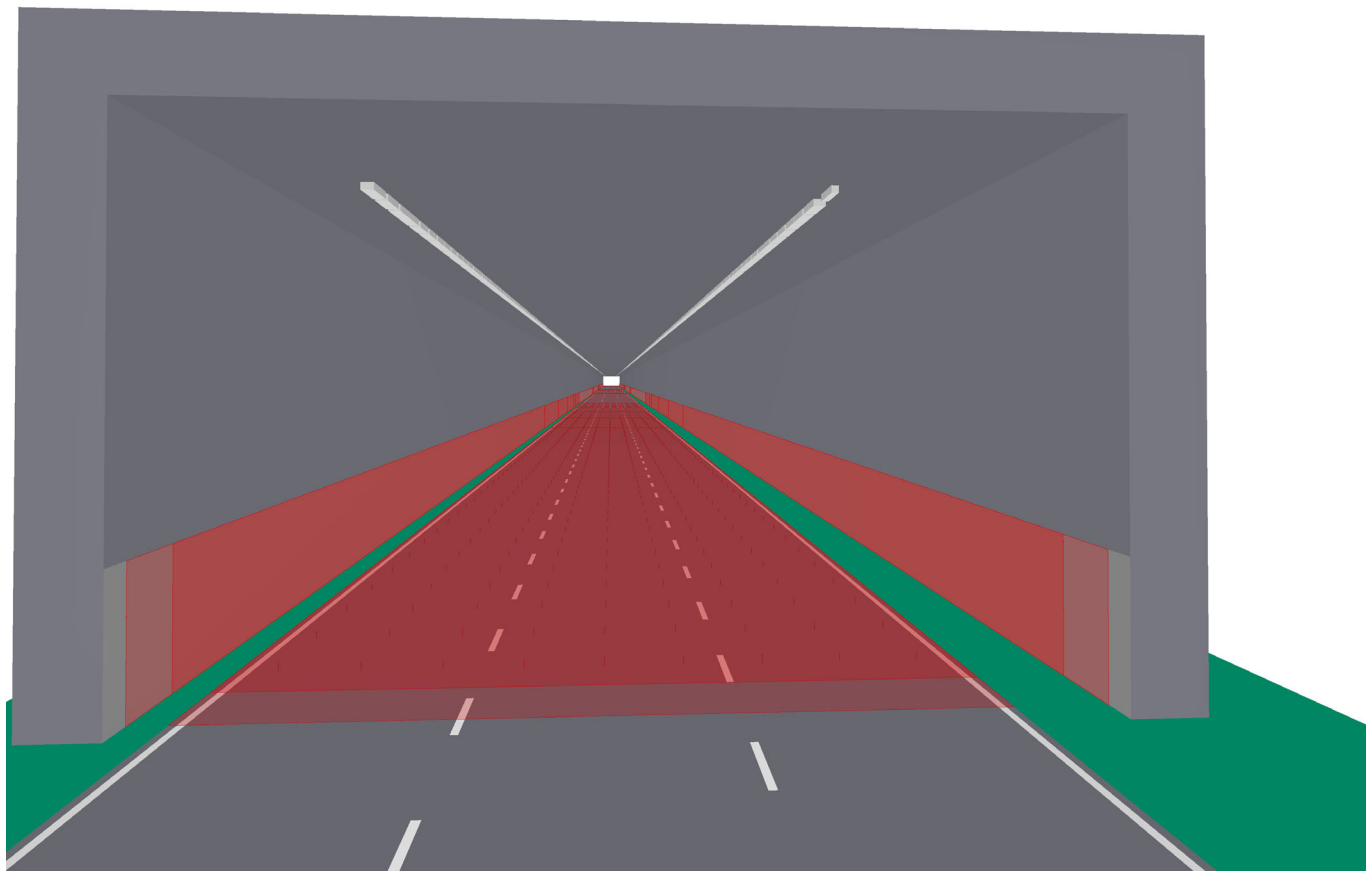
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1.1 Description, Tunnel

1.1.4 3D view, View 1



Handwritten signatures:
1. *Shubh*
2. *Adar*
3. *Rob*
4. *CSA Son*
5. *Sanjay Kumar*

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Installation : MAIN TUNNEL 16.32KM
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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.60 m - 795.16 m Points: nx = 382, ny = 9, nz = 3

Observer (starting point coordinate) : x = -84.29 m; z = 1.50 m dx = 85.93 m (moving)

y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

TH1

Measuring range: 2.00 m - 84.00 m Points: nx = 40, ny = 9, nz = 3

Observer (starting point coordinate) : x = -58.00 m; z = 1.50 m dx = 61.03 m (fix)

y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

$\bar{E}_m$	:	397.51 cd/m ²	397.60 cd/m ²	397.41 cd/m ²	
U _o	L _{min} / $\bar{E}_m$	: 0.55	0.54	0.52	0.4
U _i	L _{i,min} /L _{i,max}	: 0.66	0.67	0.67	0.6
f _{TI,max}	Max.	: 2 %	2 %	2 %	

Wall left (diffus 30%)

$\bar{E}_m$: 279.56 cd/m²
U_o L_{min}/ $\bar{E}_m$: 0.61
L_{wall}/L_{fsp} : 0.76

Wall right (diffus 30%)

$\bar{E}_m$: 261.06 cd/m²
U_o L_{min}/ $\bar{E}_m$: 0.59
L_{wall}/L_{fsp} : 0.70

Illuminance

Roadway

$\bar{E}_m$ 4967.15 lx
U_o E_{min}/ $\bar{E}_m$: 0.55

Wall left

$\bar{E}_m$ 2928.64 lx
U_o E_{min}/ $\bar{E}_m$: 0.61

Wall right

$\bar{E}_m$ 2735.11 lx
U_o E_{min}/ $\bar{E}_m$: 0.59

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Shirley Harris

RELUX®

RELUX®

Shane
~~Adai~~
Rob
Chris
Scott
Wah

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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TR 1 START

Measuring range: 168.00 m - 188.00 m Points: nx = 10, ny = 9, nz = 3
Observer (starting point coordinate) : x = 108.00 m; z = 1.50 m dx = 61.00 m (fix)
y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	145.98 cd/m ²	146.04 cd/m ²	145.95 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.68	0.68	0.67	0.4
U _i	L _{i,min} /L _{i,max}	: 0.70	0.70	0.70	0.6
f _{TI,max}	Max.	: 2 %	2 %	2 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	102.90 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.73
L _{wall} /L _{fsp}	:	0.76

Wall right (diffus 30%)

$\bar{L}_m$	:	96.36 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.72
L _{wall} /L _{fsp}	:	0.71

Illuminance

Roadway

$\bar{E}_m$	:	1839.99 lx
U _o	E _{min} / $\bar{E}_m$	: 0.67

Wall left

$\bar{E}_m$	:	1078.67 lx
U _o	E _{min} / $\bar{E}_m$	: 0.73

Wall right

$\bar{E}_m$	:	1010.33 lx
U _o	E _{min} / $\bar{E}_m$	: 0.72

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Lincoln
~~Adair~~
Robb
McAdams
Adair

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Lincoln
~~Adair~~
Robb
McAdams
Adair

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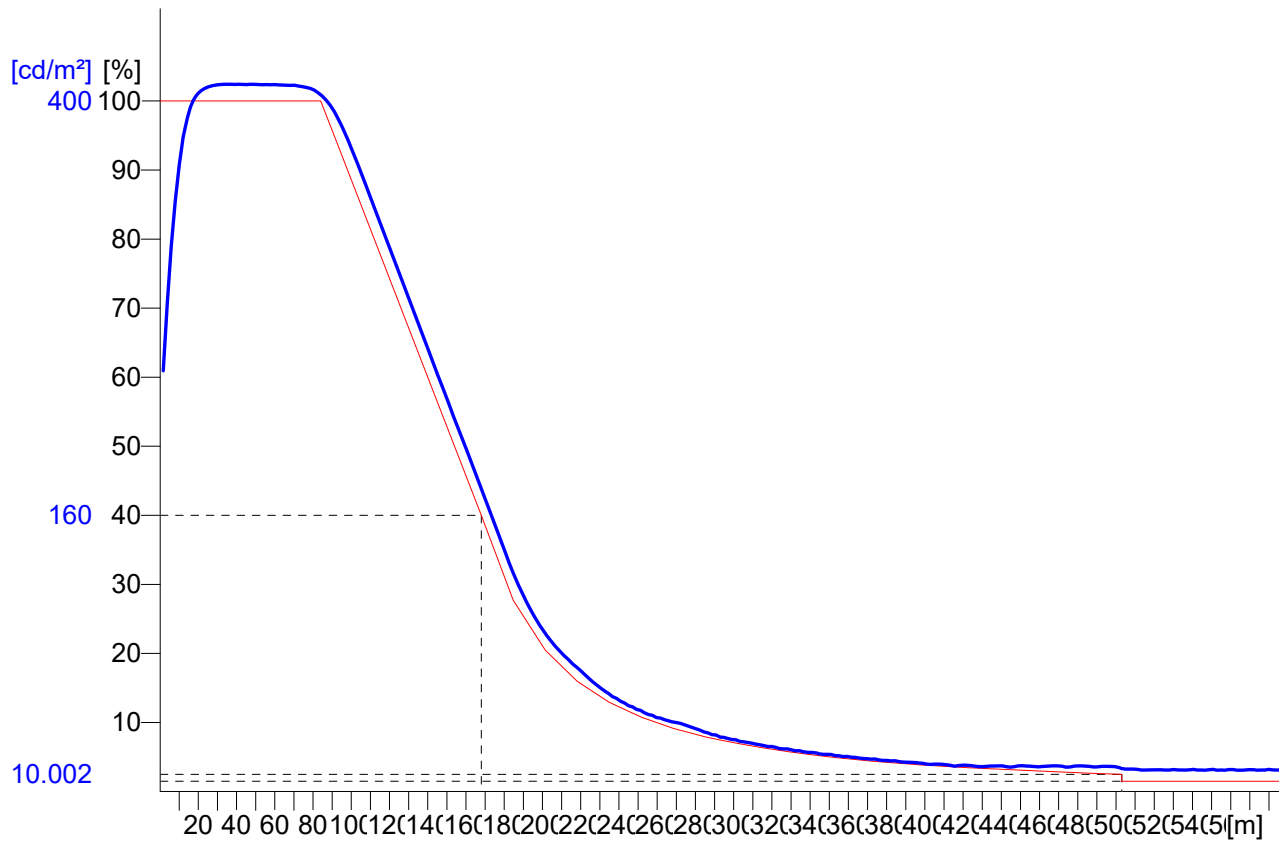
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Robb
McAdams
Adair

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1.2 Calculation results, Tunnel

1.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -84.3, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

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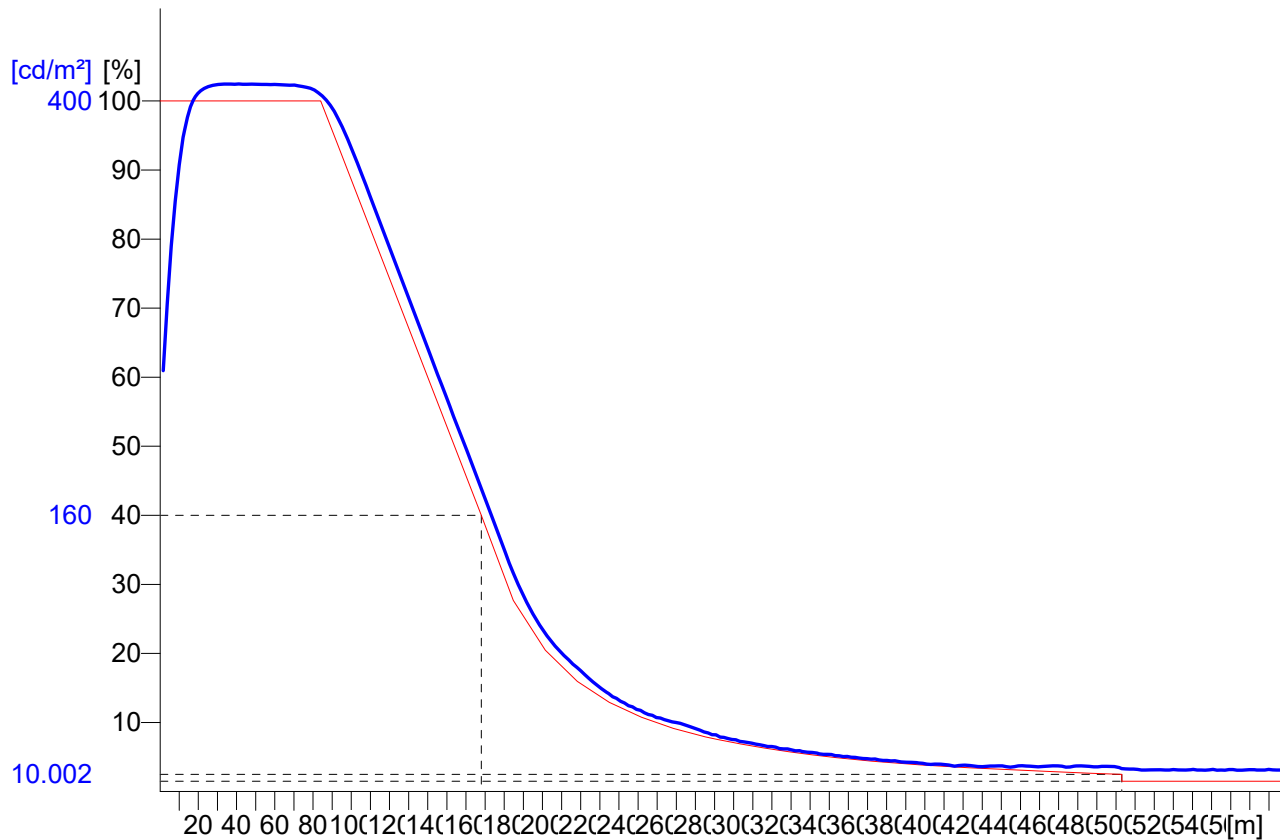
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Object : BBMP ROAD TUNNEL PROJECT
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 Project number : 81942
 Date : 23.09.2024



1.2 Calculation results, Tunnel

1.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



Observer location 2 : x = -84.3, y = 5.25, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

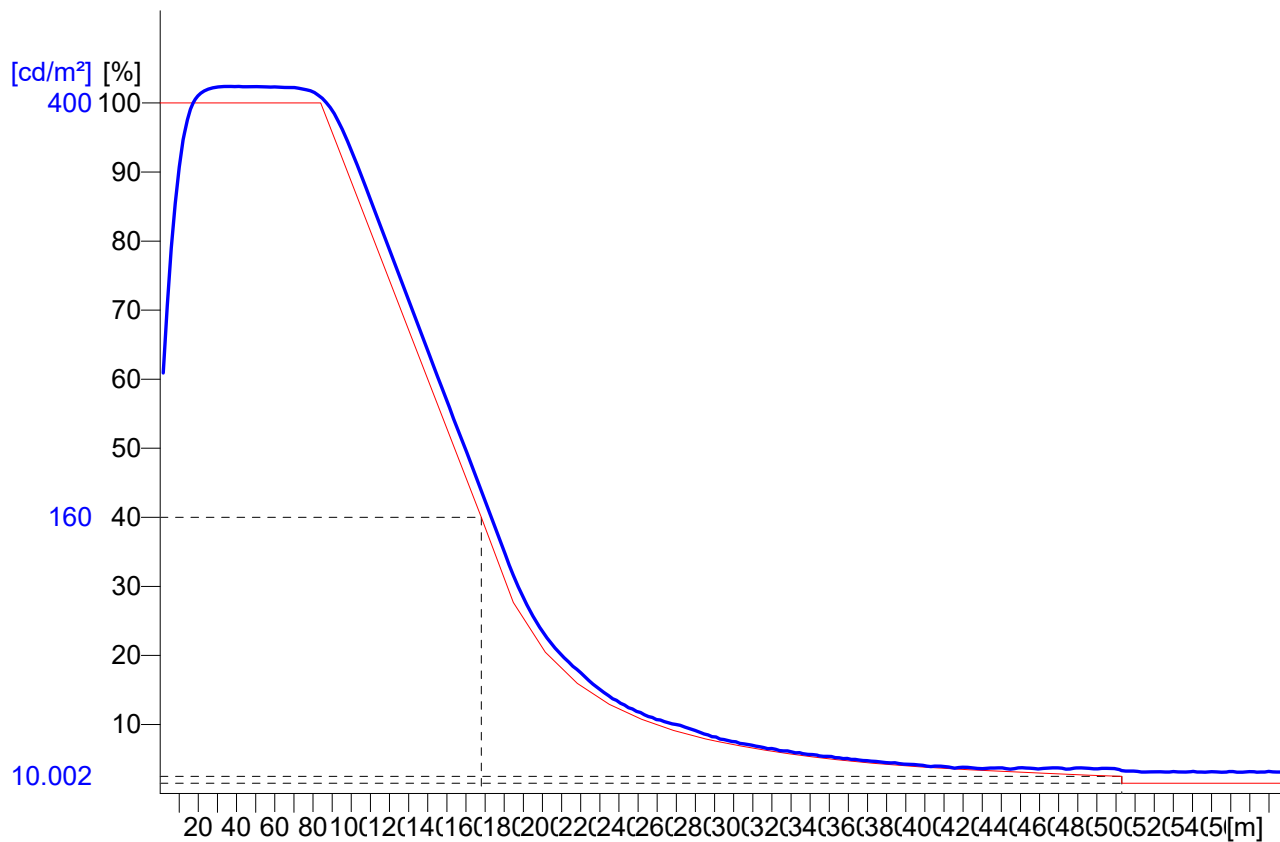
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
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1.2 Calculation results, Tunnel

1.2.4 Evolution, Adaptation (L), S1: 100%, Obs. 3



Observer location 3 : x = -84.3, y = 8.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

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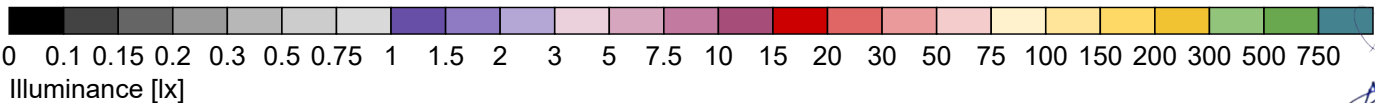
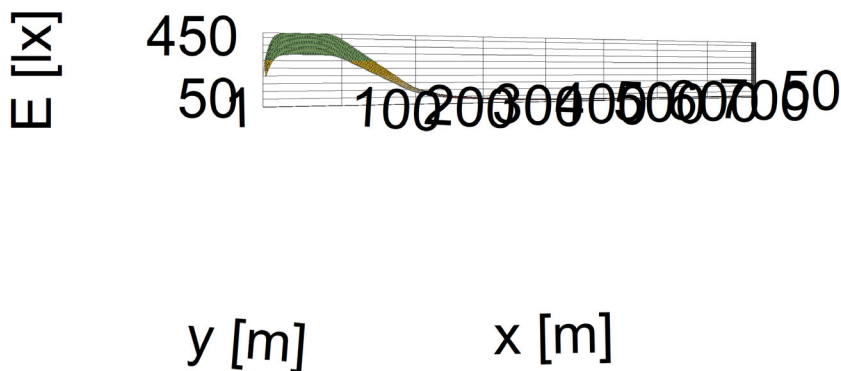
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1 Tunnel

1.3 Calculation results, Tunnel

1.3.1 3D mountain plot, Adaptation (L), S1: 100%, Obs. 1



Illuminance [lx]

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1. *[Signature]*
2. *[Signature]*
3. *[Signature]*
4. *[Signature]*

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1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

[m]	220	250	274	293	309	320	328	333	336	338	340	342	342	343	343	343
9.92	247	280	306	327	344	356	364	369	373	376	377	379	380	380	381	381
8.75	277	313	341	364	382	394	403	409	413	415	416	418	418	419	419	419
7.58	304	343	374	399	418	432	441	447	451	453	455	456	456	457	457	457
6.42	322	363	396	421	441	455	464	471	474	477	478	479	479	[480]	[480]	[480]
5.25	305	344	376	401	421	435	444	450	454	456	457	458	459	459	460	459
4.08	281	316	345	368	387	400	409	415	419	421	422	423	423	424	424	424
2.92	253	284	310	331	348	360	369	375	378	381	382	382	383	383	384	384
1.75	(219)	247	270	289	305	317	325	331	334	336	338	338	339	339	339	340
0.58	3.03	5.07	7.12	9.18	11.23	13.27	15.32	17.38	19.42	21.48	23.52	25.58	27.62	29.67	31.73	33.78



Part1

Observer location 1 : x = -58, y = 1.75, z = 1.5 (dx = 61.03)
Average luminance $\bar{L}_m$: 398 cd/m²
Minimum luminance L_{min} : 219 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.55
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.66

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Signature 5

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1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

343	343	343	343	344	344	344	345	344	344	344	344	344	344	345	345
381	381	381	381	381	382	382	382	382	382	382	382	382	382	382	383
419	419	420	420	420	420	420	420	420	420	420	420	420	420	420	420
457	457	457	457	457	457	457	458	457	457	457	457	458	457	457	457
[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	[480]	479	479
460	459	460	460	460	459	459	460	459	459	459	459	459	459	459	459
424	424	424	424	424	424	424	424	424	424	424	424	424	424	423	423
384	384	384	384	384	383	383	384	383	383	384	384	384	384	383	383
340	340	340	340	340	340	339	340	340	340	340	340	340	340	340	339
35.83	37.88	39.92	41.97	44.03	46.08	48.12	50.17	52.22	54.28	56.33	58.38	60.42	62.47	64.53	66.57



Part2

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

345	345	345	344	343	343	342	340
383	383	382	382	381	381	380	378
420	420	420	419	418	418	417	415
457	457	456	456	455	455	453	451
479	479	479	478	478	477	476	474
459	459	458	458	457	457	455	453
423	423	423	422	422	421	420	418
383	383	382	382	382	381	380	378
339	339	339	339	339	338	337	336
68.62	70.68	72.72	74.78	76.82	78.88	80.93	82.97

[m]



Part3

[Handwritten signatures]

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1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

[m]	2900	3320	3650	3880	4040	4140	4190	4230	4250	4270	4280	4290	4300
9.92	3210	3680	4030	4290	4460	4570	4630	4670	4690	4710	4720	4730	4740
8.75	3540	4070	4460	4750	4940	5060	5120	5160	5190	5210	5220	5230	5240
7.58	3830	4410	4850	5160	5380	5510	5580	5630	5660	5670	5680	5690	5700
6.42	4020	4640	5100	5440	5660	5800	5880	5930	5960	5970	5980	5990	5990
5.25	3830	4410	4860	5180	5400	5530	5610	5670	5700	5710	5720	5720	5720
4.08	3500	4030	4430	4720	4920	5050	5140	5190	5220	5240	5240	5230	5230
2.92	3120	3590	3940	4200	4390	4510	4590	4640	4680	4690	4690	4690	4690
1.75	(2730)	3140	3460	3690	3860	3980	4060	4110	4140	4150	4150	4150	4150
0.58	3.03	5.07	7.12	9.18	11.23	13.27	15.32	17.38	19.42	21.48	23.52	25.58	27.62
	Illuminance [lx]												



Part1

Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 4970 lx
Minimum illuminance	E_{min} : 2730 lx
Maximum illuminance	E_{max} : 6000 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.82 (0.55)
Diversity U_d	E_{min}/E_{max} : 1 : 2.2 (0.46)

[Handwritten signatures]

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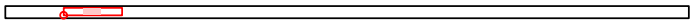
Object : BBMP ROAD TUNNEL PROJECT
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Project number : 81942
Date : 23.09.2024



1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

4310	4310	4300	4290	4290	4290	4290	4290	4300	4310	4310	4310	4300
4750	4750	4740	4730	4730	4730	4730	4730	4740	4750	4750	4750	4740
5250	5250	5240	5230	5230	5230	5230	5230	5240	5250	5250	5250	5240
5710	5700	5700	5700	5700	5700	5700	5700	5700	5710	5710	5710	5700
[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]
5730	5730	5730	5730	5740	5740	5740	5730	5730	5730	5730	5730	5730
5240	5240	5240	5250	5260	5260	5260	5250	5240	5240	5240	5240	5250
4690	4690	4690	4700	4710	4720	4710	4700	4690	4690	4690	4690	4700
4150	4150	4160	4170	4170	4180	4180	4170	4160	4150	4150	4160	4160
29.67	31.73	33.78	35.83	37.88	39.92	41.97	44.03	46.08	48.12	50.17	52.22	54.28
												5



Part2

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
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Project number : 81942
Date : 23.09.2024



1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

4290	4290	4290	4290	4300	4300	4310	4310	4310	4290	4290	4280	4270	4260
4730	4730	4730	4730	4740	4740	4750	4750	4740	4730	4720	4720	4710	4700
5230	5230	5230	5230	5230	5240	5250	5250	5240	5230	5220	5220	5210	5200
5700	5700	5700	5700	5700	5700	5710	5710	5700	5700	5690	5690	5680	5660
[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	[6000]	5990	5990	5990	5980	5960
5740	5740	5740	5740	5730	5730	5730	5730	5730	5730	5730	5730	5720	5700
5250	5260	5260	5260	5250	5240	5240	5240	5240	5240	5250	5250	5240	5220
4710	4710	4720	4710	4700	4690	4690	4690	4690	4690	4700	4700	4700	4680
4170	4180	4180	4170	4170	4160	4150	4150	4150	4160	4170	4170	4160	4140
6.33	58.38	60.42	62.47	64.53	66.57	68.62	70.68	72.72	74.78	76.82	78.88	80.93	82.97



Part3

[Handwritten signatures]

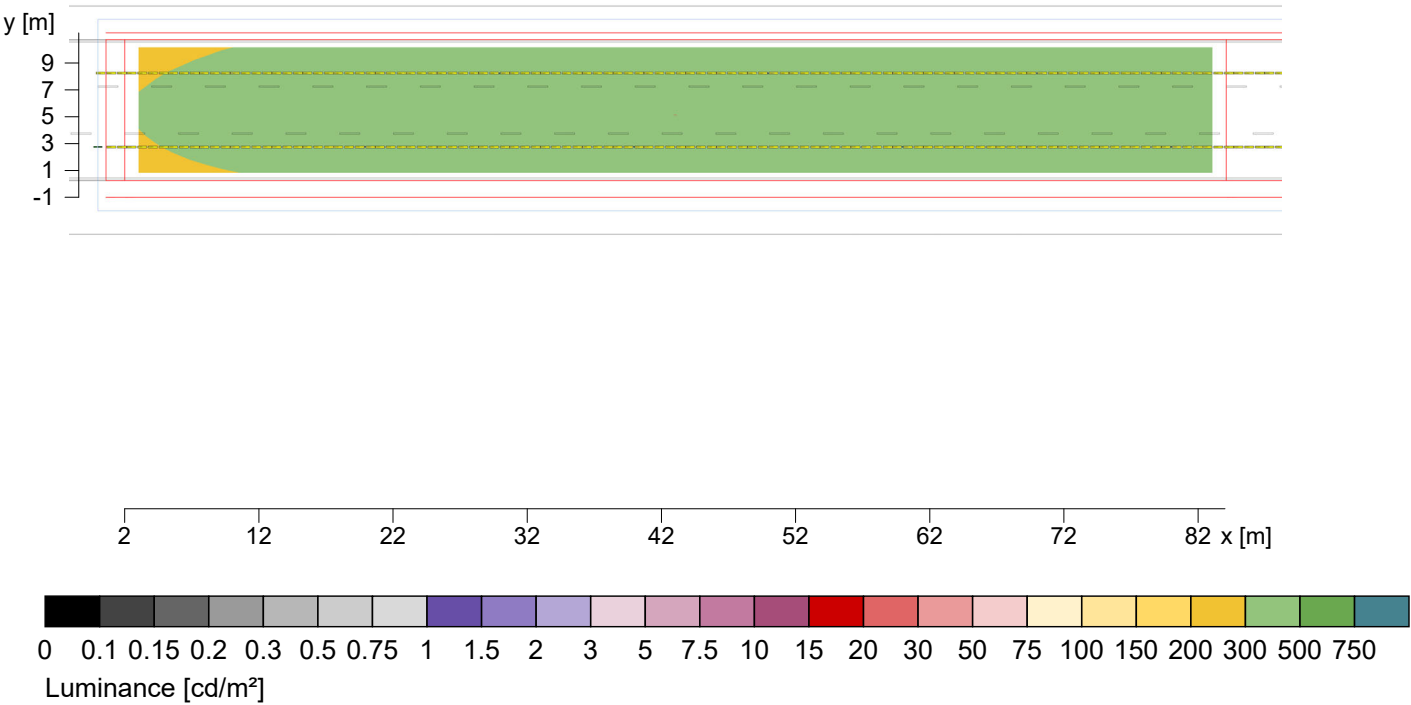
-please put your own address here-

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1.4 Calculation results, Tunnel

1.4.3 Pseudo colours, TH1 (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: $x = -58, y = 1.75, z = 1.5 (dx = 6)$
 L_{min} : 398 cd/m²
 $L_{min}/\bar{L}_m$: 219 cd/m²
 $L_{l,min}/L_{l,max}$: 0.55
: 0.66

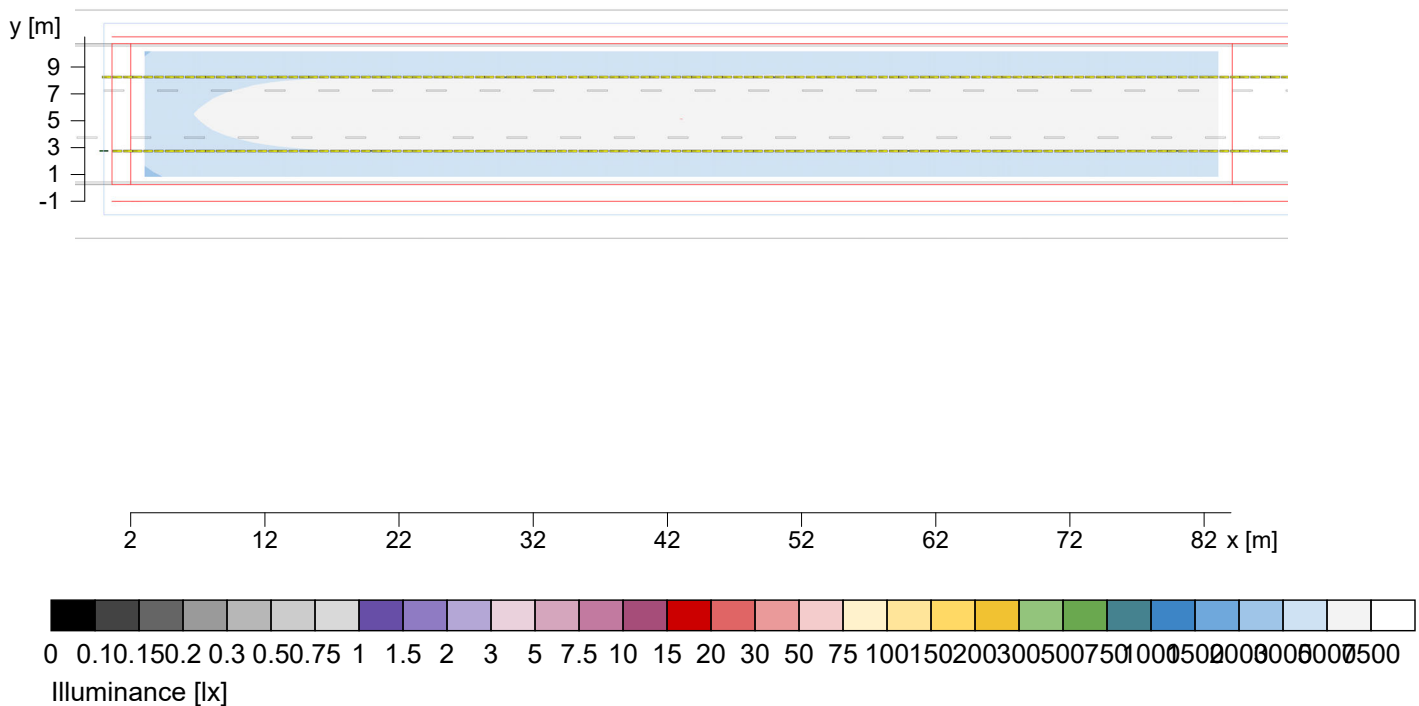
[Handwritten signatures]

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1.4 Calculation results, Tunnel

1.4.4 Pseudo colours, TH1 (E), S1: 100%



Height reference plane
Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 4970 lx
 E_{max} : 2730 lx
 $E_{min}/\bar{E}_m$: 6000 lx
 $E_{min}/\bar{E}_m$: 1 : 1.82 (0.55)
 E_{min}/E_{max} : 1 : 2.2 (0.46)

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1 Tunnel

1.5 Calculation results, Tunnel

1.5.1 Table, TH2 (L), S1: 100%, Obs. 1

[m]	335	334	332	329	326	322	317	313	308	303	299	294
9.92	371	369	367	364	360	356	351	347	341	336	331	325
8.75	410	408	405	402	398	393	387	382	376	370	364	358
7.58	448	445	442	438	433	428	422	417	410	404	397	390
6.42	472	470	466	462	456	451	444	438	431	424	417	410
5.25	451	449	445	441	436	431	425	419	412	406	399	392
4.08	416	414	411	407	402	398	392	387	381	375	368	362
2.92	376	374	371	368	364	360	355	350	344	339	333	327
1.75	333	331	328	325	322	319	314	310	305	300	295	(290)
0.58	85.04	87.12	89.21	91.29	93.38	95.46	97.54	99.62	101.71	103.79	105.88	107.96



Observer location 1 : x = 24, y = 1.75, z = 1.5 (dx = 61.04)
Average luminance $\bar{L}_m$: 379 cd/m²
Minimum luminance L_{min} : 290 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.76
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.87

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1.5 Calculation results, Tunnel

1.5.2 Table, TH2 (E), S1: 100%

[m]	4250	4240	4220	4180	4130	4070	4000	3940	3880	3820	3770	3710
9.92	4690	4670	4650	4600	4550	4480	4410	4350	4280	4210	4150	4090
8.75	5180	5170	5140	5090	5030	4960	4880	4810	4730	4660	4590	4520
7.58	5640	5620	5580	5530	5470	5400	5320	5240	5160	5080	4990	4910
6.42	[5940]	5910	5870	5820	5750	5680	5600	5520	5430	5340	5250	5160
5.25	5680	5650	5610	5560	5490	5430	5350	5280	5190	5110	5020	4930
4.08	5190	5160	5130	5080	5020	4970	4910	4840	4760	4680	4590	4510
2.92	4650	4620	4590	4540	4500	4450	4400	4340	4270	4190	4110	4040
1.75	4120	4090	4060	4020	3980	3940	3890	3840	3780	3710	3640	(3570)
0.58	85.04	87.12	89.21	91.29	93.38	95.46	97.54	99.62	101.71	103.79	105.88	107.96
	Illuminance [lx]											



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 4760 lx
Minimum illuminance	E_{min} : 3570 lx
Maximum illuminance	E_{max} : 5940 lx
Uniformity U_o	$E_{min}/\bar{E}_m$: 1 : 1.33 (0.75)
Diversity U_d	E_{min}/E_{max} : 1 : 1.66 (0.6)

[Handwritten signatures]

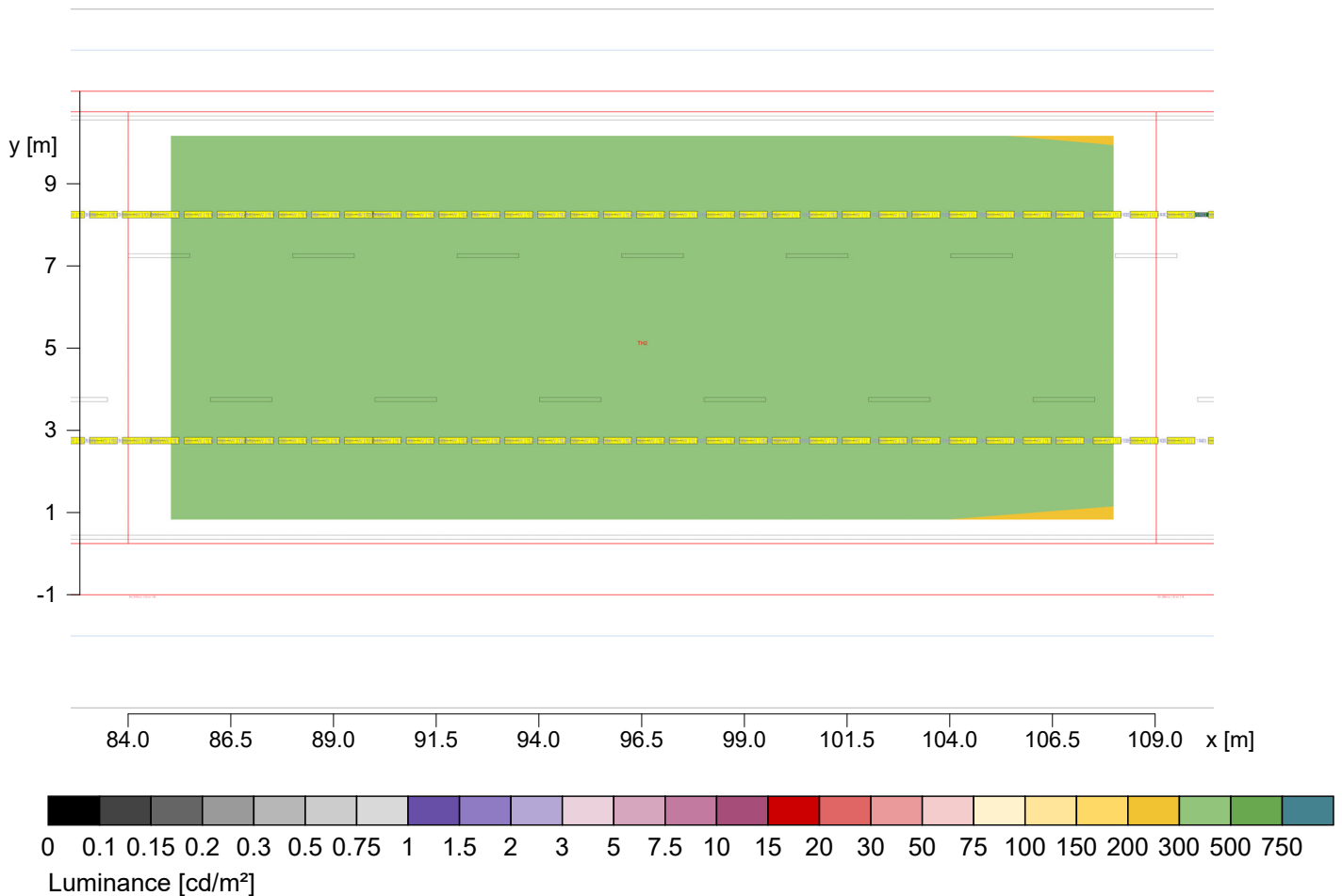
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1.5 Calculation results, Tunnel

1.5.3 Pseudo colours, TH2 (L), S1: 100%, Obs. 1



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1.5.4 Pseudo colours, TH2 (E), S1: 100%



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~~Adai~~
Robo
Em. Soro
Adai

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1 Tunnel

1.6 Calculation results, Tunnel

1.6.1 Table, TH3 (L), S1: 100%, Obs. 1

[m]	288	283	278	273	268	263	258	253	249	244	238	233
9.92	318	313	307	301	296	291	285	280	275	269	264	258
8.75	351	345	339	333	327	321	314	308	302	296	290	283
7.58	383	376	369	363	356	350	342	336	329	322	316	309
6.42	[403]	396	389	382	375	368	360	353	346	339	332	324
5.25	386	379	372	365	358	352	345	338	331	324	318	310
4.08	356	349	343	337	331	325	318	312	305	299	293	286
2.92	322	316	310	305	299	294	288	282	276	270	265	259
1.75	285	280	275	271	265	260	255	250	245	240	235	(229)
0.58	110.04	112.12	114.21	116.29	118.38	120.46	122.54	124.62	126.71	128.79	130.88	132.96



Observer location 1 : x = 49, y = 1.75, z = 1.5 (dx = 61.04)
Average luminance $\bar{L}_m$: 310 cd/m²
Minimum luminance L_{min} : 229 cd/m²
Overall uniformity U_o : 0.74
Longitudinal uniformity U_l : 0.8

[Handwritten signatures]

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1.6 Calculation results, Tunnel

1.6.2 Table, TH3 (E), S1: 100%

[m]	3650	3580	3510	3440	3370	3310	3250	3190	3130	3080	3010	2940
9.92	4020	3950	3870	3790	3720	3650	3580	3520	3450	3390	3320	3240
8.75	4440	4360	4280	4190	4110	4040	3960	3890	3820	3740	3670	3580
7.58	4830	4740	4650	4570	4490	4400	4310	4230	4150	4070	3980	3900
6.42	[5080]	4990	4890	4810	4720	4630	4540	4450	4370	4280	4190	4100
5.25	4850	4760	4680	4600	4520	4430	4340	4260	4170	4080	4000	3910
4.08	4430	4350	4280	4210	4140	4070	3980	3900	3810	3730	3650	3570
2.92	3960	3900	3830	3770	3710	3640	3570	3490	3410	3340	3270	3200
1.75	3510	3450	3400	3350	3290	3230	3160	3090	3020	2960	2890	(2830)
0.58	110.04	112.12	114.21	116.29	118.38	120.46	122.54	124.62	126.71	128.79	130.88	132.96
	Illuminance [lx]											



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3890 lx
Minimum illuminance	E_{min} : 2830 lx
Maximum illuminance	E_{max} : 5080 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.37 (0.73)
Diversity U_d	E_{min}/E_{max} : 1 : 1.79 (0.56)

[Handwritten signatures]

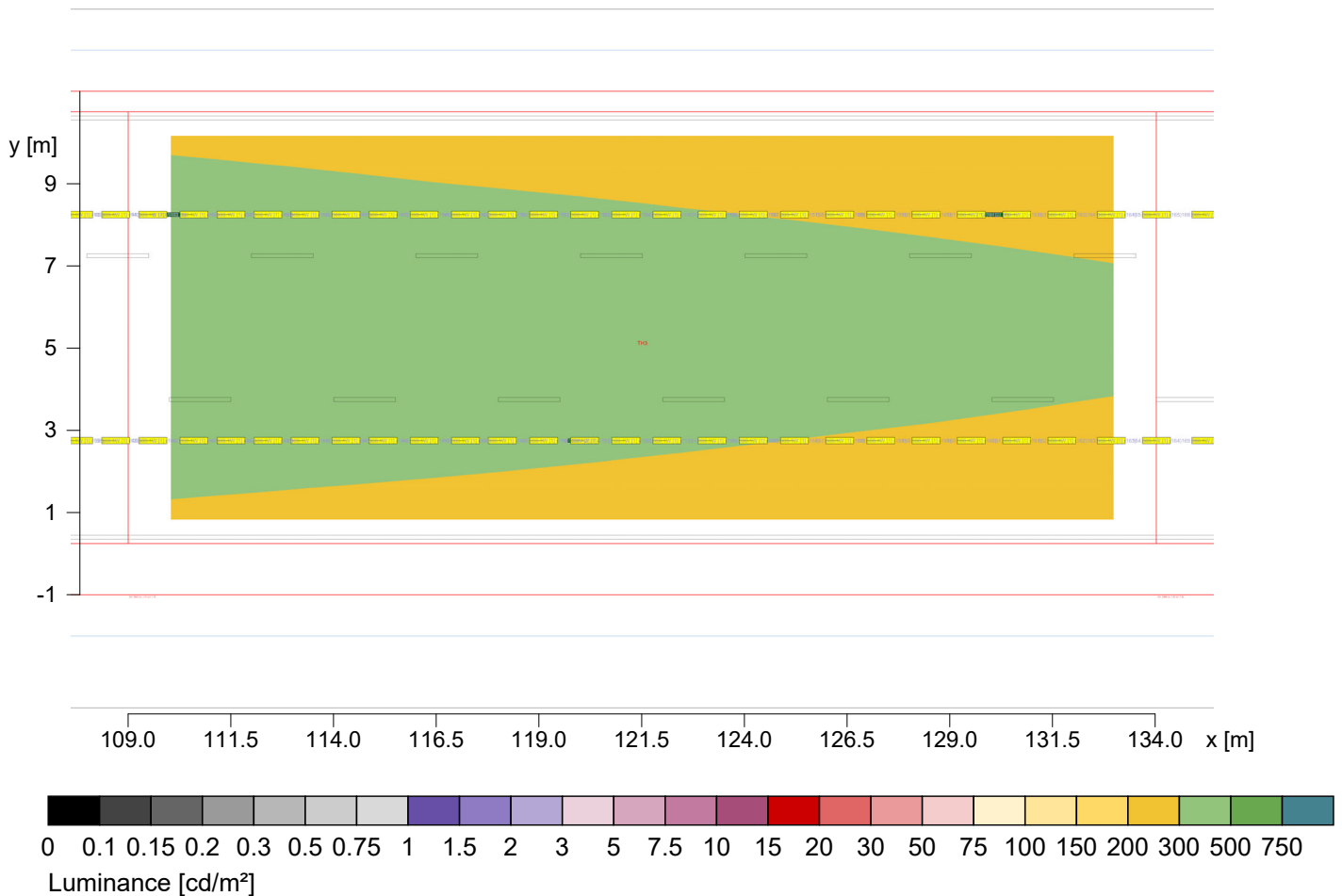
-please put your own address here-

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1.6 Calculation results, Tunnel

1.6.3 Pseudo colours, TH3 (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: $x = 49, y = 1.75, z = 1.5$ (dx = 6) : 310 cd/m²
 L_{min} : 229 cd/m²
 $L_{min}/\bar{L}_m$: 0.74
 $L_{l,min}/L_{l,max}$: 0.8

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1.6.4 Pseudo colours, TH3 (E), S1: 100%



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Robo
Em. Soro
Adai

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1 Tunnel

1.7 Calculation results, Tunnel

1.7.1 Table, TH4 (L), S1: 100%, Obs. 1

[m]	227	222	217	212	207	203	197	193	188	182	177	171
9.92	250	245	240	234	229	223	218	213	207	201	195	190
8.75	277	270	264	258	252	246	240	234	228	221	215	209
7.58	302	295	288	282	275	268	261	255	248	241	234	227
6.42	318	310	303	296	289	282	274	268	260	253	246	239
5.25	304	297	290	283	276	269	263	256	249	242	236	229
4.08	280	274	268	262	255	248	242	236	230	223	217	211
2.92	253	248	242	237	231	225	219	214	208	202	197	191
1.75	225	220	215	210	205	200	194	189	184	179	175	(170)
0.58	135.04	137.12	139.21	141.29	143.38	145.46	147.54	149.62	151.71	153.79	155.88	157.96



Observer location 1 : x = 74, y = 1.75, z = 1.5 (dx = 61.04)
Average luminance $\bar{L}_m$: 237 cd/m²
Minimum luminance L_{min} : 170 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.72
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.75

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1.7 Calculation results, Tunnel

1.7.2 Table, TH4 (E), S1: 100%

[m]	2870	2800	2730	2670	2610	2550	2500	2440	2370	2300	2230	2160
9.92	3160	3080	3010	2940	2870	2810	2750	2690	2610	2530	2460	2380
8.75	3490	3410	3330	3260	3180	3110	3040	2970	2890	2800	2720	2630
7.58	3810	3720	3640	3550	3470	3380	3300	3220	3130	3050	2960	2870
6.42	[4000]	3910	3830	3740	3650	3560	3470	3390	3290	3200	3110	3030
5.25	3830	3740	3660	3580	3490	3400	3310	3230	3140	3060	2980	2900
4.08	3500	3430	3360	3280	3200	3110	3030	2950	2870	2800	2730	2660
2.92	3140	3080	3010	2940	2870	2790	2710	2640	2570	2500	2440	2380
1.75	2780	2730	2670	2610	2540	2470	2400	2340	2270	2220	2170	(2110)
0.58	135.04	137.12	139.21	141.29	143.38	145.46	147.54	149.62	151.71	153.79	155.88	157.96
	Illuminance [lx]											
	[m]											



Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 2980 lx
Minimum illuminance E_{min} : 2110 lx
Maximum illuminance E_{max} : 4000 lx
Uniformity U_0 $E_{min}/\bar{E}_m$: 1 : 1.41 (0.71)
Diversity U_d E_{min}/E_{max} : 1 : 1.9 (0.53)

[Handwritten signatures]

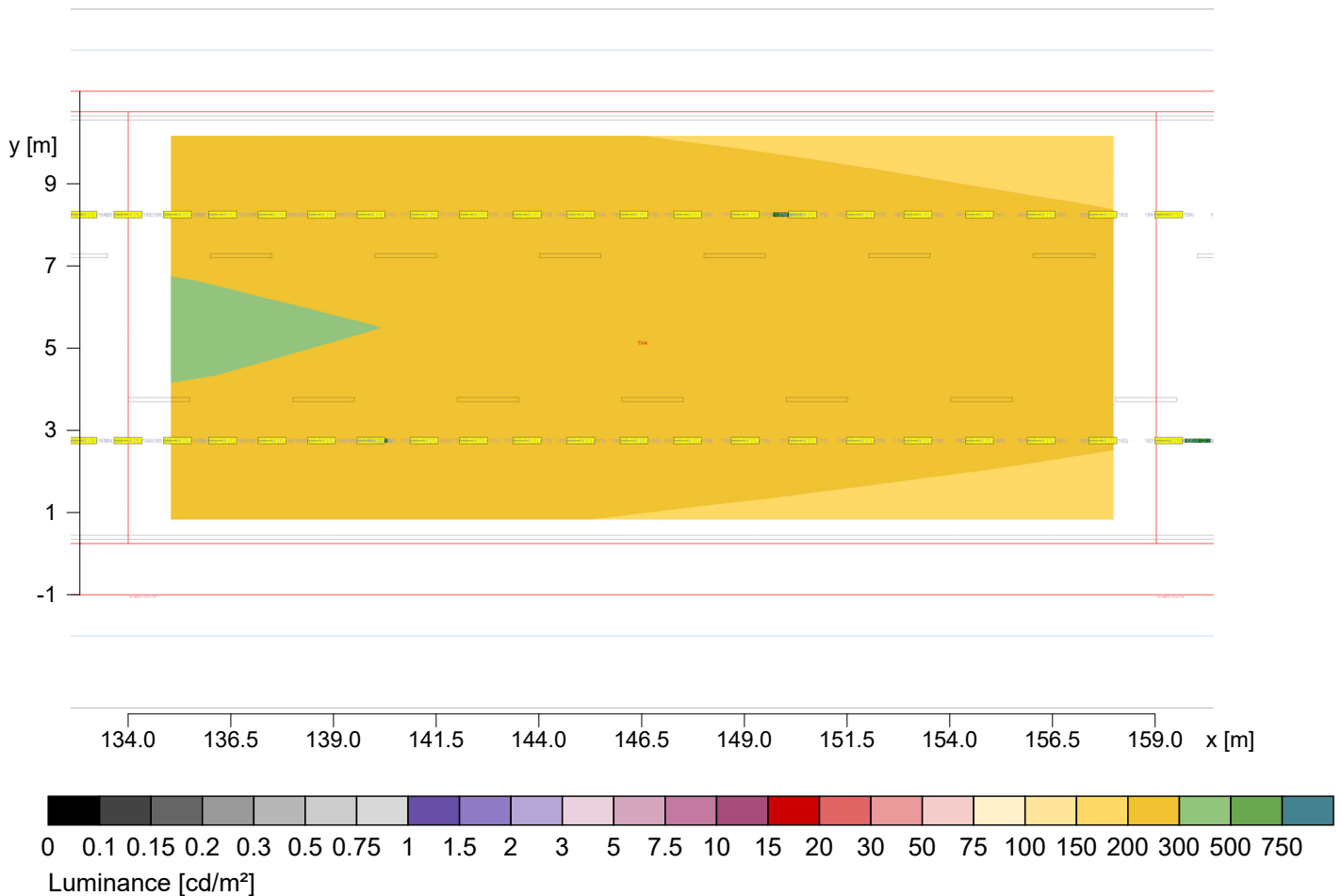
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.7 Calculation results, Tunnel

1.7.3 Pseudo colours, TH4 (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

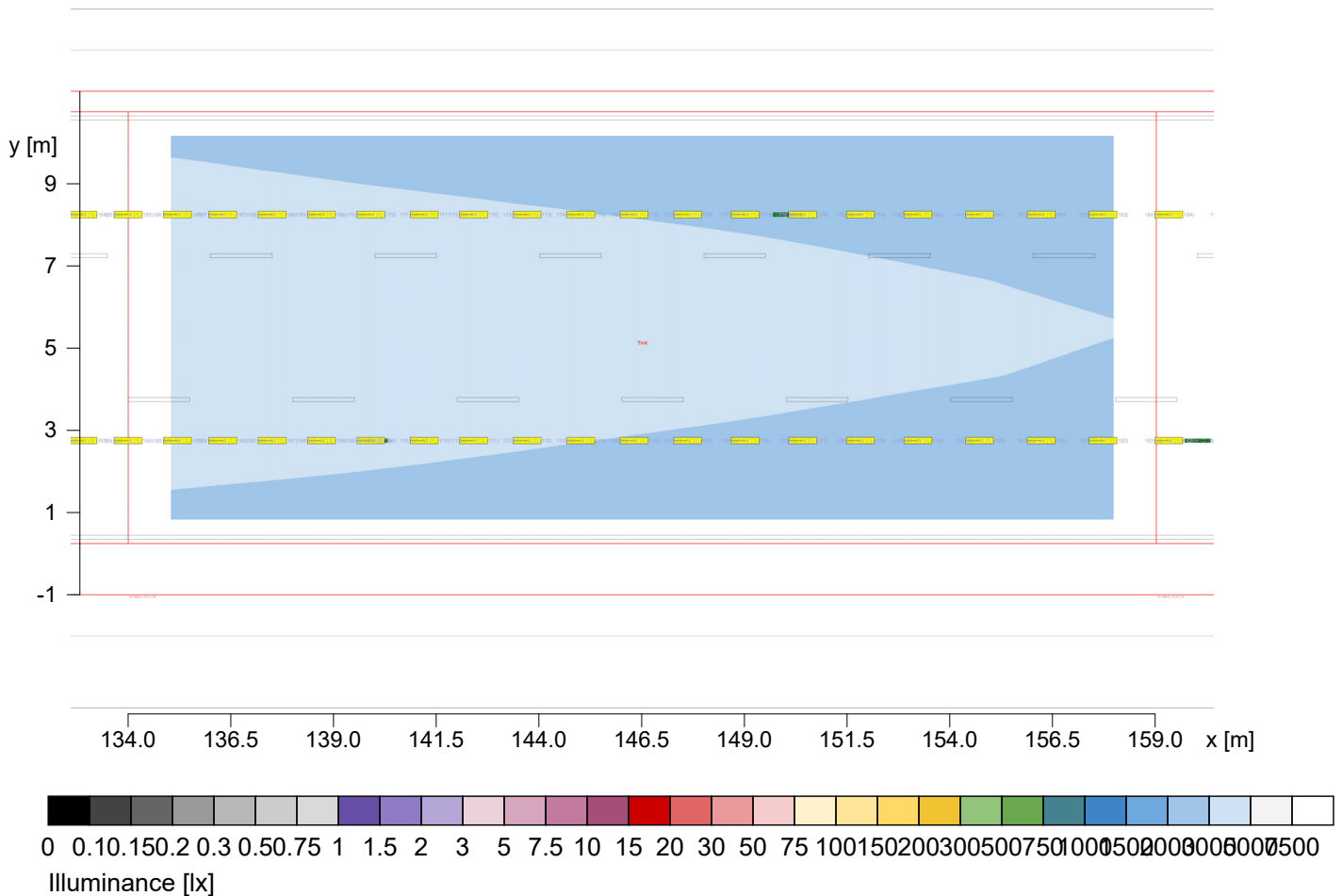
$\bar{L}_m$: 237 cd/m²
 L_{min} : 170 cd/m²
 $L_{min}/\bar{L}_m$: 0.72
 $L_{l,min}/L_{l,max}$: 0.75

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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1.7 Calculation results, Tunnel

1.7.4 Pseudo colours, TH4 (E), S1: 100%



Height reference plane
Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 2980 lx
 E_{max} : 2110 lx
 $E_{min}/\bar{E}_m$: 4000 lx
 E_{min}/E_{max} : 1 : 1.41 (0.71)
 E_{min}/E_{max} : 1 : 1.9 (0.53)

[Handwritten signatures]

-please put your own address here-

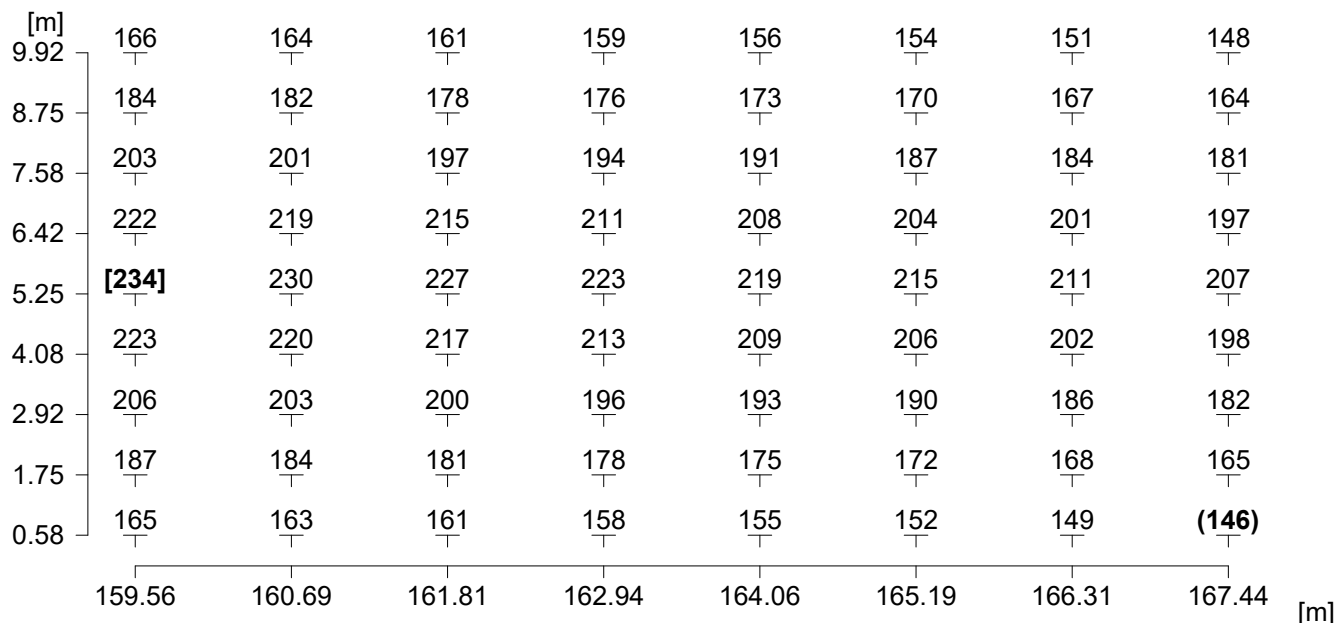
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.8 Calculation results, Tunnel

1.8.1 Table, TH5 (L), S1: 100%, Obs. 1



Observer location 1 : x = 99, y = 1.75, z = 1.5 (dx = 60.56)
Average luminance $\bar{L}_m$: 188 cd/m²
Minimum luminance L_{min} : 146 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.78
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.88

[Signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.8 Calculation results, Tunnel

1.8.2 Table, TH5 (E), S1: 100%

[m]	2090	2060	2030	2000	1970	1940	1910	1880
9.92	2320	2290	2250	2220	2180	2150	2120	2080
8.75	2570	2530	2490	2450	2410	2380	2340	2300
7.58	2810	2770	2720	2680	2630	2590	2550	2500
6.42	2960	2910	2860	2820	2770	2720	2680	2630
5.25	2830	2790	2740	2700	2650	2600	2560	2510
4.08	2600	2560	2520	2470	2430	2380	2340	2290
2.92	2330	2300	2260	2220	2180	2130	2090	2050
1.75	2060	2030	2000	1960	1930	1890	1850	(1810)
0.58	159.56	160.69	161.81	162.94	164.06	165.19	166.31	167.44
Illuminance [lx]								



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 2370 lx
Minimum illuminance	E_{min} : 1810 lx
Maximum illuminance	E_{max} : 2960 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.31 (0.77)
Diversity U_d	E_{min}/E_{max} : 1 : 1.63 (0.61)

[Handwritten signatures]

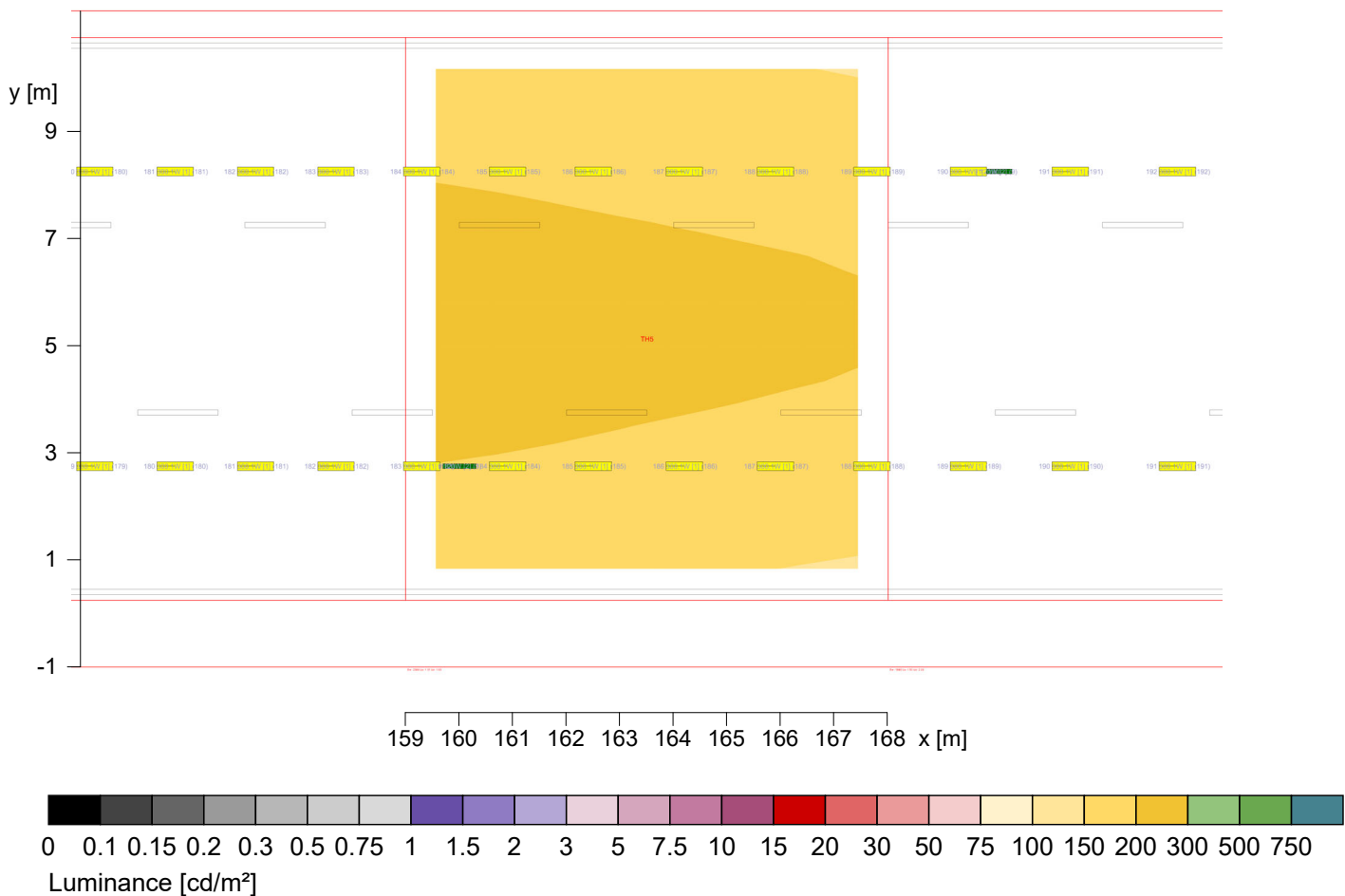
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.8 Calculation results, Tunnel

1.8.3 Pseudo colours, TH5 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = 99, y = 1.75, z = 1.5$ (dx = 6
 L_{min} : 188 cd/m²
 $L_{min}/\bar{L}_m$: 146 cd/m²
 $L_{l,min}/L_{l,max}$: 0.78
 $L_{l,min}/L_{l,max}$: 0.88

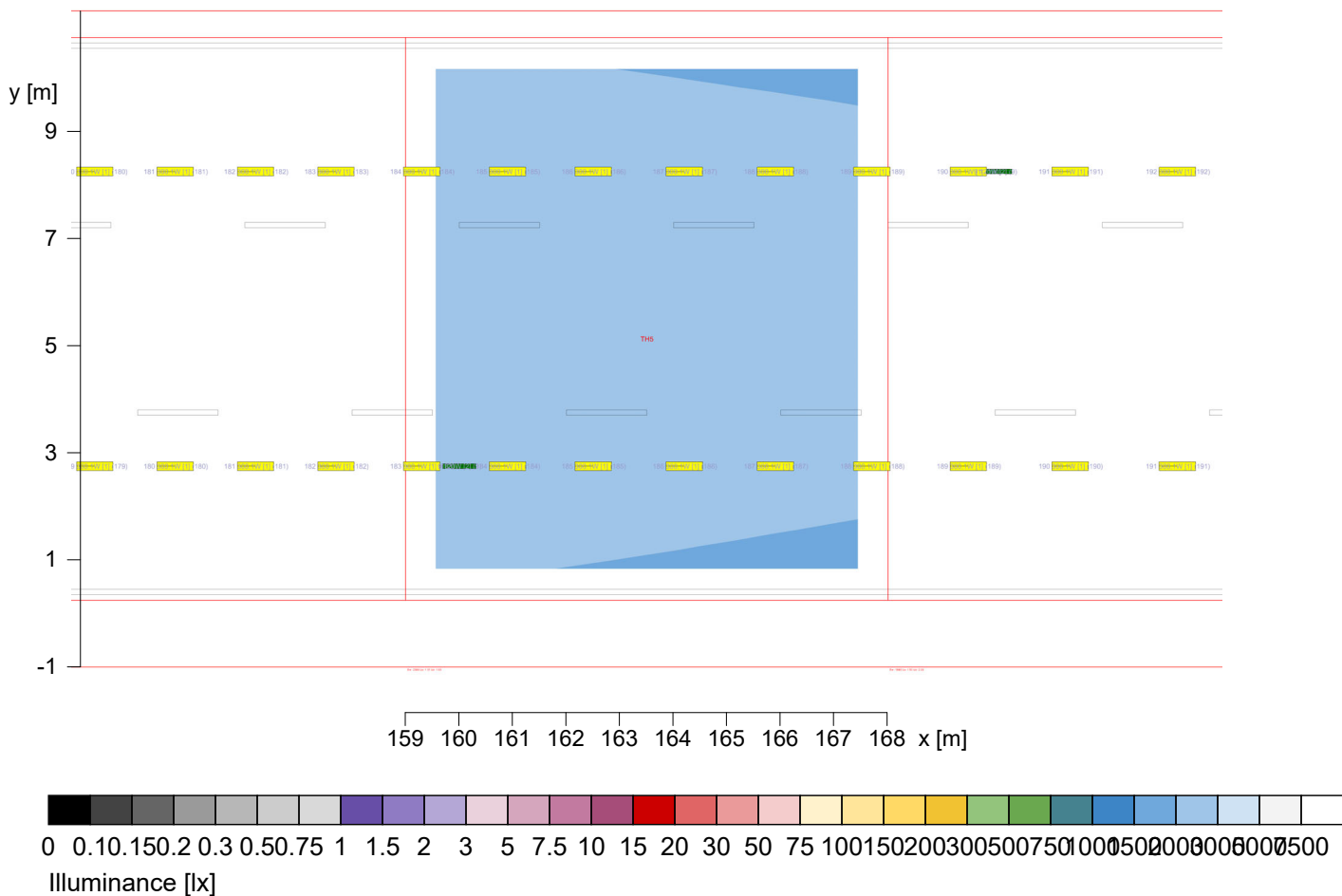
[Handwritten signatures and notes]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.8 Calculation results, Tunnel

1.8.4 Pseudo colours, TH5 (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 2370 lx
 E_{min} : 1810 lx
 E_{max} : 2960 lx
 $E_{min}/\bar{E}_m$: 1 : 1.31 (0.77)
 E_{min}/E_{max} : 1 : 1.63 (0.61)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.9 Calculation results, Tunnel

1.9.1 Table, TR 1 START (L), S1: 100%, Obs. 1

[m]	145	141	136	130	125	120	115	110	106	102
9.92	160	155	149	144	138	133	127	122	117	112
8.75	176	171	164	158	152	146	140	134	128	123
7.58	192	186	179	172	165	159	152	146	140	134
6.42	[202]	196	189	182	174	167	160	154	147	141
5.25	193	187	180	173	166	160	153	147	141	135
4.08	178	172	166	160	154	148	142	136	130	124
2.92	161	156	150	145	139	134	128	123	118	112
1.75	143	138	133	129	124	119	114	109	105	(100)
0.58										
	169.00	171.00	173.00	175.00	177.00	179.00	181.00	183.00	185.00	187.00



Observer location 1 : x = 108, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 146 cd/m²
Minimum luminance L_{min} : 99.7 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.68
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.7

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.9 Calculation results, Tunnel

1.9.2 Table, TR 1 START (E), S1: 100%

[m]	1850	1790	1720	1650	1580	1510	1440	1380	1330	1280
9.92	1850	1790	1720	1650	1580	1510	1440	1380	1330	1280
8.75	2040	1970	1900	1820	1740	1660	1590	1520	1470	1410
7.58	2250	2180	2100	2010	1920	1840	1760	1690	1620	1560
6.42	2440	2360	2280	2190	2100	2010	1930	1840	1760	1690
5.25	[2570]	2480	2390	2300	2210	2120	2030	1940	1860	1780
4.08	2450	2370	2280	2200	2110	2030	1940	1860	1770	1700
2.92	2240	2160	2090	2010	1940	1870	1790	1700	1620	1550
1.75	2000	1930	1870	1800	1740	1680	1600	1530	1460	1390
0.58	1770	1710	1650	1600	1540	1490	1420	1360	1290	(1230)
	169.00	171.00	173.00	175.00	177.00	179.00	181.00	183.00	185.00	187.00
	Illuminance [lx]									



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 1840 lx
Minimum illuminance	E_{min} : 1230 lx
Maximum illuminance	E_{max} : 2570 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.5 (0.67)
Diversity U_d	E_{min}/E_{max} : 1 : 2.09 (0.48)

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.10 Calculation results, Tunnel

1.10.1 Table, TR 2 MIDDLE (L), S1: 100%, Obs. 1

[m]	19.1	18.5	18.5	18.7	18.3	18.4	18.3	18.5	17.9	17.4
9.92	21.1	20.8	20.8	20.6	20.1	20.4	20.2	20.2	19.7	19.5
8.75	23.7	23.1	23	22.8	22.4	22.4	22.2	22.3	21.8	21.4
7.58	26	25.4	25.3	25.2	24.6	24.3	23.9	24.1	23.5	23.2
6.42	[27.6]	26.6	26.5	26.6	25.9	25.5	25.1	25.3	24.7	24.2
5.25	26.2	25.5	25.2	25.3	24.8	24.2	24	24.3	23.5	23.2
4.08	24.3	23.8	23.6	23.5	22.9	22.3	22	22.1	21.6	21.4
2.92	22.1	21.6	21.6	21.3	20.9	20.1	19.9	19.9	19.5	19.3
1.75	19.7	19.2	19.1	19.1	18.5	17.7	17.5	17.6	(17.1)	(17.1)
0.58										
	336.00	338.00	340.00	342.00	344.00	346.00	348.00	350.00	352.00	354.00



Observer location 1 : x = 275, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 22 cd/m²
Minimum luminance L_{min} : 17.1 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.78
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.88

[Signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.10 Calculation results, Tunnel

1.10.2 Table, TR 2 MIDDLE (E), S1: 100%

[m]	239	231	226	226	227	232	237	239	232	222
9.92	264	257	252	250	250	258	261	263	254	247
8.75	293	288	283	279	278	285	286	287	279	272
7.58	321	319	315	309	306	308	306	304	297	294
6.42	[340]	338	334	328	323	322	318	316	310	307
5.25	326	326	324	317	310	305	300	297	291	291
4.08	301	304	304	296	286	277	269	266	261	265
2.92	272	276	276	269	258	247	238	235	232	236
1.75	241	246	245	240	230	219	210	206	(205)	209
0.58										
	336.00	338.00	340.00	342.00	344.00	346.00	348.00	350.00	352.00	354.00
	Illuminance [lx]									



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 275 lx
Minimum illuminance	E_{min} : 205 lx
Maximum illuminance	E_{max} : 340 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.34 (0.75)
Diversity U_d	E_{min}/E_{max} : 1 : 1.66 (0.6)

[Handwritten signatures]

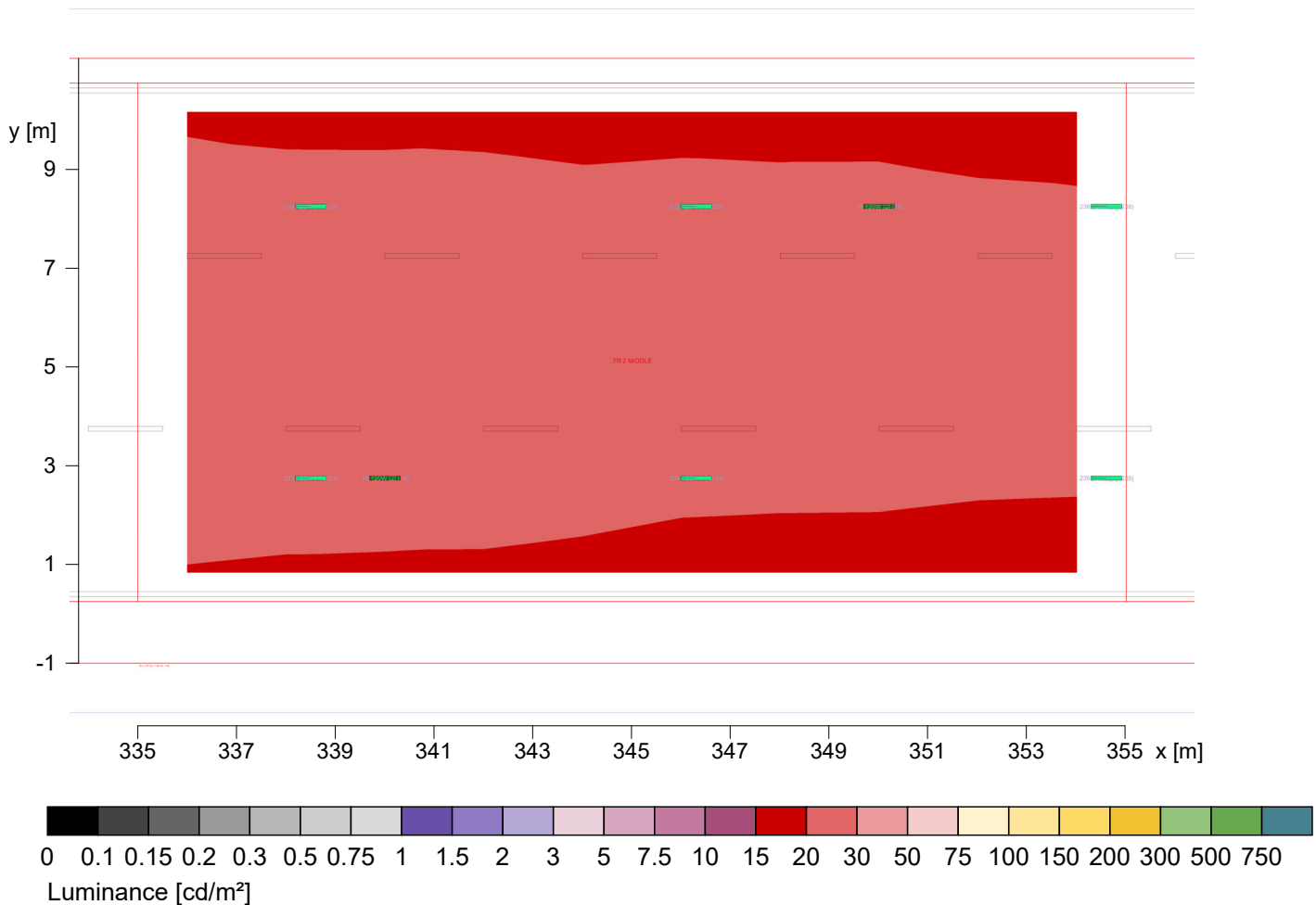
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.10 Calculation results, Tunnel

1.10.3 Pseudo colours, TR 2 MIDDLE (L), S1: 100%, Obs. 1



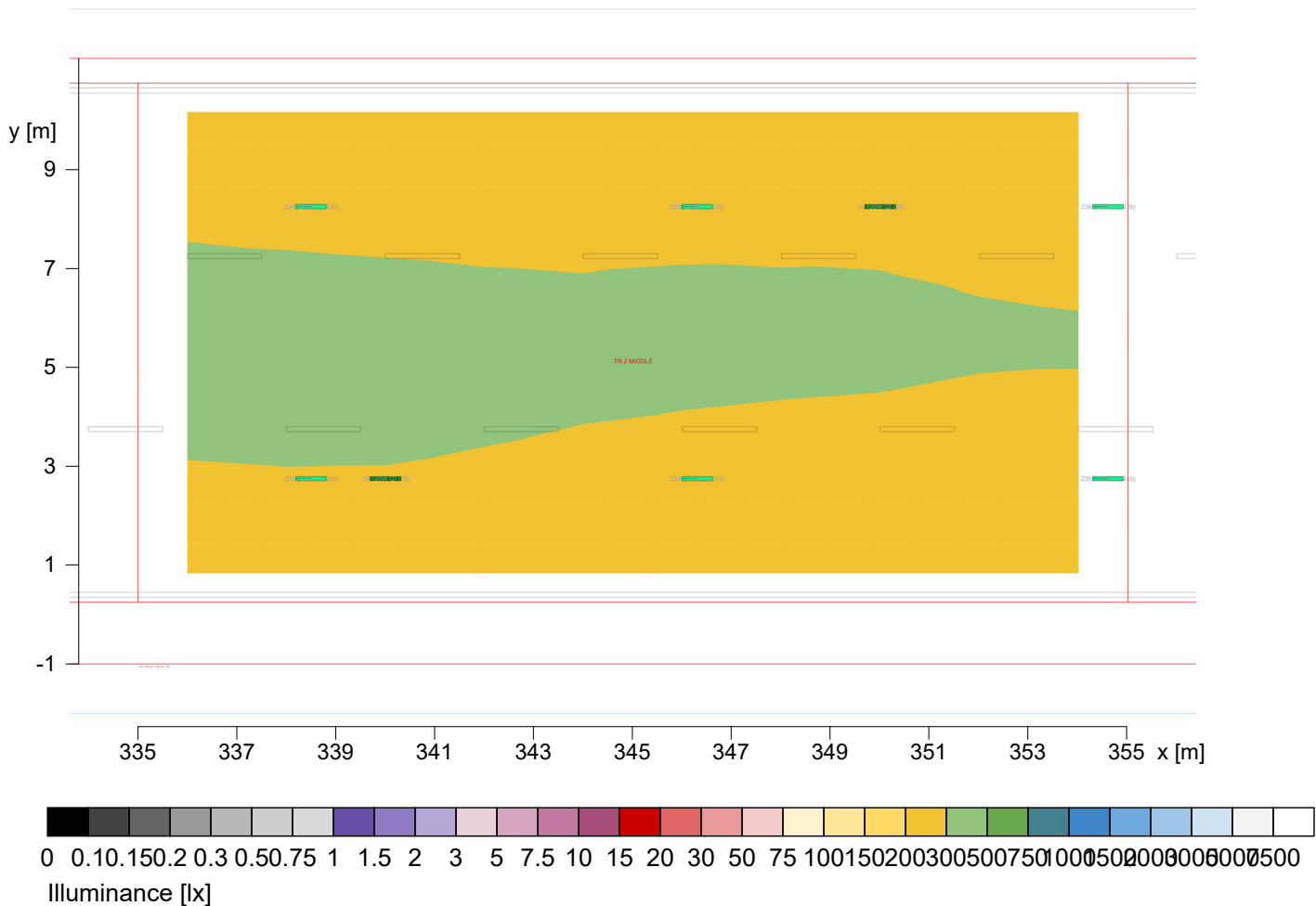
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.10 Calculation results, Tunnel

1.10.4 Pseudo colours, TR 2 MIDDLE (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 275 lx
 E_{min} : 205 lx
 E_{max} : 340 lx
 $E_{min}/\bar{E}_m$: 1 : 1.34 (0.75)
 E_{min}/E_{max} : 1 : 1.66 (0.6)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.11 Calculation results, Tunnel

1.11.1 Table, TR 2 END (L), S1: 100%, Obs. 1

[m]	11.9	11.9	12.1	12.4	12.2	12.3	12.5	11.9	11.4	(11.2)
9.92	13.5	13.4	13.4	13.7	13.4	13.6	13.6	13.2	13	12.9
8.75	15.1	15	14.9	15	14.7	14.8	14.9	14.8	14.6	14.4
7.58	16.6	16.4	16.3	16.3	15.9	15.9	16.2	16.1	16.1	16.1
6.42	17.4	17.3	17.1	17.1	16.7	16.8	17.3	17.1	16.9	16.8
5.25	16.6	16.5	16.3	16.3	16.1	16.1	16.4	16.4	16.3	16.2
4.08	15.7	15.6	15.2	14.8	14.6	14.7	14.9	15.2	15.6	15.4
2.92	14.3	14.2	13.8	13.3	13.1	13.3	13.5	13.8	14.3	14.3
1.75	12.6	12.5	12.2	11.7	11.5	11.7	12	12.4	12.7	12.7
0.58										
	481.00	483.00	485.00	487.00	489.00	491.00	493.00	495.00	497.00	499.00



Observer location 1 : x = 420, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 14.5 cd/m²
Minimum luminance L_{min} : 11.2 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.77
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.92

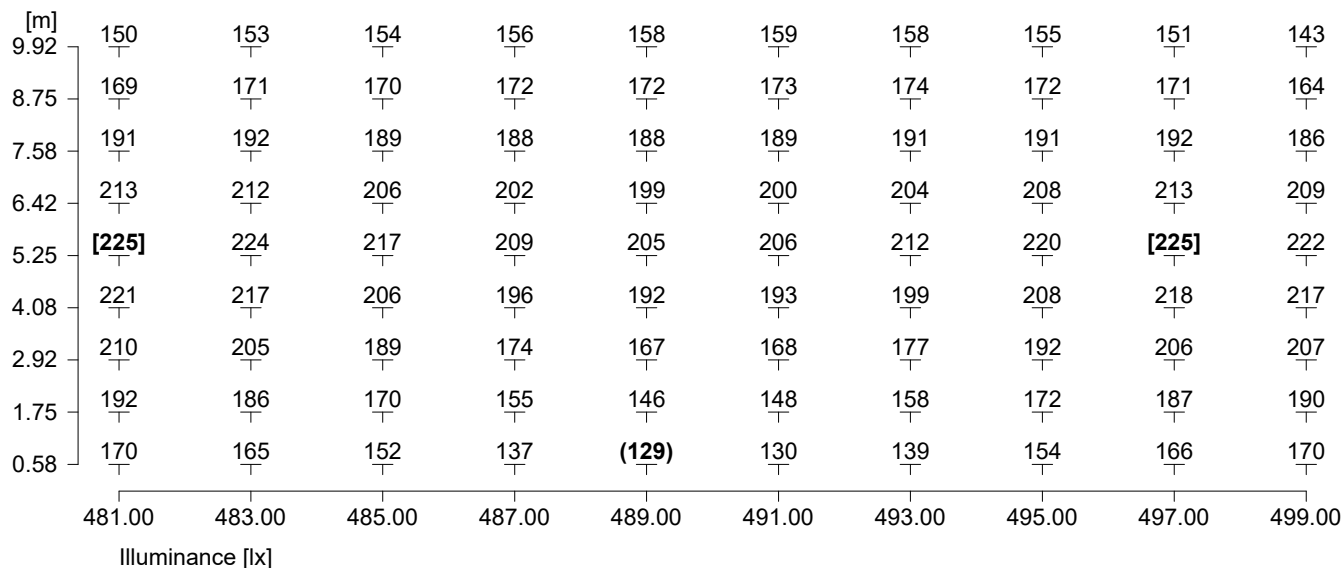
[Signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.11 Calculation results, Tunnel

1.11.2 Table, TR 2 END (E), S1: 100%



Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 184 lx
Minimum illuminance E_{min} : 129 lx
Maximum illuminance E_{max} : 225 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.42 (0.7)
Diversity U_d E_{min}/E_{max} : 1 : 1.74 (0.57)

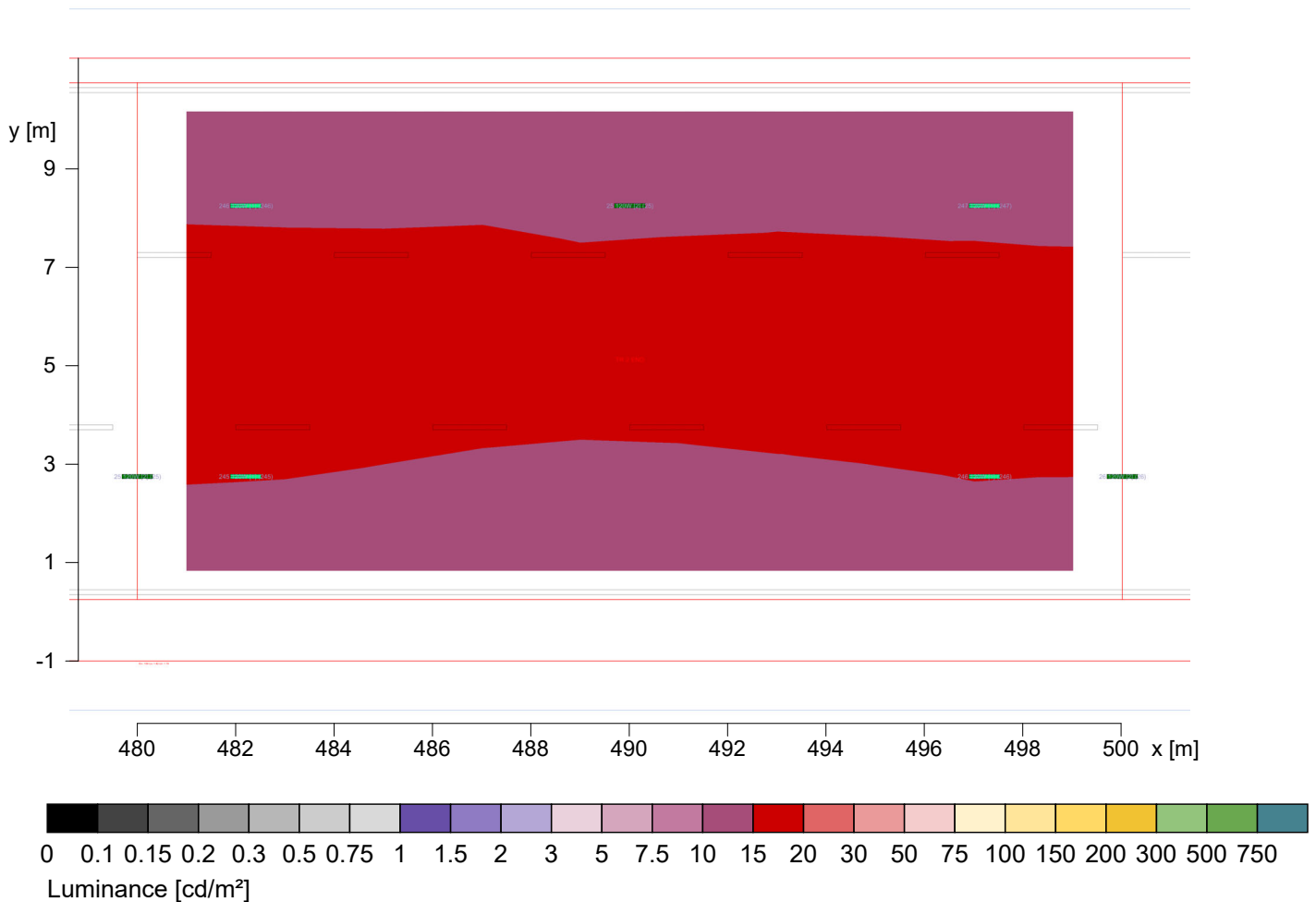
[Signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.11 Calculation results, Tunnel

1.11.3 Pseudo colours, TR 2 END (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

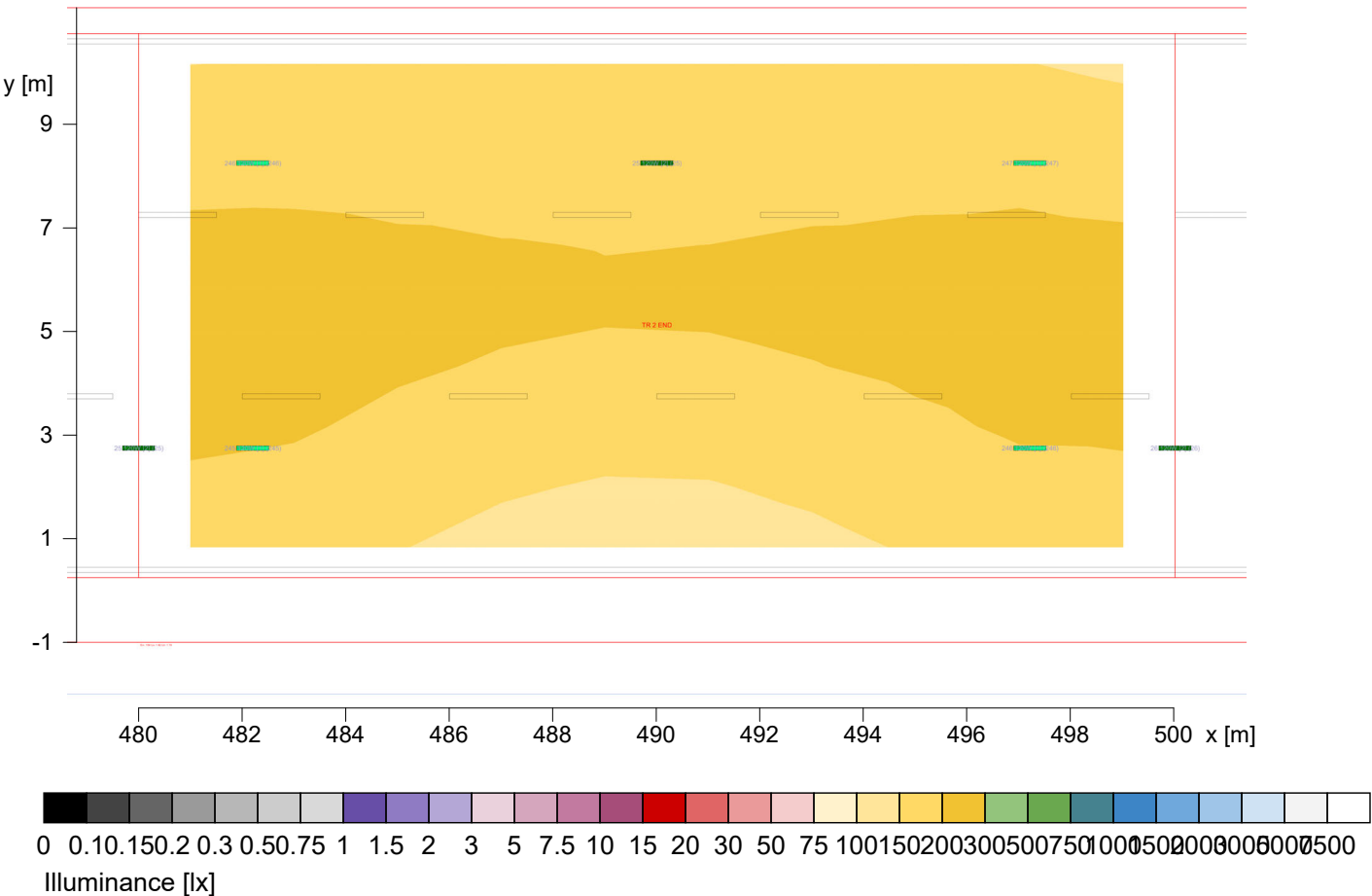
$\bar{L}_m$: 14.5 cd/m²
 L_{min} : 11.2 cd/m²
 $L_{min}/\bar{L}_m$: 0.77
 $L_{l,min}/L_{l,max}$: 0.92

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.11 Calculation results, Tunnel

1.11.4 Pseudo colours, TR 2 END (E), S1: 100%



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 184 lx
Minimum illuminance	E_{min} : 129 lx
Maximum illuminance	E_{max} : 225 lx
Uniformity U_o	$E_{min}/\bar{E}_m$: 1 : 1.42 (0.7)
Diversity U_d	E_{min}/E_{max} : 1 : 1.74 (0.57)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

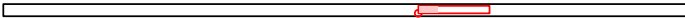


1 Tunnel

1.12 Calculation results, Tunnel

1.12.1 Table, IN 1 (L), S1: 100%, Obs. 1

[m]	(10)	10.2	10.2	10.4	10.3	10.2	10.3	10.3	10.6	10.5	10.4	10.4	10.4	10.6
9.92														
8.75	11.3	11.5	11.7	11.9	11.6	11.4	11.4	11.6	12	11.6	11.5	11.4	11.6	12
7.58	12.8	13	13.2	13.3	12.9	12.8	12.7	12.9	13.2	12.9	12.8	12.7	12.9	13.2
6.42	14.4	14.4	14.4	14.5	14.1	14	13.9	13.9	14.4	14.1	14	14	14	14.4
5.25	15.3	[15.5]	15	15	14.9	14.6	14.9	14.5	14.9	14.8	14.6	14.9	14.5	14.9
4.08	14.8	14.7	14.5	14.6	14.1	13.9	13.9	13.8	14.3	14	13.8	13.9	13.8	14.3
2.92	14	13.9	13.7	13.6	13.1	12.9	12.8	12.9	13.3	12.9	12.8	12.8	12.9	13.2
1.75	13.1	12.8	12.7	12.6	12	11.8	11.6	11.8	12	11.7	11.7	11.6	11.7	12
0.58	12.1	11.8	11.4	11.3	10.8	10.7	10.5	10.4	10.6	10.5	10.5	10.5	10.4	10.6
	504.00	506.00	508.00	510.00	512.00	514.00	516.00	518.00	520.00	522.00	524.00	526.00	528.00	530.00
														5



Part1

Observer location 1 : x = 418, y = 1.75, z = 1.5 (dx = 85.93)
Average luminance $\bar{L}_m$: 12.6 cd/m²
Minimum luminance L_{min} : 9.97 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.79
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.88

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.12 Calculation results, Tunnel

1.12.1 Table, IN 1 (L), S1: 100%, Obs. 1

10.5	10.4	10.4	10.4	10.6	10.5	10.4	10.4	10.4	10.6	10.5	10.4	10.4	10.4	10.6
11.6	11.5	11.4	11.6	12	11.6	11.5	11.4	11.6	12	11.6	11.5	11.4	11.6	12
12.9	12.8	12.7	12.9	13.2	12.9	12.8	12.7	12.9	13.2	12.9	12.8	12.7	12.9	13.2
14.1	14	14	14	14.4	14.1	14	14	14	14.4	14.1	14	14	14	14.4
14.8	14.6	14.9	14.5	14.9	14.8	14.6	14.9	14.5	14.9	14.8	14.6	14.9	14.5	14.9
14	13.8	13.9	13.8	14.3	14	13.8	13.9	13.8	14.3	14	13.8	13.9	13.8	14.3
12.9	12.8	12.8	12.9	13.2	12.9	12.8	12.8	12.9	13.2	12.9	12.8	12.8	12.9	13.2
11.7	11.7	11.6	11.7	12	11.7	11.7	11.6	11.7	12	11.7	11.7	11.6	11.7	12
10.5	10.5	10.4	10.4	10.6	10.5	10.5	10.4	10.4	10.6	10.5	10.5	10.4	10.4	10.6
32.00	534.00	536.00	538.00	540.00	542.00	544.00	546.00	548.00	550.00	552.00	554.00	556.00	558.00	560.00



Part2

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.12 Calculation results, Tunnel

1.12.1 Table, IN 1 (L), S1: 100%, Obs. 1

10.5	10.4	10.4	10.4	10.6	10.5	10.4	10.4	10.4	10.6	10.5	10.4	10.4	10.4	10.6
11.6	11.5	11.4	11.6	12	11.6	11.5	11.4	11.6	12	11.6	11.5	11.4	11.6	12
12.9	12.8	12.7	12.9	13.2	12.9	12.8	12.7	12.9	13.2	12.9	12.8	12.7	12.9	13.2
14.1	14	14	14	14.4	14.1	14	14	14	14.4	14.1	14	14	14	14.4
14.8	14.6	14.9	14.5	14.9	14.8	14.6	14.9	14.5	14.9	14.8	14.6	14.9	14.5	14.9
14	13.8	13.9	13.8	14.3	14	13.8	13.9	13.8	14.3	14	13.8	13.9	13.8	14.3
12.9	12.8	12.8	12.9	13.2	12.9	12.8	12.8	12.9	13.2	12.9	12.8	12.8	12.9	13.2
11.7	11.7	11.6	11.7	12	11.7	11.7	11.6	11.7	12	11.7	11.7	11.6	11.7	12
10.5	10.5	10.4	10.4	10.6	10.5	10.5	10.4	10.4	10.6	10.5	10.5	10.4	10.4	10.6
562.00	564.00	566.00	568.00	570.00	572.00	574.00	576.00	578.00	580.00	582.00	584.00	586.00	588.00	590.00



Part3

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-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.12 Calculation results, Tunnel

1.12.1 Table, IN 1 (L), S1: 100%, Obs. 1

10.5	10.4	10.4	10.3	10.6	10.4
11.6	11.5	11.4	11.6	12	11.6
12.9	12.8	12.7	12.9	13.2	12.9
14.1	14	14	14	14.4	14.1
14.8	14.6	14.9	14.5	14.9	14.8
14	13.8	13.9	13.8	14.3	14
12.9	12.8	12.8	12.9	13.2	12.9
11.7	11.7	11.6	11.7	12	11.7
10.5	10.5	10.4	10.3	10.6	10.4
592.00	594.00	596.00	598.00	600.00	602.00

[m]



Part4

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.12 Calculation results, Tunnel

1.12.2 Table, IN 1 (E), S1: 100%

[m]	(119)	120	126	130	129	126	127	131	134	131	128	128	132	134	132	128
9.92																
8.75	135	137	143	147	144	141	141	145	150	146	142	142	146	150	146	142
7.58	155	156	161	165	161	157	157	162	167	162	158	158	162	167	162	158
6.42	177	174	177	180	175	172	172	176	181	176	172	172	176	181	176	172
5.25	[189]	185	186	187	184	180	180	184	188	185	180	180	185	188	185	180
4.08	184	178	178	180	174	171	171	175	180	175	171	171	175	180	175	171
2.92	174	167	165	167	161	157	157	160	165	160	157	157	160	165	160	157
1.75	161	154	153	152	146	142	141	145	149	145	141	141	145	149	145	141
0.58	150	143	139	137	131	128	128	129	131	129	127	127	129	131	129	127
	504.00	506.00	508.00	510.00	512.00	514.00	516.00	518.00	520.00	522.00	524.00	526.00	528.00	530.00	532.00	534.00
	Illuminance [lx]															



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 156 lx
Minimum illuminance E_{min} : 119 lx
Maximum illuminance E_{max} : 189 lx
Uniformity U_0 $E_{min}/\bar{E}_m$: 1 : 1.31 (0.76)
Diversity U_d E_{min}/E_{max} : 1 : 1.59 (0.63)

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.12 Calculation results, Tunnel

1.12.2 Table, IN 1 (E), S1: 100%

128	132	134	132	128	128	132	134	132	128	128	132	134	132	128	128
142	146	150	146	142	142	146	150	146	142	142	146	150	146	142	142
158	162	167	162	158	158	162	167	162	158	158	162	167	162	158	158
172	176	181	176	172	172	176	181	176	172	172	176	181	176	172	172
180	185	188	185	180	180	185	188	185	180	180	185	188	185	180	180
171	175	180	175	171	171	175	180	175	171	171	175	180	175	171	171
157	160	165	160	157	157	160	165	160	157	157	160	165	160	157	157
141	145	149	145	141	141	145	149	145	141	141	145	149	145	141	141
127	129	131	129	127	127	129	131	129	127	127	129	131	129	127	127
536.00	538.00	540.00	542.00	544.00	546.00	548.00	550.00	552.00	554.00	556.00	558.00	560.00	562.00	564.00	566.00



Part2

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



1.12 Calculation results, Tunnel

1.12.2 Table, IN 1 (E), S1: 100%

132	134	132	128	128	132	134	132	128	128	132	134	132	128	128	131	134
146	150	146	142	142	146	150	146	142	142	146	150	146	142	142	146	150
162	167	162	158	158	162	167	162	158	158	162	167	162	158	158	162	167
176	181	176	172	172	176	181	176	172	172	176	181	176	172	172	176	181
185	188	185	180	180	185	188	185	180	180	185	188	185	180	180	185	188
175	180	175	171	171	175	180	175	171	171	175	180	175	171	171	175	180
160	165	160	157	157	160	165	160	157	157	160	165	160	157	157	160	165
145	149	145	141	141	145	149	145	141	141	145	149	145	141	141	145	149
129	131	129	127	127	129	131	129	127	127	129	131	129	127	127	129	131
568.00	570.00	572.00	574.00	576.00	578.00	580.00	582.00	584.00	586.00	588.00	590.00	592.00	594.00	596.00	598.00	600.



Part3

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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1.12 Calculation results, Tunnel

1.12.2 Table, IN 1 (E), S1: 100%

131
├─
146
├─
162
├─
176
├─
184
├─
175
├─
160
├─
145
├─
129
├─
00 602.00 [m]



Part4

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1.12.3 Pseudo colours, IN 1 (L), S1: 100%, Obs. 1

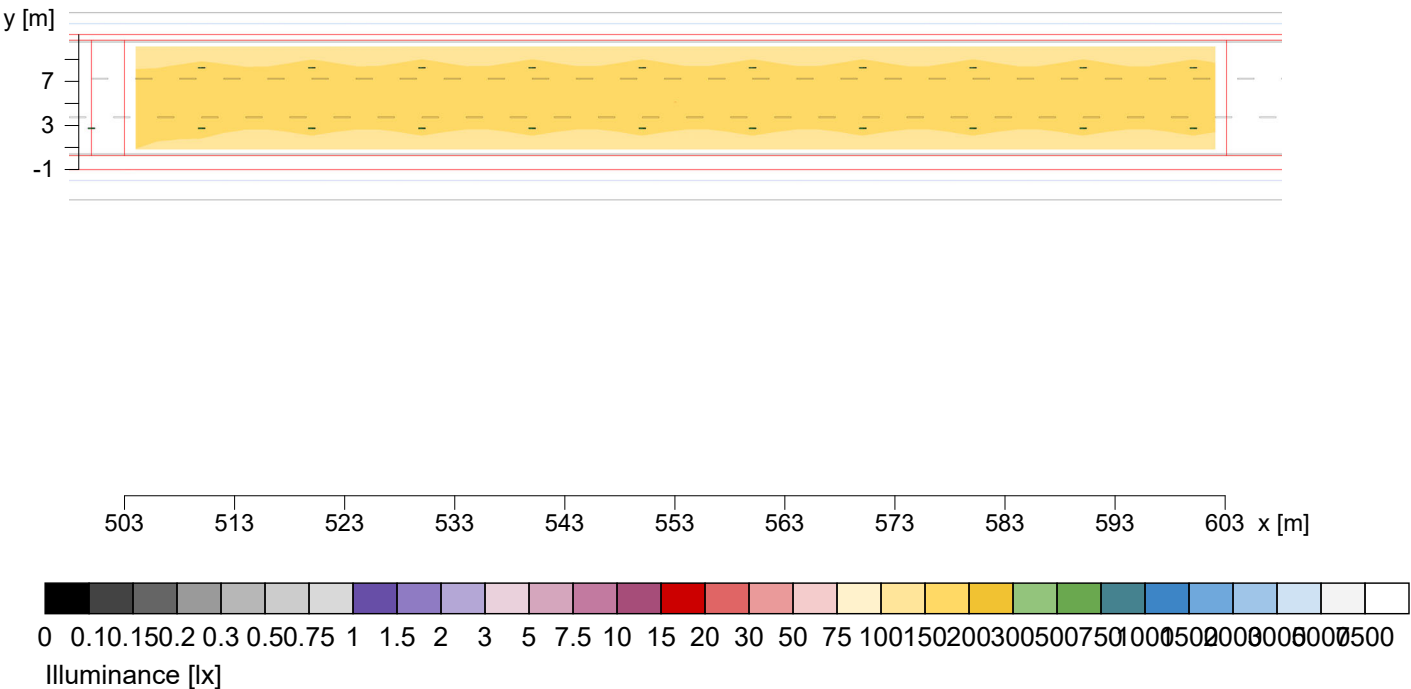


Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



1.12 Calculation results, Tunnel

1.12.4 Pseudo colours, IN 1 (E), S1: 100%



Height reference plane		: 0.00 m
Average illuminance	$\bar{E}_m$	: 156 lx
Minimum illuminance	E_{min}	: 119 lx
Maximum illuminance	E_{max}	: 189 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	: 1 : 1.31 (0.76)
Diversity U_d	E_{min}/E_{max}	: 1 : 1.59 (0.63)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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2 INTERIOR 2

2.1 Description, INTERIOR 2

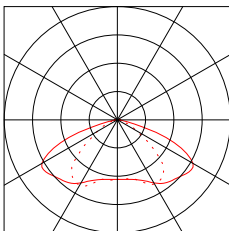
2.1.1 Luminaire list

Adaptation
LDC in use

Interior
LDC in use

Bajaj

8
Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



Row of luminaires: Row 1.1

Number of luminaires: 817

Basic position: x=0.00m y=2.50m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 98.0kW (16.33 km)

Constant distance: 20.00m

Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	120W / 14.96klm	2	100% 100%
2	20.00	120W / 14.96klm	2	100% 100%
3	40.00	120W / 14.96klm	2	100% 100%
4	60.00	120W / 14.96klm	2	100% 100%
5	80.00	120W / 14.96klm	2	100% 100%
6	100.00	120W / 14.96klm	2	100% 100%
7	120.00	120W / 14.96klm	2	100% 100%
8	140.00	120W / 14.96klm	2	100% 100%
9	160.00	120W / 14.96klm	2	100% 100%
10	180.00	120W / 14.96klm	2	100% 100%
11	200.00	120W / 14.96klm	2	100% 100%
12	220.00	120W / 14.96klm	2	100% 100%
13	240.00	120W / 14.96klm	2	100% 100%
14	260.00	120W / 14.96klm	2	100% 100%
15	280.00	120W / 14.96klm	2	100% 100%
16	300.00	120W / 14.96klm	2	100% 100%
17	320.00	120W / 14.96klm	2	100% 100%
18	340.00	120W / 14.96klm	2	100% 100%
19	360.00	120W / 14.96klm	2	100% 100%
20	380.00	120W / 14.96klm	2	100% 100%
21	400.00	120W / 14.96klm	2	100% 100%
22	420.00	120W / 14.96klm	2	100% 100%
23	440.00	120W / 14.96klm	2	100% 100%

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-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



2 INTERIOR 2

2.1 Description, INTERIOR 2

2.1.1 Luminaire list

24	460.00	120W / 14.96klm 2	100%	100%
25	480.00	120W / 14.96klm 2	100%	100%
26	500.00	120W / 14.96klm 2	100%	100%
27	520.00	120W / 14.96klm 2	100%	100%
28	540.00	120W / 14.96klm 2	100%	100%
29	560.00	120W / 14.96klm 2	100%	100%
30	580.00	120W / 14.96klm 2	100%	100%
31	600.00	120W / 14.96klm 2	100%	100%
32	620.00	120W / 14.96klm 2	100%	100%
33	640.00	120W / 14.96klm 2	100%	100%
34	660.00	120W / 14.96klm 2	100%	100%
35	680.00	120W / 14.96klm 2	100%	100%
36	700.00	120W / 14.96klm 2	100%	100%
37	720.00	120W / 14.96klm 2	100%	100%
38	740.00	120W / 14.96klm 2	100%	100%
39	760.00	120W / 14.96klm 2	100%	100%
40	780.00	120W / 14.96klm 2	100%	100%
:	:	:	:	:
813	16240.00	120W / 14.96klm 2	100%	100%
814	16260.00	120W / 14.96klm 2	100%	100%
815	16280.00	120W / 14.96klm 2	100%	100%
816	16300.00	120W / 14.96klm 2	100%	100%
817	16320.00	120W / 14.96klm 2	100%	100%

Row of luminaires: Row 2.1

Number of luminaires: 816

Basic position: x=10.00m y=8.00m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 97.9kW (16.33 km)

Constant distance: 20.00m

Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	10.00	120W / 14.96klm 2	100%	100%
2	30.00	120W / 14.96klm 2	100%	100%
3	50.00	120W / 14.96klm 2	100%	100%
4	70.00	120W / 14.96klm 2	100%	100%
5	90.00	120W / 14.96klm 2	100%	100%
6	110.00	120W / 14.96klm 2	100%	100%
7	130.00	120W / 14.96klm 2	100%	100%
8	150.00	120W / 14.96klm 2	100%	100%
9	170.00	120W / 14.96klm 2	100%	100%
10	190.00	120W / 14.96klm 2	100%	100%
11	210.00	120W / 14.96klm 2	100%	100%
12	230.00	120W / 14.96klm 2	100%	100%
13	250.00	120W / 14.96klm 2	100%	100%
14	270.00	120W / 14.96klm 2	100%	100%
15	290.00	120W / 14.96klm 2	100%	100%
16	310.00	120W / 14.96klm 2	100%	100%
17	330.00	120W / 14.96klm 2	100%	100%
18	350.00	120W / 14.96klm 2	100%	100%
19	370.00	120W / 14.96klm 2	100%	100%
20	390.00	120W / 14.96klm 2	100%	100%

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2 INTERIOR 2

2.1 Description, INTERIOR 2

2.1.1 Luminaire list

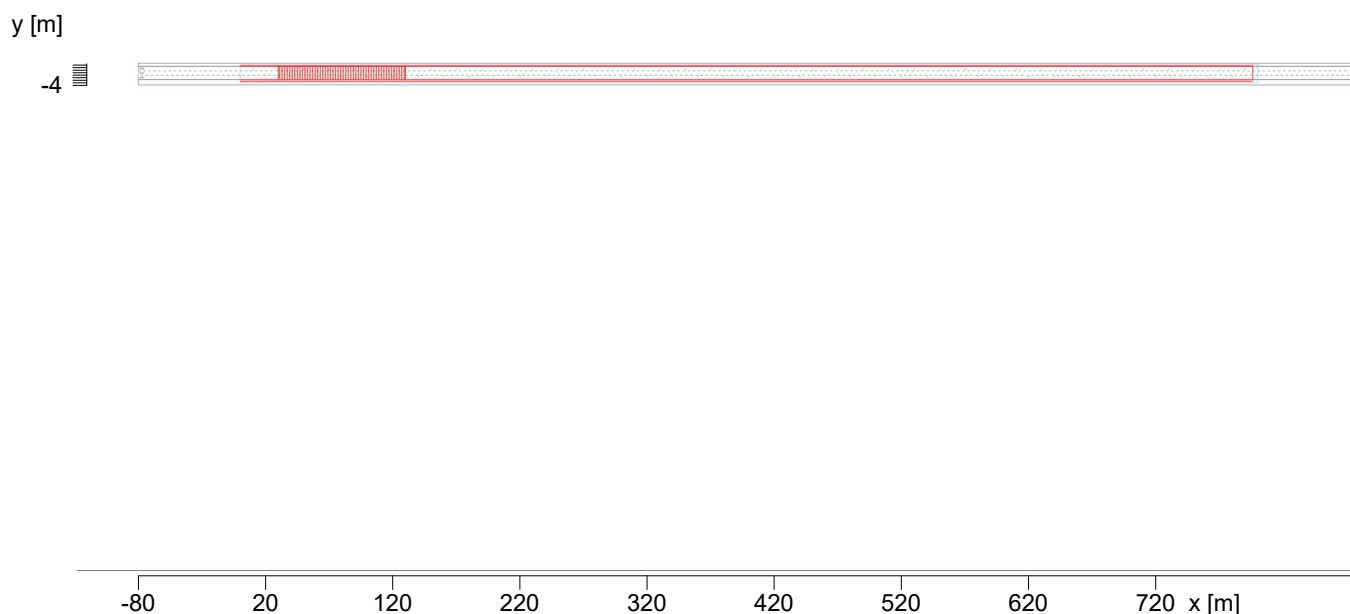
21	410.00	120W / 14.96klm 2	100%	100%
22	430.00	120W / 14.96klm 2	100%	100%
23	450.00	120W / 14.96klm 2	100%	100%
24	470.00	120W / 14.96klm 2	100%	100%
25	490.00	120W / 14.96klm 2	100%	100%
26	510.00	120W / 14.96klm 2	100%	100%
27	530.00	120W / 14.96klm 2	100%	100%
28	550.00	120W / 14.96klm 2	100%	100%
29	570.00	120W / 14.96klm 2	100%	100%
30	590.00	120W / 14.96klm 2	100%	100%
31	610.00	120W / 14.96klm 2	100%	100%
32	630.00	120W / 14.96klm 2	100%	100%
33	650.00	120W / 14.96klm 2	100%	100%
34	670.00	120W / 14.96klm 2	100%	100%
35	690.00	120W / 14.96klm 2	100%	100%
36	710.00	120W / 14.96klm 2	100%	100%
37	730.00	120W / 14.96klm 2	100%	100%
38	750.00	120W / 14.96klm 2	100%	100%
39	770.00	120W / 14.96klm 2	100%	100%
40	790.00	120W / 14.96klm 2	100%	100%
:	:	:	:	:
812	16230.00	120W / 14.96klm 2	100%	100%
813	16250.00	120W / 14.96klm 2	100%	100%
814	16270.00	120W / 14.96klm 2	100%	100%
815	16290.00	120W / 14.96klm 2	100%	100%
816	16310.00	120W / 14.96klm 2	100%	100%

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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2.1 Description, INTERIOR 2

2.1.2 Floor plan



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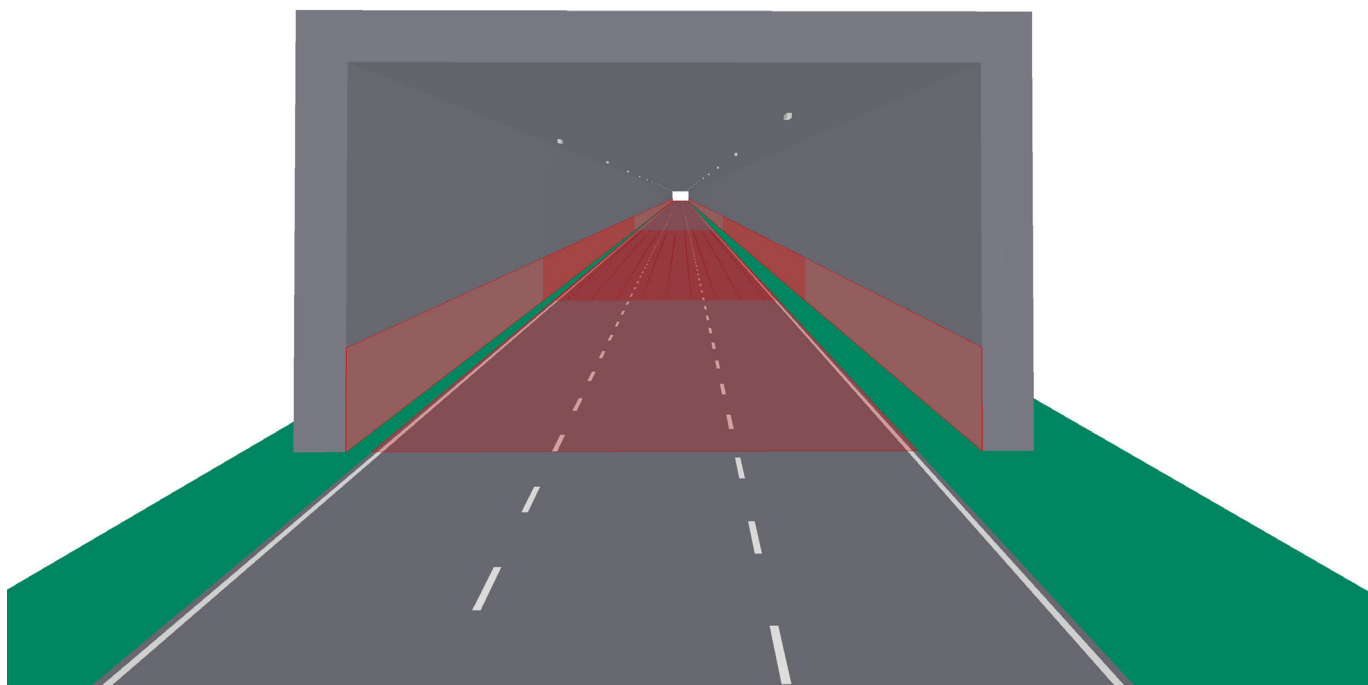
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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2.1 Description, INTERIOR 2

2.1.3 3D view, View from the left



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2. *[Signature]*
3. *[Signature]*
4. *[Signature]*
5. *[Signature]*

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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2 INTERIOR 2

2.2 Calculation results, INTERIOR 2

2.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%

Interior

2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.00 m - 796.00 m Points: nx = 398, ny = 9, nz = 3

Observer (starting point coordinate) : x = -84.93 m; z = 1.50 m dx = 85.93 m (moving)

y = 1.75 m

y = 5.25 m

y = 8.75 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

IN 2

Measuring range: 30.00 m - 130.00 m Points: nx = 50, ny = 9, nz = 3

Observer (starting point coordinate) : x = -54.93 m; z = 1.50 m dx = 85.93 m (fix)

y = 1.75 m

y = 5.25 m

y = 8.75 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$: 6.27 cd/m²

6.27 cd/m²

6.27 cd/m²

U_o L_{min}/ $\bar{L}_m$: 0.76

0.75

0.74

0.4

U_i L_{i,min}/L_{i,max} : 0.88

0.97

0.87

0.6

f_{TI,max} Max. : 5 %

5 %

5 %

Wall left (diffus 30%)

$\bar{L}_m$: 4.33 cd/m²

U_o L_{min}/ $\bar{L}_m$: 0.77

L_{wall}/L_{fsp} : 0.74

Wall right (diffus 30%)

$\bar{L}_m$: 4.12 cd/m²

U_o L_{min}/ $\bar{L}_m$: 0.74

L_{wall}/L_{fsp} : 0.70

Illuminance

Roadway

$\bar{E}_m$: 77.95 lx

U_o E_{min}/ $\bar{E}_m$: 0.68

Wall left

$\bar{E}_m$: 45.41 lx

U_o E_{min}/ $\bar{E}_m$: 0.77

Wall right

$\bar{E}_m$: 43.20 lx

U_o E_{min}/ $\bar{E}_m$: 0.74

Signature

Signature

Signature

Signature

Signature

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

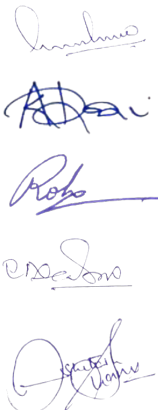
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2 INTERIOR 2

2.2 Calculation results, INTERIOR 2

2.2.1 Result overview, S1: 100%

qc: The backward reflecion of the road was calculated.



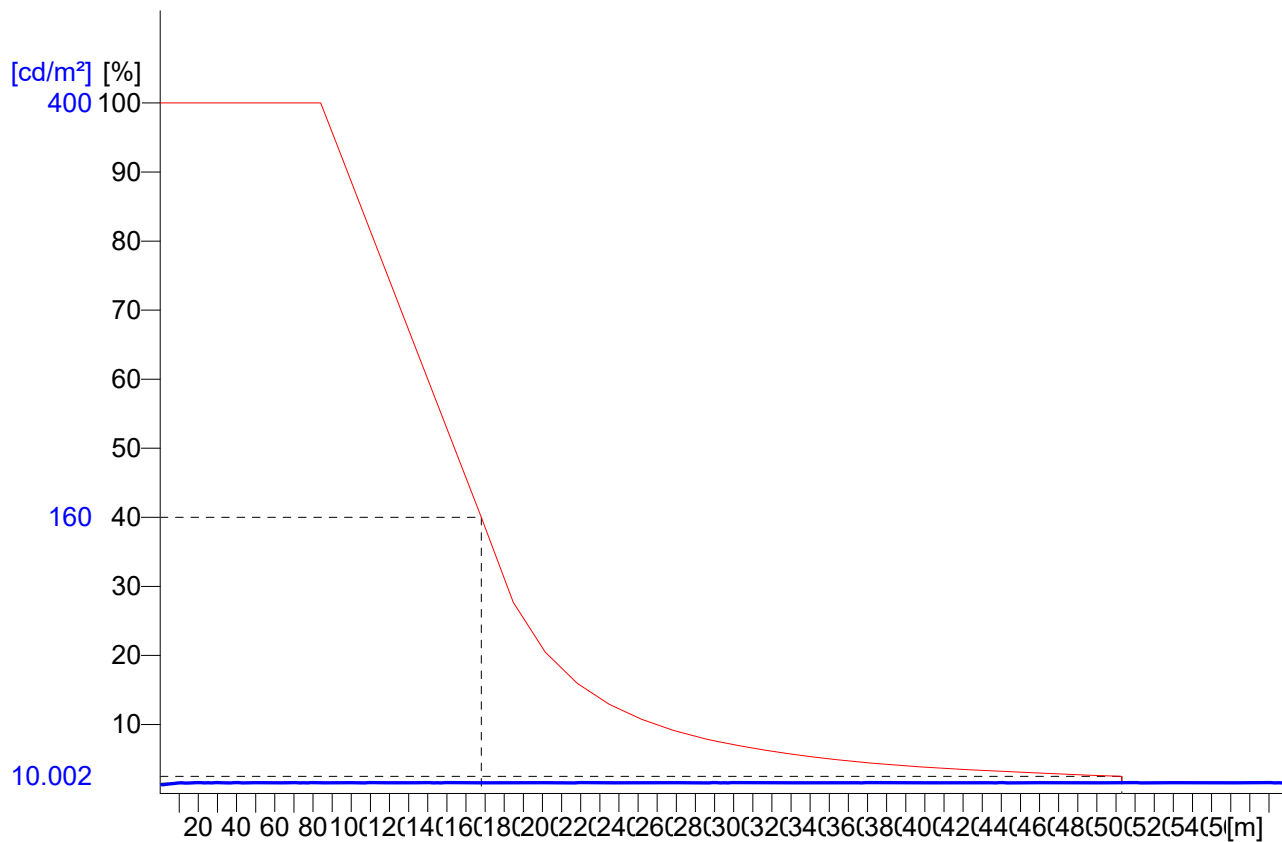
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



2.2 Calculation results, INTERIOR 2

2.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -84.9, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

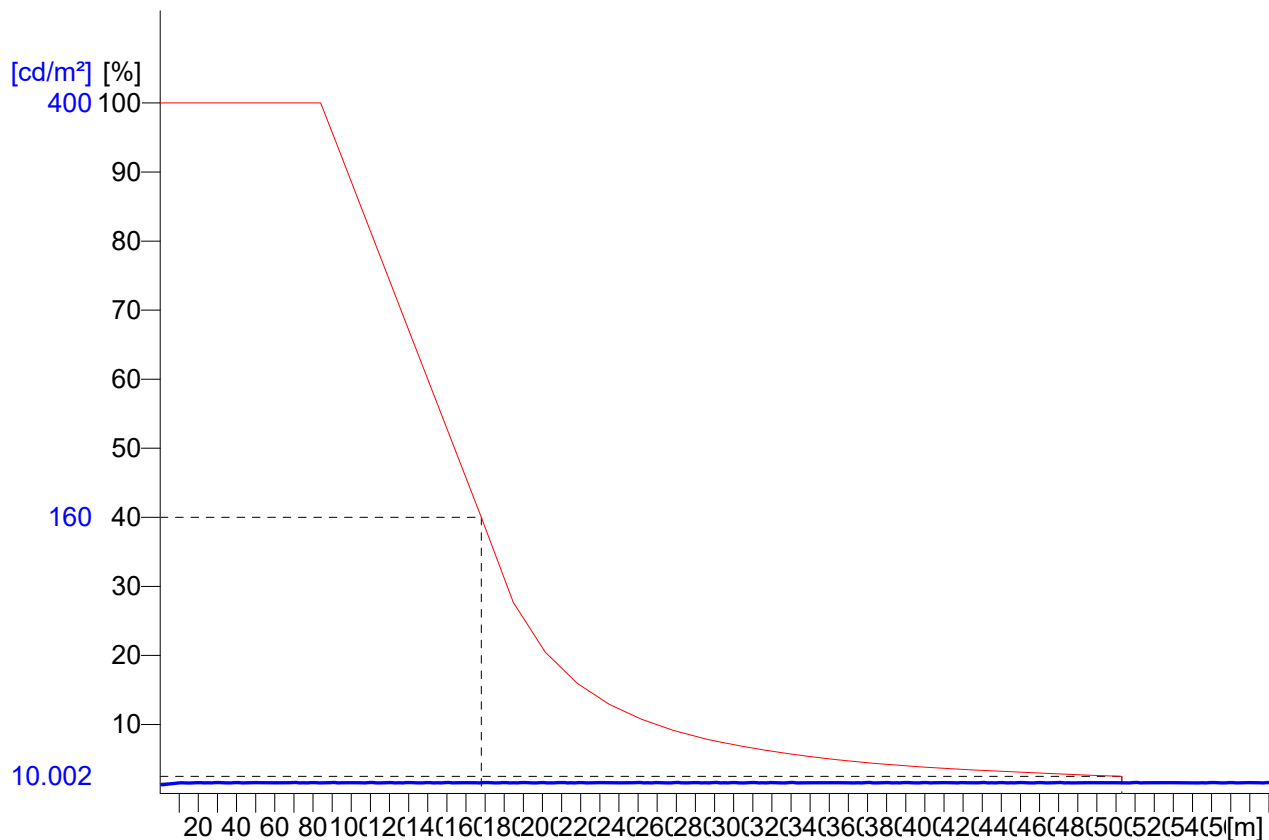
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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2.2 Calculation results, INTERIOR 2

2.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



Observer location 2 : x = -84.9, y = 5.25, z = 1.5 (dx = 85.93)
Evaluation of L on whole width of road

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

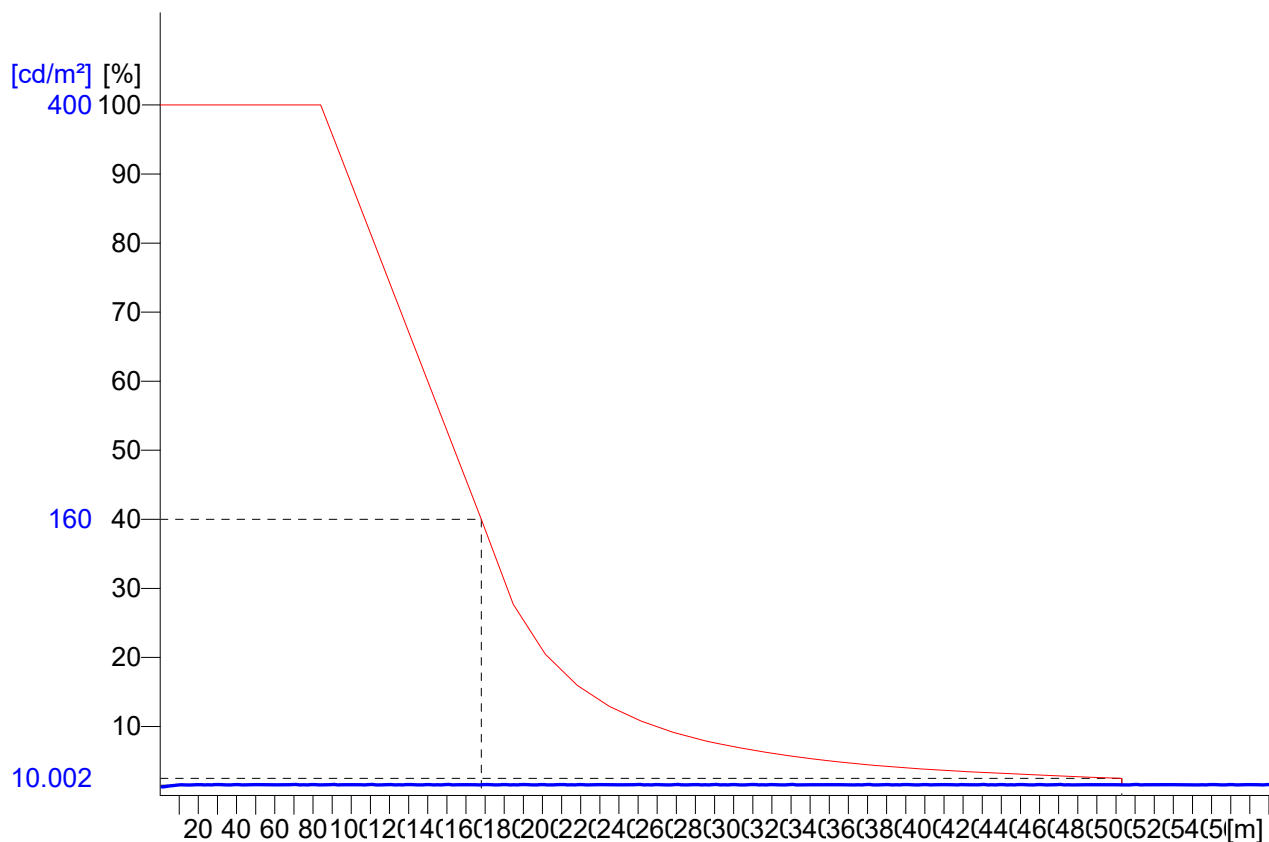
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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2.2 Calculation results, INTERIOR 2

2.2.4 Evolution, Adaptation (L), S1: 100%, Obs. 3



Observer location 3 : x = -84.9, y = 8.75, z = 1.5 (dx = 85.93)
Evaluation of L on whole width of road

[Signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2 INTERIOR 2

2.3 Calculation results, INTERIOR 2

2.3.1 Table, IN 2 (L), S1: 100%, Obs. 1

[m]	5.64	5.43	5.1	(4.77)	4.91	4.94	4.93	5.26	5.54	5.64	5.64	5.43	5.1	(4.77)
9.92	6.23	5.97	5.69	5.4	5.7	5.69	5.51	5.77	6.08	6.21	6.23	5.97	5.69	5.4
8.75	6.8	6.51	6.38	6.16	6.35	6.34	6.18	6.38	6.6	6.75	6.8	6.51	6.39	6.16
7.58	7.15	6.97	7.05	6.95	7.17	7.2	6.91	7.01	6.96	7.09	7.15	6.97	7.05	6.95
6.42	7.44	7.28	7.39	7.21	7.34	[7.45]	7.31	7.36	7.37	7.35	7.44	7.28	7.39	7.21
5.25	7.15	6.86	7	6.91	7.04	7.1	6.93	6.92	6.87	7.09	7.16	6.86	7	6.91
4.08	6.38	6.23	6.42	6.62	6.72	6.77	6.53	6.41	6.16	6.4	6.38	6.23	6.42	6.62
2.92	5.71	5.55	5.82	6.11	6.22	6.26	6.04	5.8	5.48	5.74	5.72	5.55	5.82	6.11
1.75	4.97	4.92	5.31	5.52	5.55	5.58	5.46	5.21	4.81	4.92	4.97	4.93	5.32	5.52
0.58	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00



Part1

Observer location 1 : x = -54.9, y = 1.75, z = 1.5 (dx = 85.93)
Average luminance $\bar{L}_m$: 6.27 cd/m²
Minimum luminance L_{min} : 4.77 cd/m²
Overall uniformity U_o : 0.76
Longitudinal uniformity U_l : 0.88

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-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2 INTERIOR 2

2.3 Calculation results, INTERIOR 2

2.3.1 Table, IN 2 (L), S1: 100%, Obs. 1

4.91	4.94	4.93	5.26	5.54	5.64	5.64	5.43	5.1	(4.77)	4.91	4.94	4.93	5.26	5.54
5.7	5.69	5.51	5.77	6.08	6.21	6.23	5.97	5.69	5.4	5.7	5.69	5.51	5.77	6.08
6.35	6.34	6.18	6.38	6.6	6.75	6.8	6.51	6.39	6.16	6.35	6.34	6.18	6.38	6.6
7.17	7.2	6.91	7.01	6.96	7.09	7.15	6.97	7.05	6.95	7.17	7.2	6.91	7.01	6.96
7.34	[7.45]	7.31	7.36	7.37	7.35	7.44	7.28	7.39	7.21	7.34	[7.45]	7.31	7.36	7.37
7.04	7.1	6.93	6.92	6.87	7.09	7.16	6.86	7	6.91	7.04	7.1	6.93	6.92	6.87
6.72	6.77	6.53	6.41	6.16	6.4	6.38	6.23	6.42	6.62	6.72	6.77	6.53	6.41	6.16
6.22	6.26	6.04	5.8	5.48	5.74	5.72	5.55	5.82	6.11	6.22	6.26	6.04	5.8	5.48
5.55	5.58	5.46	5.21	4.81	4.92	4.97	4.93	5.32	5.52	5.55	5.58	5.46	5.21	4.81
59.00	61.00	63.00	65.00	67.00	69.00	71.00	73.00	75.00	77.00	79.00	81.00	83.00	85.00	87.00



Part2

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2 INTERIOR 2

2.3 Calculation results, INTERIOR 2

2.3.1 Table, IN 2 (L), S1: 100%, Obs. 1

5.64	5.64	5.43	5.1	(4.77)	4.91	4.94	4.93	5.26	5.54	5.64	5.64	5.43	5.1	(4.77)
6.21	6.23	5.97	5.69	5.4	5.7	5.69	5.51	5.77	6.08	6.21	6.23	5.97	5.69	5.4
6.75	6.8	6.51	6.39	6.16	6.35	6.34	6.18	6.38	6.6	6.75	6.8	6.51	6.39	6.16
7.09	7.15	6.97	7.05	6.95	7.17	7.2	6.91	7.01	6.96	7.09	7.15	6.97	7.05	6.95
7.35	7.44	7.28	7.39	7.21	7.34	[7.45]	7.31	7.36	7.37	7.35	7.44	7.28	7.39	7.21
7.09	7.16	6.86	7	6.91	7.04	7.1	6.93	6.92	6.87	7.09	7.16	6.86	7	6.91
6.4	6.38	6.23	6.42	6.62	6.72	6.77	6.53	6.41	6.16	6.4	6.38	6.23	6.42	6.62
5.74	5.72	5.55	5.82	6.11	6.22	6.26	6.04	5.8	5.48	5.74	5.72	5.55	5.82	6.11
4.92	4.97	4.93	5.32	5.52	5.55	5.58	5.46	5.21	4.81	4.92	4.97	4.93	5.32	5.52
89.00	91.00	93.00	95.00	97.00	99.00	101.00	103.00	105.00	107.00	109.00	111.00	113.00	115.00	117.00



Part3

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2 INTERIOR 2

2.3 Calculation results, INTERIOR 2

2.3.1 Table, IN 2 (L), S1: 100%, Obs. 1

4.91	4.94	4.92	5.25	5.53	5.62
5.7	5.69	5.5	5.76	6.07	6.2
6.34	6.34	6.18	6.38	6.6	6.74
7.17	7.2	6.91	7.01	6.95	7.08
7.34	[7.45]	7.31	7.35	7.37	7.35
7.04	7.1	6.93	6.92	6.87	7.09
6.72	6.77	6.53	6.4	6.15	6.4
6.22	6.26	6.04	5.8	5.48	5.73
5.55	5.58	5.46	5.21	4.81	4.91
119.00	121.00	123.00	125.00	127.00	129.00 [m]



Part4

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, INTERIOR 2

2.3.2 Table, IN 2 (E), S1: 100%

[m]	79	71.9	63.5	57.1	54.7	54.7	57.1	63.5	72	79	79	72	63.5	57.1
9.92	86.6	79	70.5	63.5	62.3	62.3	63.5	70.5	79.1	86.7	86.7	79.1	70.5	63.5
8.75	92.9	85.9	78.4	72.6	72.7	72.7	72.7	78.5	86	93	93	86	78.5	72.7
7.58	94	90.1	85.9	83.7	85.8	85.8	83.7	85.9	90.1	94	94	90.1	86	83.7
6.42	94.1	91.6	90.5	90.3	92.6	92.6	90.3	90.5	91.6	[94.2]	[94.2]	91.6	90.5	90.3
5.25	85.8	83.7	85.1	88.8	93	93	88.8	85.1	83.7	85.9	85.9	83.7	85.1	88.8
4.08	72.2	72.1	78.3	85.3	91.6	91.6	85.4	78.3	72.1	72.3	72.3	72.1	78.3	85.4
2.92	61.6	62.9	70.5	79	86.1	86.1	79	70.5	62.9	61.7	61.7	62.9	70.6	79
1.75	(53.1)	55.9	63.5	71.6	77.3	77.3	71.6	63.5	55.9	(53.1)	(53.1)	55.9	63.5	71.6
0.58														
	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00
	Illuminance [lx]													



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 78 lx
Minimum illuminance E_{min} : 53.1 lx
Maximum illuminance E_{max} : 94.2 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.47 (0.68)
Diversity U_d E_{min}/E_{max} : 1 : 1.77 (0.56)

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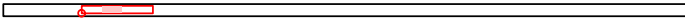
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, INTERIOR 2

2.3.2 Table, IN 2 (E), S1: 100%

54.8	54.8	57.1	63.5	72	79	79	72	63.5	57.1	54.8	54.8	57.1	63.5	72
62.4	62.4	63.5	70.5	79.1	86.7	86.7	79.1	70.5	63.5	62.4	62.4	63.5	70.5	79.1
72.7	72.7	72.7	78.5	86	93	93	86	78.5	72.7	72.7	72.7	72.7	78.5	86
85.8	85.8	83.7	86	90.1	94	94	90.1	86	83.7	85.8	85.8	83.7	86	90.1
92.6	92.6	90.3	90.5	91.6	[94.2]	[94.2]	91.6	90.5	90.3	92.6	92.6	90.3	90.5	91.6
93	93	88.8	85.1	83.7	85.9	85.9	83.7	85.1	88.8	93	93	88.8	85.1	83.7
91.7	91.7	85.4	78.3	72.1	72.3	72.3	72.1	78.3	85.4	91.7	91.7	85.4	78.3	72.1
86.2	86.2	79	70.6	62.9	61.7	61.7	62.9	70.6	79	86.2	86.2	79	70.6	62.9
77.4	77.4	71.6	63.5	55.9	(53.1)	(53.1)	55.9	63.5	71.6	77.4	77.4	71.6	63.5	55.9
59.00	61.00	63.00	65.00	67.00	69.00	71.00	73.00	75.00	77.00	79.00	81.00	83.00	85.00	87.00



Part2

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, INTERIOR 2

2.3.2 Table, IN 2 (E), S1: 100%

79	79	72	63.5	57.1	54.8	54.8	57.1	63.5	72	79	79	72	63.5	57.1
86.7	86.7	79.1	70.5	63.5	62.4	62.4	63.5	70.5	79.1	86.7	86.7	79.1	70.5	63.5
93	93	86	78.5	72.7	72.7	72.7	72.7	78.5	86	93	93	86	78.5	72.7
94	94	90.1	86	83.7	85.8	85.8	83.7	86	90.1	94	94	90.1	85.9	83.7
[94.2]	[94.2]	91.6	90.5	90.3	92.6	92.6	90.3	90.5	91.6	[94.2]	[94.2]	91.6	90.5	90.3
85.9	85.9	83.7	85.1	88.8	93	93	88.8	85.1	83.7	85.9	85.9	83.7	85.1	88.8
72.3	72.3	72.1	78.3	85.4	91.7	91.7	85.4	78.3	72.1	72.3	72.3	72.1	78.3	85.4
61.7	61.7	62.9	70.6	79	86.2	86.2	79	70.6	62.9	61.7	61.7	62.9	70.5	79
(53.1)	(53.1)	55.9	63.5	71.6	77.4	77.4	71.6	63.5	55.9	(53.1)	(53.1)	55.9	63.5	71.6
89.00	91.00	93.00	95.00	97.00	99.00	101.00	103.00	105.00	107.00	109.00	111.00	113.00	115.00	117.00



Part3

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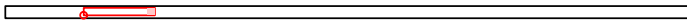
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, INTERIOR 2

2.3.2 Table, IN 2 (E), S1: 100%

54.7	54.7	57.1	63.5	71.9	79
62.3	62.3	63.5	70.5	79	86.6
72.7	72.7	72.6	78.4	85.9	92.9
85.8	85.8	83.7	85.9	90.1	94
92.6	92.6	90.3	90.5	91.6	94.1
93	93	88.8	85.1	83.7	85.8
91.6	91.6	85.3	78.3	72.1	72.2
86.1	86.1	79	70.5	62.9	61.6
77.3	77.3	71.6	63.5	55.9	(53.1)
119.00	121.00	123.00	125.00	127.00	129.00 [m]



Part4

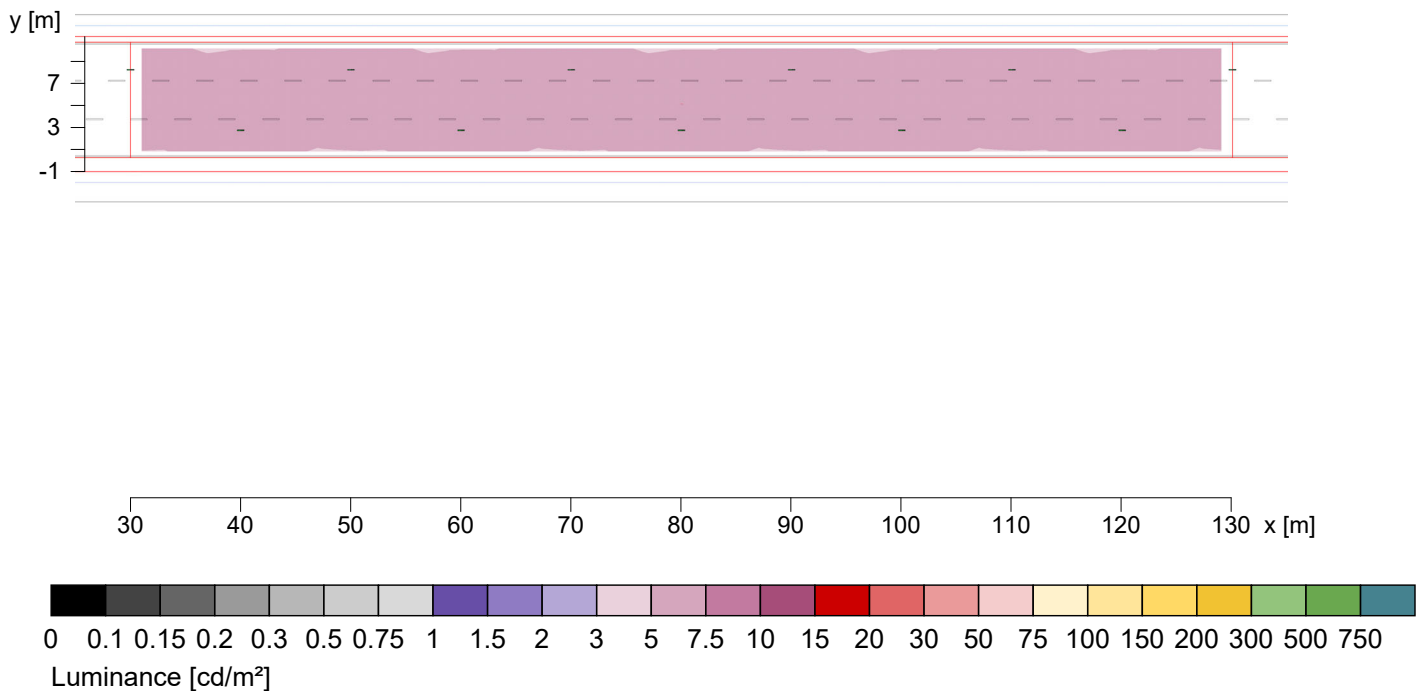
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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, INTERIOR 2

2.3.3 Pseudo colours, IN 2 (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: $x = -54.9, y = 1.75, z = 1.5$ (dx = 0.1)
 L_{min} : 6.27 cd/m²
 $L_{min}/\bar{L}_m$: 4.77 cd/m²
 $L_{l,min}/L_{l,max}$: 0.76
: 0.88

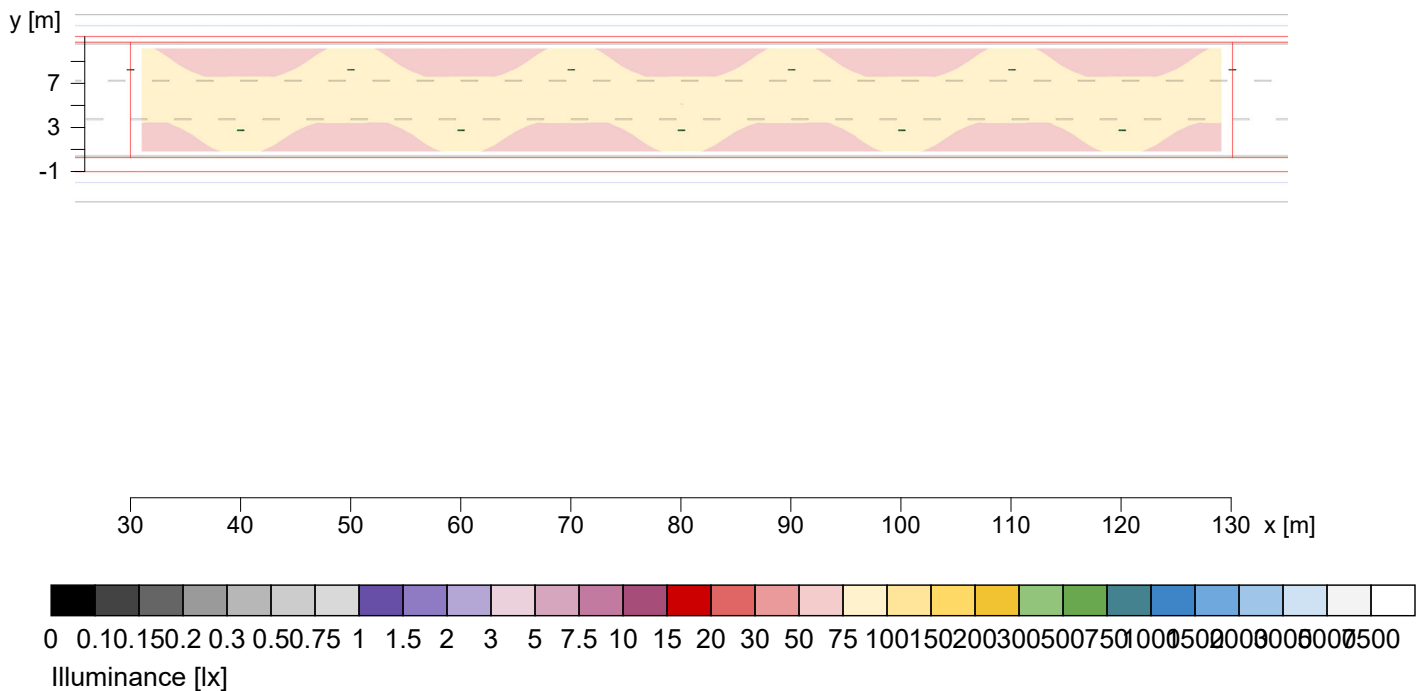
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, INTERIOR 2

2.3.4 Pseudo colours, IN 2 (E), S1: 100%



Height reference plane
Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 78 lx
 E_{max} : 53.1 lx
 $E_{min}/\bar{E}_m$: 94.2 lx
 $E_{min}/\bar{E}_m$: 1 : 1.47 (0.68)
 E_{min}/E_{max} : 1 : 1.77 (0.56)

[Signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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3 EMERGENCY

3.1 Description, EMERGENCY

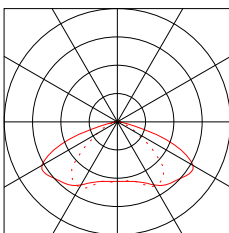
3.1.1 Luminaire list

Adaptation
LDC in use

Interior
LDC in use

Bajaj

8
Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



Row of luminaires: Row 1.1

Number of luminaires: 817

Basic position: x=0.00m y=2.50m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 98.0kW (16.33 km)

Constant distance: 20.00m

Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control	gr.S1	Int.1
1	0.00	120W / 14.96klm	2	100%	100%
2	20.00	120W / 14.96klm	2	100%	100%
3	40.00	120W / 14.96klm	2	100%	100%
4	60.00	120W / 14.96klm	2	100%	100%
5	80.00	120W / 14.96klm	2	100%	100%
6	100.00	120W / 14.96klm	2	100%	100%
7	120.00	120W / 14.96klm	2	100%	100%
8	140.00	120W / 14.96klm	2	100%	100%
9	160.00	120W / 14.96klm	2	100%	100%
10	180.00	120W / 14.96klm	2	100%	100%
11	200.00	120W / 14.96klm	2	100%	100%
12	220.00	120W / 14.96klm	2	100%	100%
13	240.00	120W / 14.96klm	2	100%	100%
14	260.00	120W / 14.96klm	2	100%	100%
15	280.00	120W / 14.96klm	2	100%	100%
16	300.00	120W / 14.96klm	2	100%	100%
17	320.00	120W / 14.96klm	2	100%	100%
18	340.00	120W / 14.96klm	2	100%	100%
19	360.00	120W / 14.96klm	2	100%	100%
20	380.00	120W / 14.96klm	2	100%	100%
21	400.00	120W / 14.96klm	2	100%	100%
22	420.00	120W / 14.96klm	2	100%	100%
23	440.00	120W / 14.96klm	2	100%	100%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



3 EMERGENCY

3.1 Description, EMERGENCY

3.1.1 Luminaire list

24	460.00	120W / 14.96klm 2	100%	100%
25	480.00	120W / 14.96klm 2	100%	100%
26	500.00	120W / 14.96klm 2	100%	100%
27	520.00	120W / 14.96klm 2	100%	100%
28	540.00	120W / 14.96klm 2	100%	100%
29	560.00	120W / 14.96klm 2	100%	100%
30	580.00	120W / 14.96klm 2	100%	100%
31	600.00	120W / 14.96klm 2	100%	100%
32	620.00	120W / 14.96klm 2	100%	100%
33	640.00	120W / 14.96klm 2	100%	100%
34	660.00	120W / 14.96klm 2	100%	100%
35	680.00	120W / 14.96klm 2	100%	100%
36	700.00	120W / 14.96klm 2	100%	100%
37	720.00	120W / 14.96klm 2	100%	100%
38	740.00	120W / 14.96klm 2	100%	100%
39	760.00	120W / 14.96klm 2	100%	100%
40	780.00	120W / 14.96klm 2	100%	100%
:	:	:	:	:
813	16240.00	120W / 14.96klm 2	100%	100%
814	16260.00	120W / 14.96klm 2	100%	100%
815	16280.00	120W / 14.96klm 2	100%	100%
816	16300.00	120W / 14.96klm 2	100%	100%
817	16320.00	120W / 14.96klm 2	100%	100%

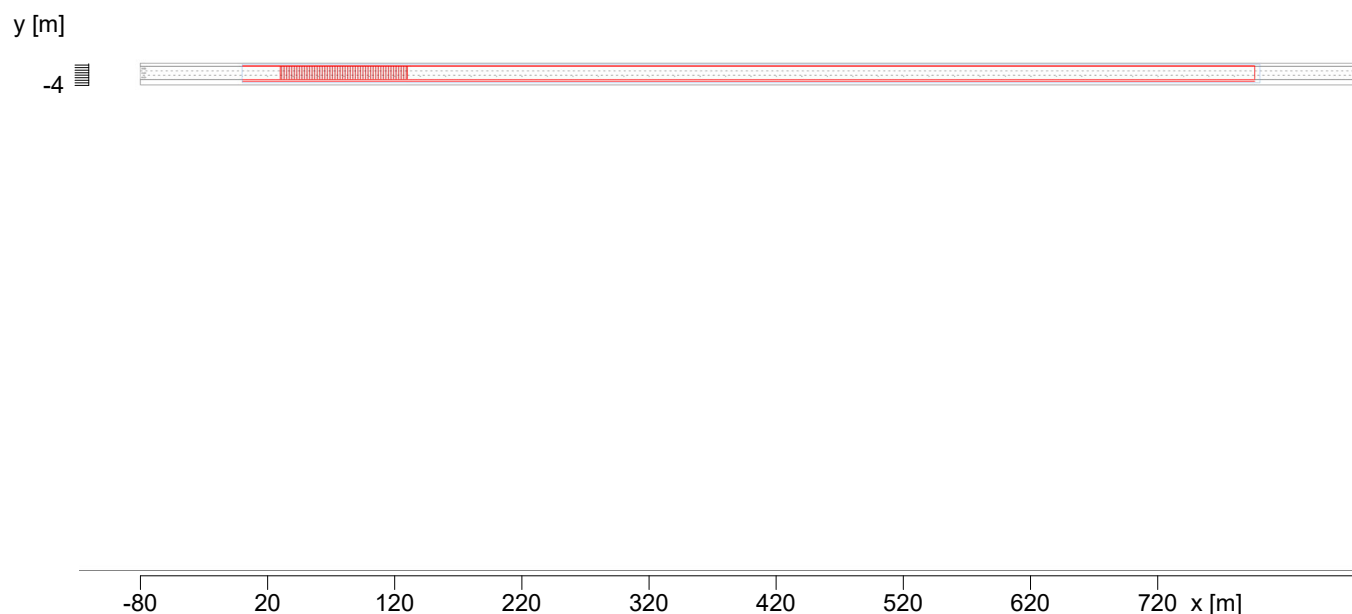
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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3.1 Description, EMERGENCY

3.1.2 Floor plan



[Handwritten signatures]

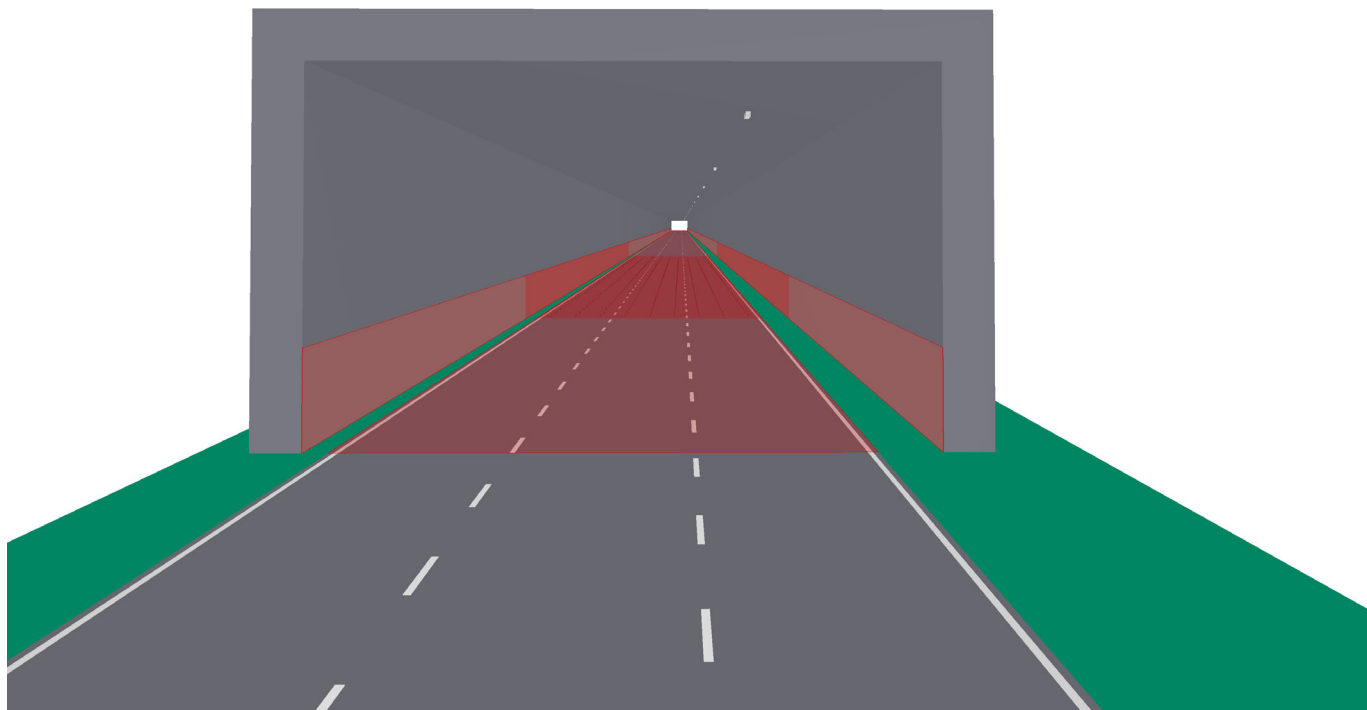
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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3.1 Description, EMERGENCY

3.1.3 3D view, View from the left



Signature
Signature
Signature
Signature
Signature

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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3 EMERGENCY

3.2 Calculation results, EMERGENCY

3.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.00 m - 796.00 m Points: nx = 398, ny = 9, nz = 3

Observer (starting point coordinate) : x = -84.93 m; z = 1.50 m dx = 85.93 m (moving)

y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

EMER

Measuring range: 30.00 m - 130.00 m Points: nx = 50, ny = 9, nz = 3

Observer (starting point coordinate) : x = -54.93 m; z = 1.50 m dx = 85.93 m (fix)

y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	3.12 cd/m ²	3.13 cd/m ²	3.14 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.42	0.42	0.42	0.4
U _i	L _{i,min} /L _{i,max}	: 0.82	0.81	0.84	0.6
f _{TI,max}	Max.	: 9 %	7 %	3 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	1.24 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.75
L _{wall} /L _{fsp}	:	0.64

Wall right (diffus 30%)

$\bar{L}_m$	:	3.15 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.61
L _{wall} /L _{fsp}	:	0.80

Illuminance

Roadway

$\bar{E}_m$	:	38.93 lx
U _o	E _{min} / $\bar{E}_m$	: 0.39

Wall left

$\bar{E}_m$	:	12.96 lx
U _o	E _{min} / $\bar{E}_m$	: 0.75

Wall right

$\bar{E}_m$	:	32.98 lx
U _o	E _{min} / $\bar{E}_m$	: 0.61

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

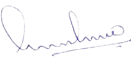
RELUX®

3 EMERGENCY

3.2 Calculation results, EMERGENCY

3.2.1 Result overview, S1: 100%

qc: The backward reflecion of the road was calculated.







-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMER (L), S1: 100%, Obs. 1

[m]	1.39	1.37	1.35	1.37	1.45	1.44	1.34	(1.32)	1.34	1.37	1.4	1.37	1.35	1.37
9.92	1.94	1.85	1.79	1.96	2.14	2.13	1.93	1.79	1.84	1.93	1.94	1.85	1.79	1.96
8.75	2.46	2.33	2.39	2.64	2.82	2.81	2.58	2.37	2.35	2.44	2.46	2.33	2.39	2.64
7.58	2.97	2.85	3.09	3.37	3.52	3.53	3.23	3.02	2.85	2.91	2.97	2.85	3.09	3.37
6.42	3.29	3.31	3.63	3.82	3.94	3.95	3.73	3.51	3.17	3.24	3.29	3.31	3.63	3.82
5.25	3.53	3.49	3.84	3.96	4.05	4.06	3.95	3.73	3.39	3.49	3.53	3.49	3.84	3.96
4.08	3.55	3.6	4	4.23	4.28	4.3	4.15	3.97	3.52	3.58	3.56	3.6	4	4.23
2.92	3.64	3.68	4.06	4.29	[4.36]	[4.36]	4.22	4.02	3.59	3.65	3.64	3.68	4.06	4.29
1.75	3.63	3.68	4.07	4.25	4.25	4.27	4.17	3.94	3.55	3.58	3.64	3.68	4.07	4.25
0.58	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00	53.00	55.00	57.00



Part1

Observer location 1 : x = -54.9, y = 1.75, z = 1.5 (dx = 85.93)
Average luminance $\bar{L}_m$: 3.12 cd/m²
Minimum luminance L_{min} : 1.32 cd/m²
Overall uniformity U_o : 0.42
Longitudinal uniformity U_l : 0.82

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMER (L), S1: 100%, Obs. 1

1.45	1.44	1.34	(1.32)	1.34	1.37	1.4	1.37	1.35	1.37	1.45	1.44	1.34	(1.32)	1.34
2.14	2.13	1.93	1.79	1.84	1.93	1.94	1.85	1.79	1.96	2.14	2.13	1.93	1.79	1.84
2.82	2.81	2.58	2.37	2.35	2.44	2.46	2.33	2.39	2.64	2.82	2.81	2.58	2.37	2.35
3.52	3.53	3.23	3.02	2.85	2.91	2.97	2.85	3.09	3.37	3.52	3.53	3.23	3.02	2.85
3.94	3.95	3.73	3.51	3.17	3.24	3.29	3.31	3.63	3.82	3.94	3.95	3.73	3.51	3.17
4.05	4.06	3.95	3.73	3.39	3.49	3.53	3.49	3.84	3.96	4.05	4.06	3.95	3.73	3.39
4.28	4.3	4.15	3.97	3.52	3.58	3.56	3.6	4	4.23	4.28	4.3	4.15	3.97	3.52
[4.36]	[4.36]	4.22	4.02	3.59	3.65	3.64	3.68	4.06	4.29	[4.36]	[4.36]	4.22	4.02	3.59
4.25	4.27	4.17	3.94	3.55	3.58	3.64	3.68	4.07	4.25	4.25	4.27	4.17	3.94	3.55
59.00	61.00	63.00	65.00	67.00	69.00	71.00	73.00	75.00	77.00	79.00	81.00	83.00	85.00	87.00



Part2

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMER (L), S1: 100%, Obs. 1

1.37	1.4	1.37	1.35	1.37	1.45	1.44	1.34	(1.32)	1.34	1.37	1.4	1.37	1.35	1.37
1.93	1.94	1.85	1.79	1.96	2.14	2.13	1.93	1.79	1.84	1.93	1.94	1.85	1.79	1.96
2.44	2.46	2.33	2.39	2.64	2.82	2.81	2.58	2.37	2.35	2.44	2.46	2.33	2.39	2.64
2.91	2.97	2.85	3.09	3.37	3.52	3.53	3.23	3.02	2.85	2.91	2.97	2.85	3.09	3.37
3.24	3.29	3.31	3.63	3.82	3.94	3.95	3.73	3.51	3.17	3.24	3.29	3.31	3.63	3.82
3.49	3.53	3.49	3.84	3.96	4.05	4.06	3.95	3.73	3.39	3.49	3.53	3.49	3.84	3.96
3.58	3.56	3.6	4	4.23	4.28	4.3	4.15	3.97	3.52	3.58	3.56	3.6	4	4.23
3.65	3.64	3.68	4.06	4.29	[4.36]	[4.36]	4.22	4.02	3.59	3.65	3.64	3.68	4.06	4.29
3.58	3.64	3.68	4.07	4.25	4.25	4.27	4.17	3.94	3.55	3.58	3.64	3.68	4.07	4.25
89.00	91.00	93.00	95.00	97.00	99.00	101.00	103.00	105.00	107.00	109.00	111.00	113.00	115.00	117.00



Part3

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

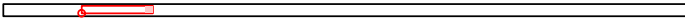


3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMER (L), S1: 100%, Obs. 1

1.45	1.44	1.34	(1.32)	1.34	1.37
2.14	2.13	1.93	1.79	1.84	1.92
2.82	2.81	2.58	2.37	2.35	2.43
3.52	3.53	3.23	3.02	2.84	2.91
3.94	3.95	3.73	3.51	3.17	3.24
4.05	4.06	3.95	3.72	3.39	3.49
4.28	4.3	4.15	3.97	3.52	3.57
[4.36]	[4.36]	4.21	4.02	3.59	3.65
4.25	4.27	4.17	3.94	3.55	3.58
119.00	121.00	123.00	125.00	127.00	129.00 [m]



Part4

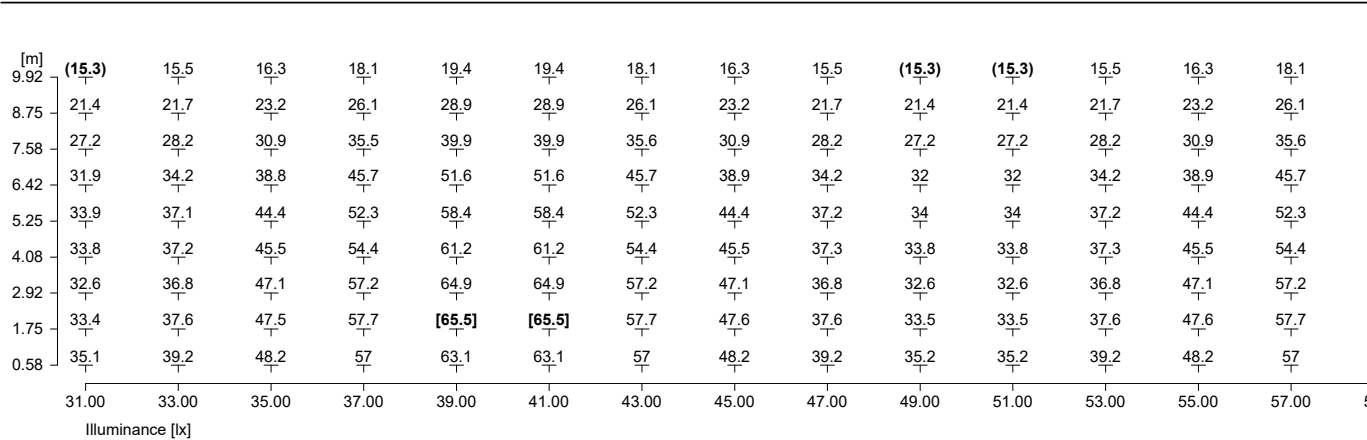
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMER (E), S1: 100%



Height reference plane
Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

$\bar{E}_m$
 E_{min}
 E_{max}
 $E_{min}/\bar{E}_m$
 E_{min}/E_{max}

: 0.00 m
: 38.9 lx
: 15.3 lx
: 65.5 lx
: 1 : 2.55 (0.39)
: 1 : 4.28 (0.23)

Part1

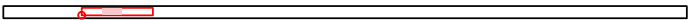
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMER (E), S1: 100%

19.4	19.4	18.1	16.3	15.5	(15.3)	(15.3)	15.5	16.3	18.1	19.4	19.4	18.1	16.3	15.5
28.9	28.9	26.1	23.2	21.7	21.4	21.4	21.7	23.2	26.1	28.9	28.9	26.1	23.2	21.7
39.9	39.9	35.6	30.9	28.2	27.2	27.2	28.2	30.9	35.6	39.9	39.9	35.6	30.9	28.2
51.6	51.6	45.7	38.9	34.2	32	32	34.2	38.9	45.7	51.6	51.6	45.7	38.9	34.2
58.4	58.4	52.3	44.4	37.2	34	34	37.2	44.4	52.3	58.4	58.4	52.3	44.4	37.2
61.2	61.2	54.4	45.5	37.3	33.8	33.8	37.3	45.5	54.4	61.2	61.2	54.4	45.5	37.3
65	65	57.2	47.1	36.8	32.6	32.6	36.8	47.1	57.2	65	65	57.2	47.1	36.8
[65.5]	[65.5]	57.7	47.6	37.6	33.5	33.5	37.6	47.6	57.7	[65.5]	[65.5]	57.7	47.6	37.6
63.1	63.1	57	48.2	39.2	35.2	35.2	39.2	48.2	57	63.1	63.1	57	48.2	39.2
59.00	61.00	63.00	65.00	67.00	69.00	71.00	73.00	75.00	77.00	79.00	81.00	83.00	85.00	87.00



Part2

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMER (E), S1: 100%

(15.3)	(15.3)	15.5	16.3	18.1	19.4	19.4	18.1	16.3	15.5	(15.3)	(15.3)	15.5	16.3	18.1
21.4	21.4	21.7	23.2	26.1	28.9	28.9	26.1	23.2	21.7	21.4	21.4	21.7	23.2	26.1
27.2	27.2	28.2	30.9	35.6	39.9	39.9	35.6	30.9	28.2	27.2	27.2	28.2	30.9	35.6
32	32	34.2	38.9	45.7	51.6	51.6	45.7	38.9	34.2	32	32	34.2	38.9	45.7
34	34	37.2	44.4	52.3	58.4	58.4	52.3	44.4	37.2	34	34	37.2	44.4	52.3
33.8	33.8	37.3	45.5	54.4	61.2	61.2	54.4	45.5	37.3	33.8	33.8	37.3	45.5	54.4
32.6	32.6	36.8	47.1	57.2	65	65	57.2	47.1	36.8	32.6	32.6	36.8	47.1	57.2
33.5	33.5	37.6	47.6	57.7	[65.5]	[65.5]	57.7	47.6	37.6	33.5	33.5	37.6	47.6	57.7
35.2	35.2	39.2	48.2	57	63.1	63.1	57	48.2	39.2	35.2	35.2	39.2	48.2	57
89.00	91.00	93.00	95.00	97.00	99.00	101.00	103.00	105.00	107.00	109.00	111.00	113.00	115.00	117.00



Part3

[Handwritten signatures]

-please put your own address here-

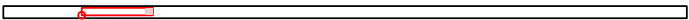
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMER (E), S1: 100%

19.4	19.4	18.1	16.3	15.5	(15.3)
28.9	28.9	26.1	23.2	21.7	21.4
39.9	39.9	35.5	30.9	28.2	27.2
51.6	51.6	45.7	38.8	34.2	31.9
58.4	58.4	52.3	44.4	37.1	33.9
61.2	61.2	54.4	45.5	37.2	33.8
64.9	64.9	57.2	47.1	36.8	32.6
[65.5]	[65.5]	57.7	47.5	37.6	33.4
63.1	63.1	57	48.2	39.2	35.1
119.00	121.00	123.00	125.00	127.00	129.00 [m]



Part4

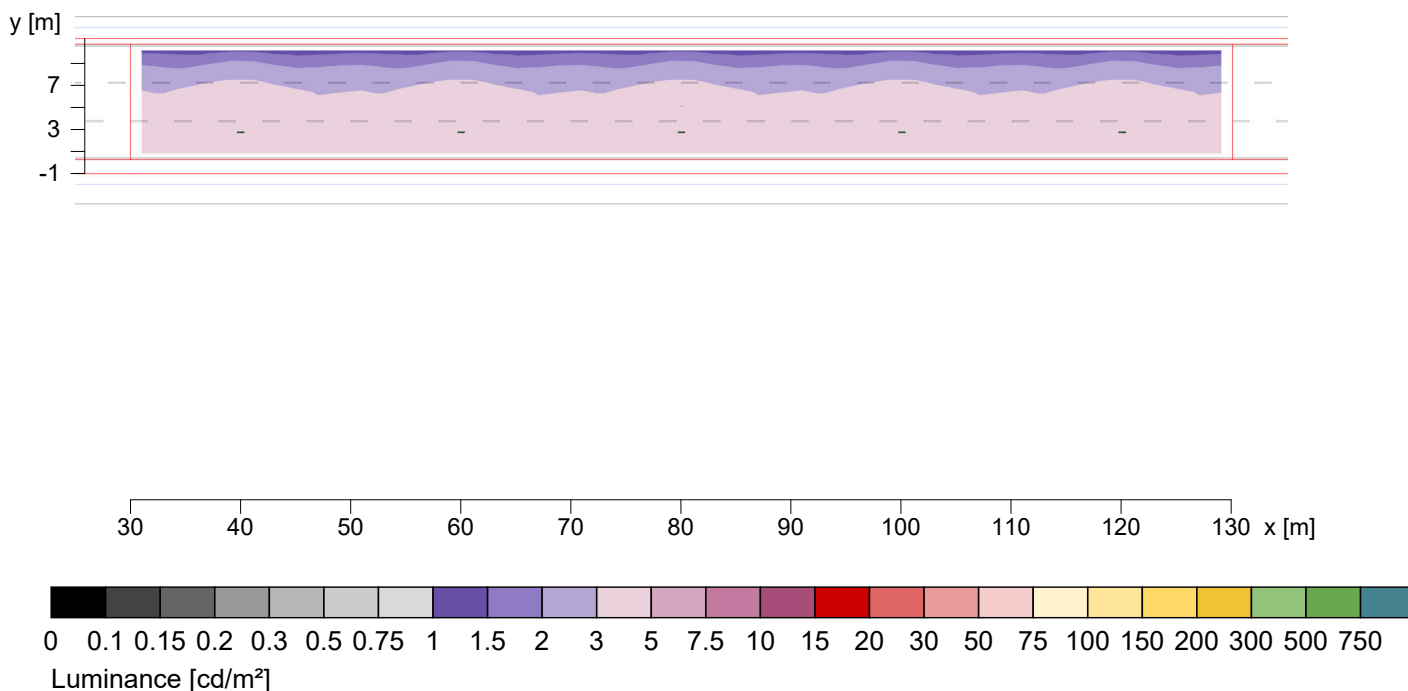
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.3 Pseudo colours, EMER (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: $x = -54.9, y = 1.75, z = 1.5$ (dx = 0.1)
 L_{min} : 3.12 cd/m²
 $L_{min}/\bar{L}_m$: 1.32 cd/m²
 $L_{l,min}/L_{l,max}$: 0.42
: 0.82

[Handwritten signatures]

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3.3.4 Pseudo colours, EMER (E), S1: 100%

Signature
~~Adair~~
Robo
ms. Soro
Signature

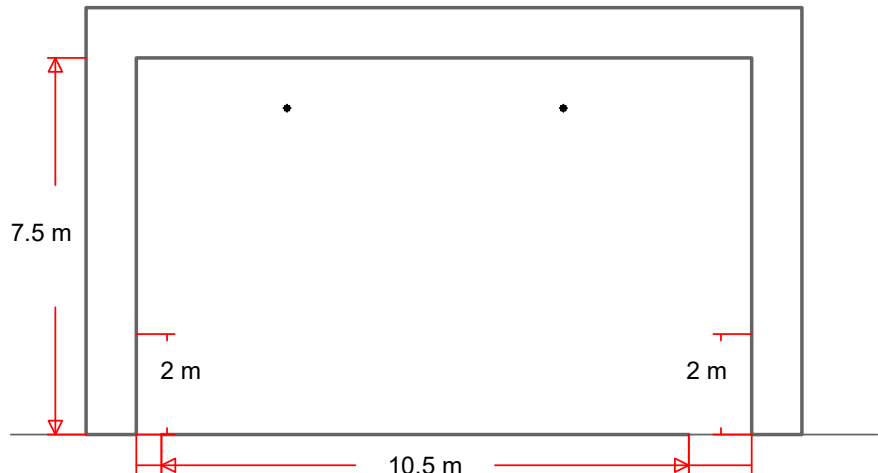
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



4 EXIT

4.1 Description, EXIT

4.1.1 Project data



Geometry tunnel

Length of the tunnel : 188 m
 Length of the tunnel (calculation model) : 188 m
 Height of the tunnel : 7.5 m

Width of the carriageway : 10.5 m
 Number of lanes : 3
 Covering / material : R1, q0 = 0.09

Marginal strip left : 0.5 m

Height of the wall (right) : 2 m
 Covering / material : diffus 30%

Marginal strip right : 1.25 m

Height of the wall (left) : 2 m
 Covering / material : diffus 30%

Calculation specifications

Speed : 100 km/h
 Length of the threshold zone : 100 m
 Luminance threshold zone : 30 cd/m²
 Luminance interior zone : 6 cd/m²

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



4 EXIT

4.1 Description, EXIT

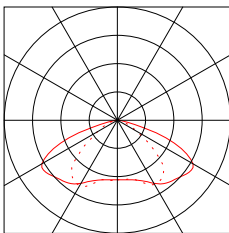
4.1.1 Project data

LDC in use

3

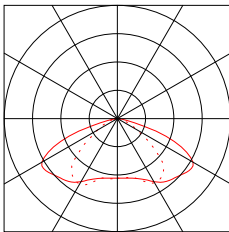
Bajaj

Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



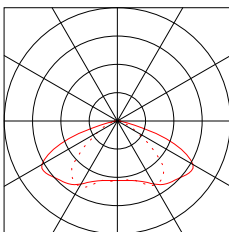
7

Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



8

Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024

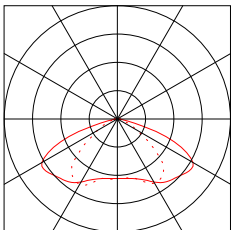


4.1 Description, EXIT

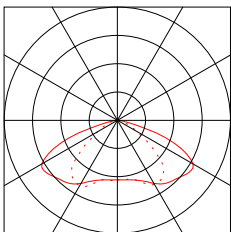
4.1.2 Luminaire list

Adaptation
 LDC in use

Bajaj
 3 26 x Order No. : s
 Luminaire name : E230315 BJTU S 243L NW SYM PC
 Equipment : 1 x Unknown 180.3 W / 22564 lm
 Maintenance factor: 0.85



7 6 x Order No. : s
 Luminaire name : E230315 BJTU S 162L NW SYM PC
 Equipment : 1 x Unknown 120 W / 14964 lm
 Maintenance factor: 0.85



Row of luminaires: Row 3.1

Number of luminaires: 16
 Basic position: x=1.00m y=2.50m, z=6.50m
 Rotation: z=180.0° C0=0.0° C90=0.0°

System power (total): 2.7kW
 -variable distances-

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.00	180.3W / 22.56klm1	100%	0%
2	7.20	180.3W / 22.56klm1	100%	0%
3	13.50	180.3W / 22.56klm1	100%	0%
4	19.70	180.3W / 22.56klm1	100%	0%
5	26.00	180.3W / 22.56klm1	100%	0%
6	32.20	180.3W / 22.56klm1	100%	0%
7	38.40	180.3W / 22.56klm1	100%	0%
8	44.70	180.3W / 22.56klm1	100%	0%
9	50.90	180.3W / 22.56klm1	100%	0%
10	57.20	180.3W / 22.56klm1	100%	0%
11	64.00	180.3W / 22.56klm1	100%	0%
12	71.80	180.3W / 22.56klm1	100%	0%
13	81.10	180.3W / 22.56klm1	100%	0%
14	88.70	120W / 14.96klm 1	100%	0%

[Handwritten signatures and initials]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



4.1 Description, EXIT

4.1.2 Luminaire list

15	98.80	120W / 14.96klm 1	100%	0%
16	110.80	120W / 14.96klm 1	100%	0%

Row of luminaires: Row 4.1

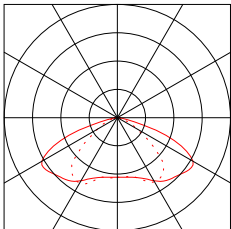
Number of luminaires: 16
 Basic position: x=1.00m y=8.00m, z=6.50m
 Rotation: z=180.0° C0=0.0° C90=0.0°

System power (total): 2.7kW
 -variable distances-

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.00	180.3W / 22.56klm1	100%	0%
2	7.20	180.3W / 22.56klm1	100%	0%
3	13.50	180.3W / 22.56klm1	100%	0%
4	19.70	180.3W / 22.56klm1	100%	0%
5	26.00	180.3W / 22.56klm1	100%	0%
6	32.20	180.3W / 22.56klm1	100%	0%
7	38.40	180.3W / 22.56klm1	100%	0%
8	44.70	180.3W / 22.56klm1	100%	0%
9	50.90	180.3W / 22.56klm1	100%	0%
10	57.20	180.3W / 22.56klm1	100%	0%
11	64.00	180.3W / 22.56klm1	100%	0%
12	71.80	180.3W / 22.56klm1	100%	0%
13	81.10	180.3W / 22.56klm1	100%	0%
14	88.70	120W / 14.96klm 1	100%	0%
15	98.80	120W / 14.96klm 1	100%	0%
16	110.80	120W / 14.96klm 1	100%	0%

Interior LDC in use

8 **Bajaj**
 Order No. : s
 Luminaire name : E230315 BJTU S 162L NW SYM PC
 Equipment : 1 x Unknown 120 W / 14964 lm
 Maintenance factor: 0.85



[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



4.1 Description, EXIT

4.1.2 Luminaire list

Row of luminaires: Row 1.1

Number of luminaires: 11
 Basic position: x=0.00m y=2.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.3kW (0.19 km)
 Constant distance: 20.00m
 Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	120W / 14.96klm	2	100% 100%
2	20.00	120W / 14.96klm	2	100% 100%
3	40.00	120W / 14.96klm	2	100% 100%
4	60.00	120W / 14.96klm	2	100% 100%
5	80.00	120W / 14.96klm	2	100% 100%
6	100.00	120W / 14.96klm	2	100% 100%
7	120.00	120W / 14.96klm	2	100% 100%
8	140.00	120W / 14.96klm	2	100% 100%
9	160.00	120W / 14.96klm	2	100% 100%
10	180.00	120W / 14.96klm	2	100% 100%

Row of luminaires: Row 2.1

Number of luminaires: 10
 Basic position: x=10.00m y=8.00m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.2kW (0.19 km)
 Constant distance: 20.00m
 Flicker frequency (v=100 km/h): 1.4 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	10.00	120W / 14.96klm	2	100% 100%
2	30.00	120W / 14.96klm	2	100% 100%
3	50.00	120W / 14.96klm	2	100% 100%
4	70.00	120W / 14.96klm	2	100% 100%
5	90.00	120W / 14.96klm	2	100% 100%
6	110.00	120W / 14.96klm	2	100% 100%
7	130.00	120W / 14.96klm	2	100% 100%
8	150.00	120W / 14.96klm	2	100% 100%
9	170.00	120W / 14.96klm	2	100% 100%
10	190.00	120W / 14.96klm	2	100% 100%

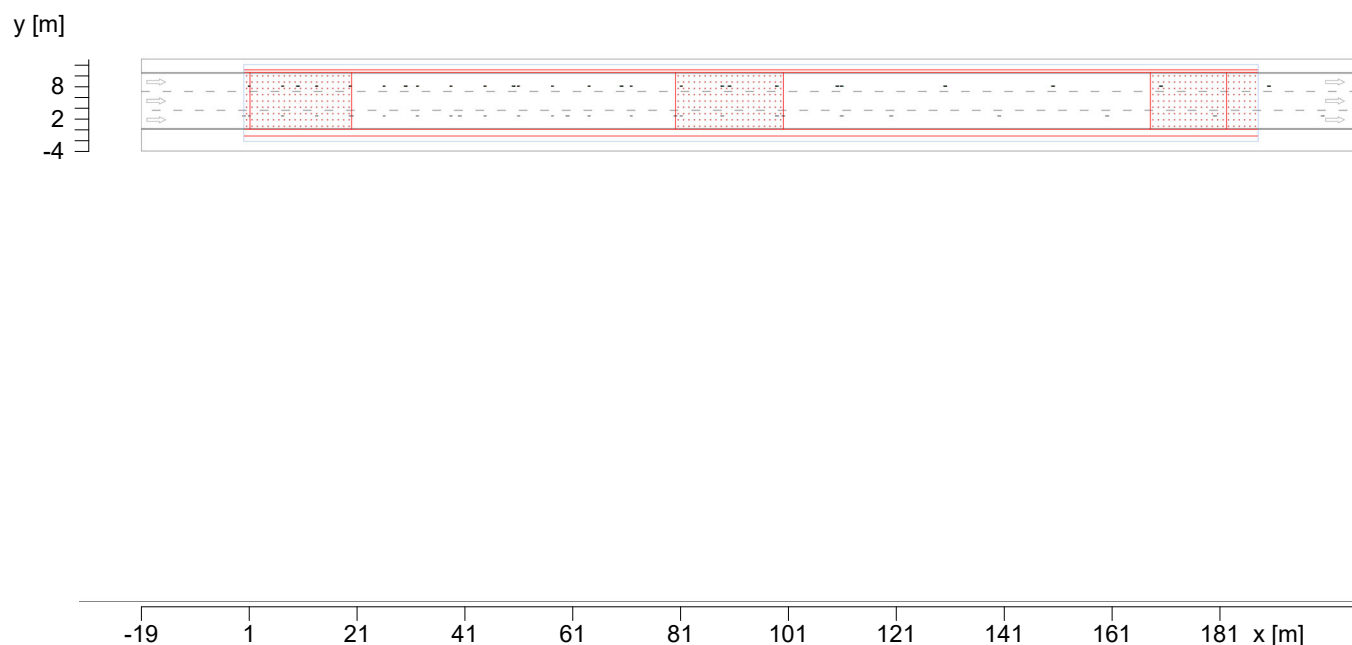
[Handwritten signatures]

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4.1 Description, EXIT

4.1.3 Floor plan



Signature
Signature
Signature
Signature
Signature

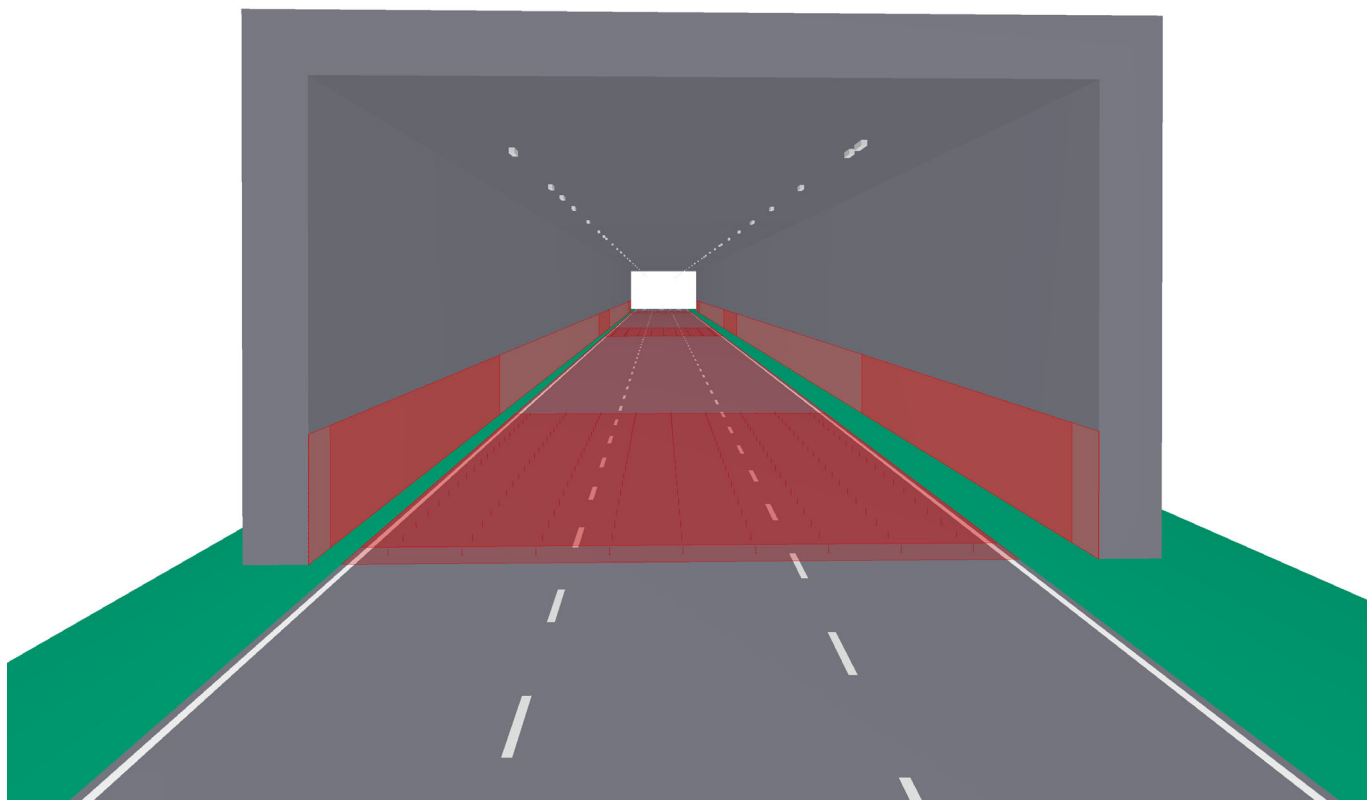
-please put your own address here-

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4.1 Description, EXIT

4.1.4 3D view, View from the left



Handwritten signatures:
1. *Shubh*
2. *Adar*
3. *Rob*
4. *CSA Son*
5. *Sanjay Kumar*

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4 EXIT

4.2 Calculation results, EXIT

4.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 1.10 m - 182.14 m Points: nx = 73, ny = 9, nz = 3

Observer (starting point coordinate) : x = -83.59 m; z = 1.50 m dx = 85.93 m (moving)
y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

EXIT END

Measuring range: 0.00 m - 20.00 m Points: nx = 20, ny = 9, nz = 3

Observer (starting point coordinate) : x = -60.00 m; z = 1.50 m dx = 60.50 m (fix)
y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

$\bar{E}_m$	:	32.81 cd/m ²	32.82 cd/m ²	32.79 cd/m ²	
U _o	L _{min} / $\bar{E}_m$	: 0.58	0.59	0.60	0.4
U _i	L _{i,min} /L _{i,max}	: 0.70	0.68	0.68	0.6
f _{TI,max}	Max.	: 3 %	3 %	3 %	

Wall left (diffus 30%)

$\bar{E}_m$: 23.19 cd/m²
U_o L_{min}/ $\bar{E}_m$: 0.63
L_{wall}/L_{fsp} : 0.77

Wall right (diffus 30%)

$\bar{E}_m$: 21.90 cd/m²
U_o L_{min}/ $\bar{E}_m$: 0.71
L_{wall}/L_{fsp} : 0.71

Illuminance

Roadway

$\bar{E}_m$: 417.63 lx
U_o E_{min}/ $\bar{E}_m$: 0.59

Wall left

$\bar{E}_m$: 242.77 lx
U_o E_{min}/ $\bar{E}_m$: 0.63

Wall right

$\bar{E}_m$: 229.22 lx
U_o E_{min}/ $\bar{E}_m$: 0.71

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Lincoln
~~Adair~~
Robb
McAdams
Adair

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4 EXIT

4.2 Calculation results, EXIT

4.2.1 Result overview, S1: 100%

EXIT START

Measuring range: 168.00 m - 188.00 m Points: nx = 20, ny = 9, nz = 3
Observer (starting point coordinate) : x = 108.00 m; z = 1.50 m dx = 60.50 m (fix)
y = 1.75 m y = 5.25 m y = 8.75 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	6.18 cd/m ²	6.19 cd/m ²	6.18 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.75	0.74	0.73	0.4
U _i	L _{i,min} /L _{i,max}	: 0.85	0.94	0.86	0.6
f _{TI,max}	Max.	: 5 %	5 %	6 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	4.26 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.77
L _{wall} /L _{fsp}	:	0.74

Wall right (diffus 30%)

$\bar{L}_m$	:	4.07 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.74
L _{wall} /L _{fsp}	:	0.70

Illuminance

Roadway

$\bar{E}_m$	:	77.67 lx
U _o	E _{min} / $\bar{E}_m$	: 0.68

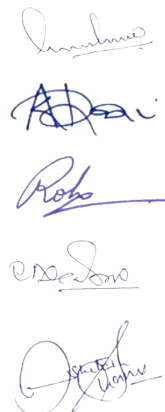
Wall left

$\bar{E}_m$	:	44.64 lx
U _o	E _{min} / $\bar{E}_m$	: 0.77

Wall right

$\bar{E}_m$	:	42.64 lx
U _o	E _{min} / $\bar{E}_m$	: 0.75

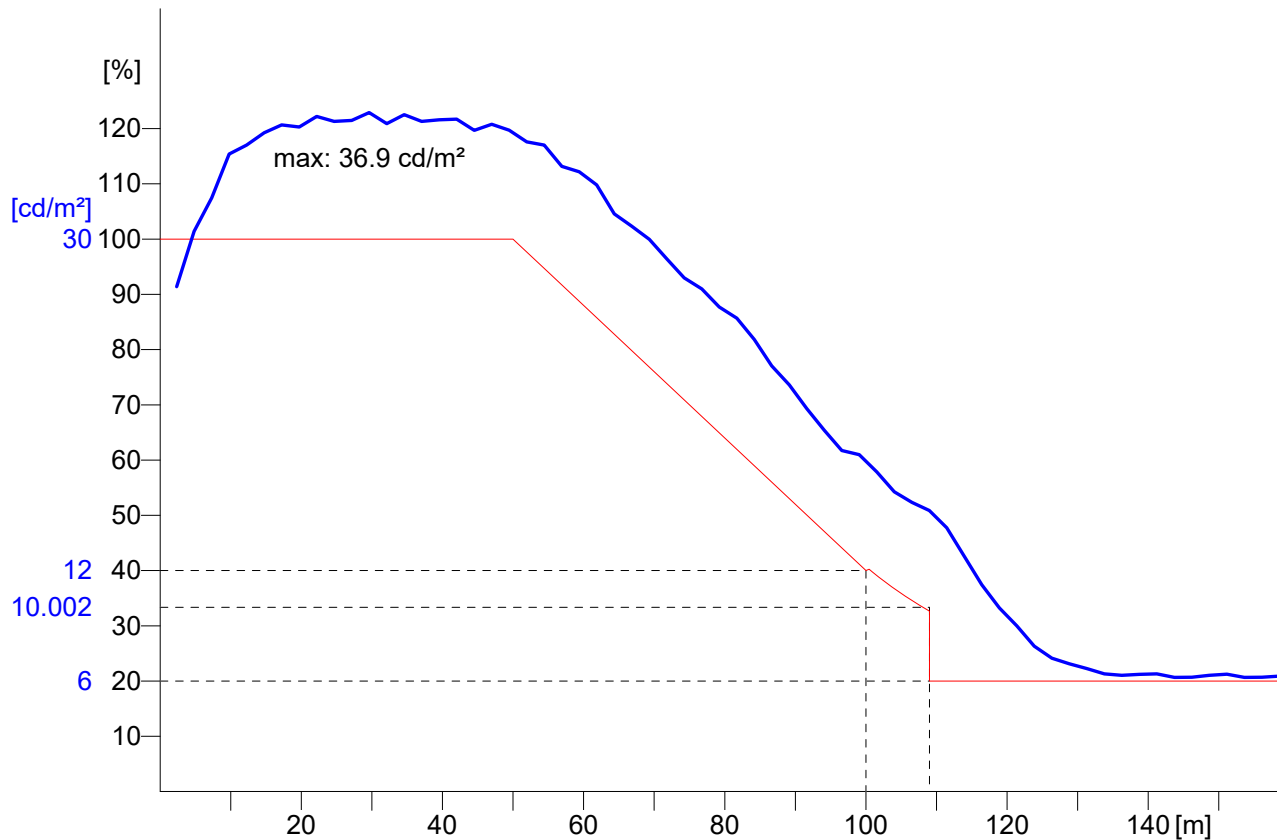
qc: The backward reflection of the road was calculated.



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4.2 Calculation results, EXIT

4.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -83.6, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

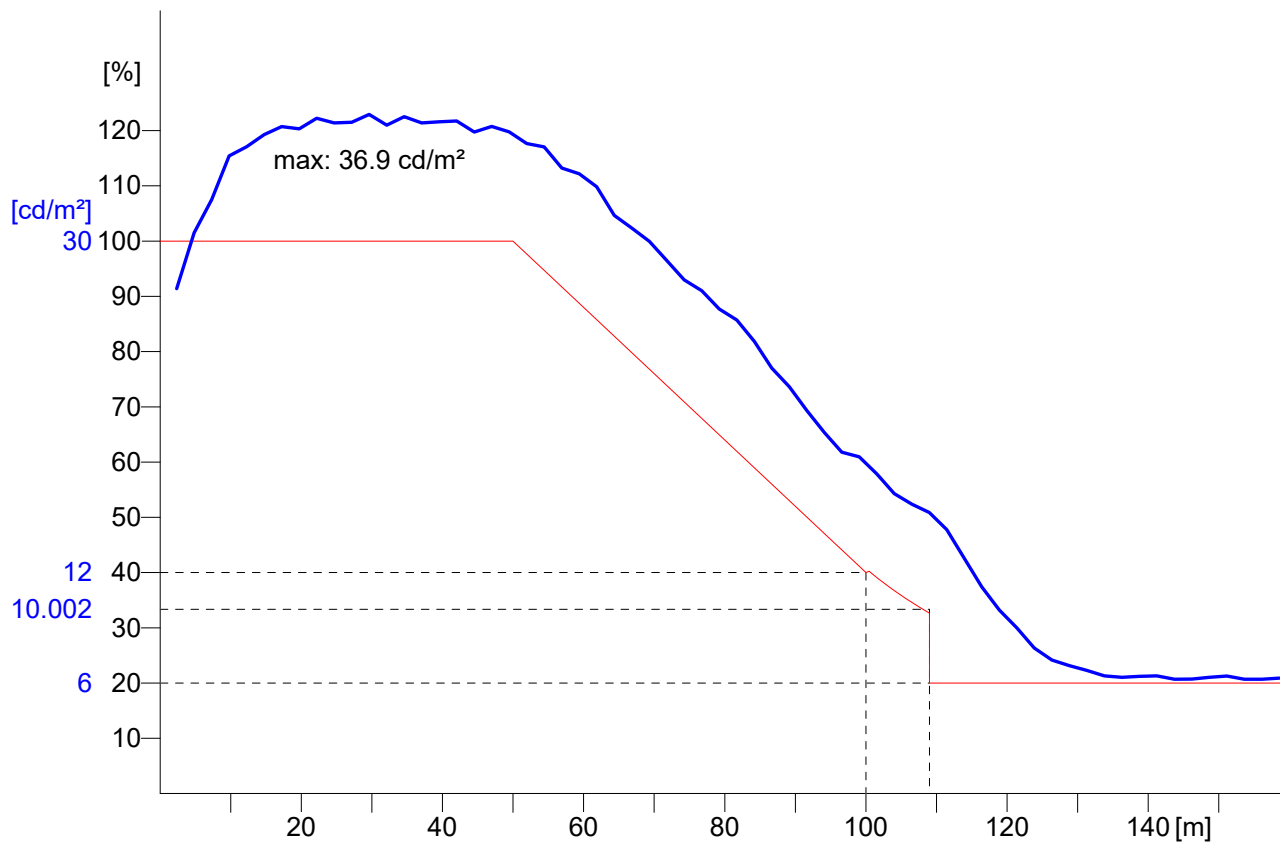
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4.2 Calculation results, EXIT

4.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



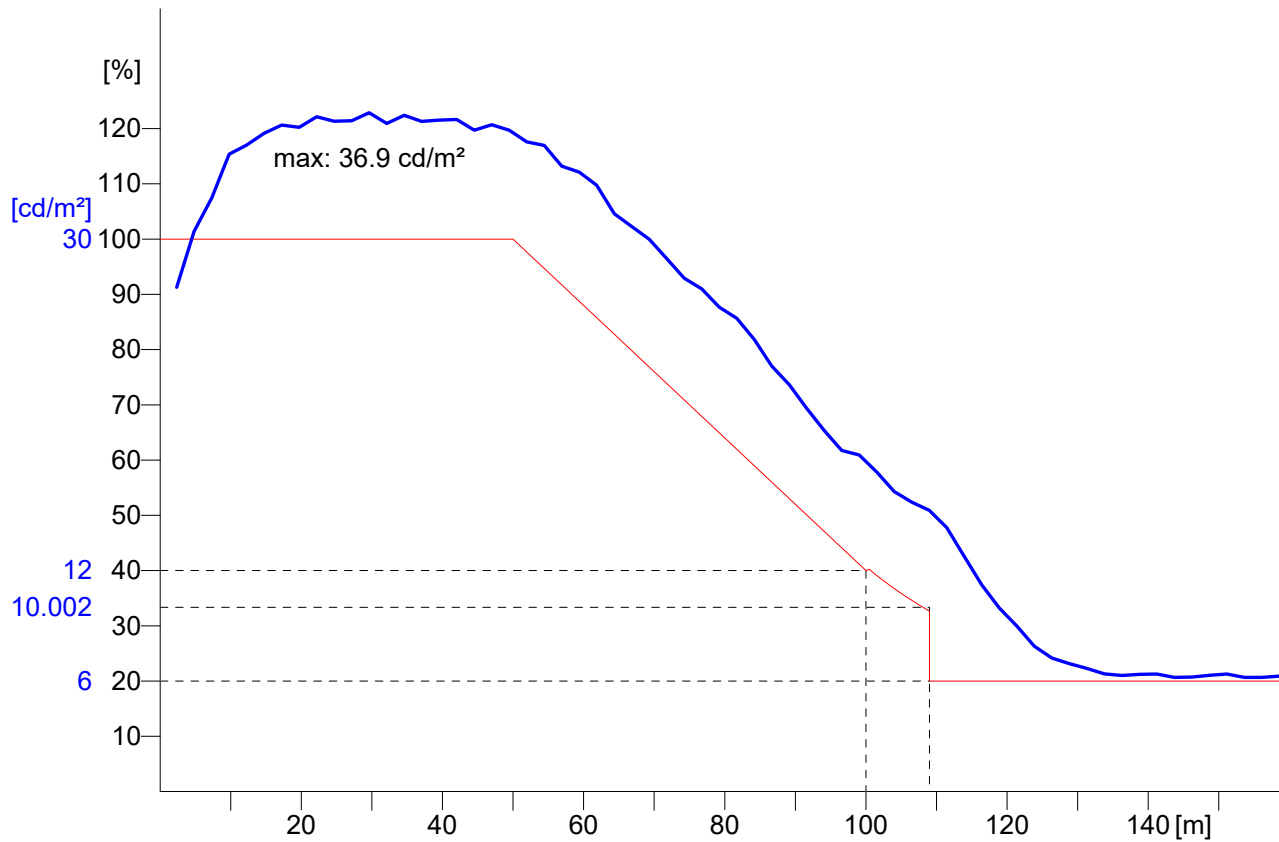
Observer location 2 : x = -83.6, y = 5.25, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

[Handwritten signatures]

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4.2 Calculation results, EXIT

4.2.4 Evolution, Adaptation (L), S1: 100%, Obs. 3



Observer location 3 : x = -83.6, y = 8.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

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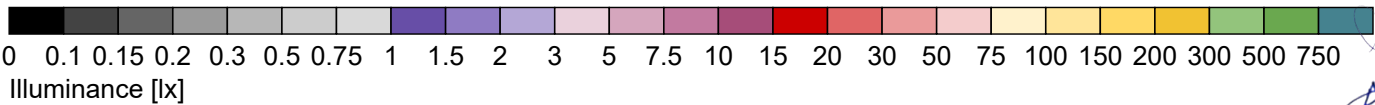
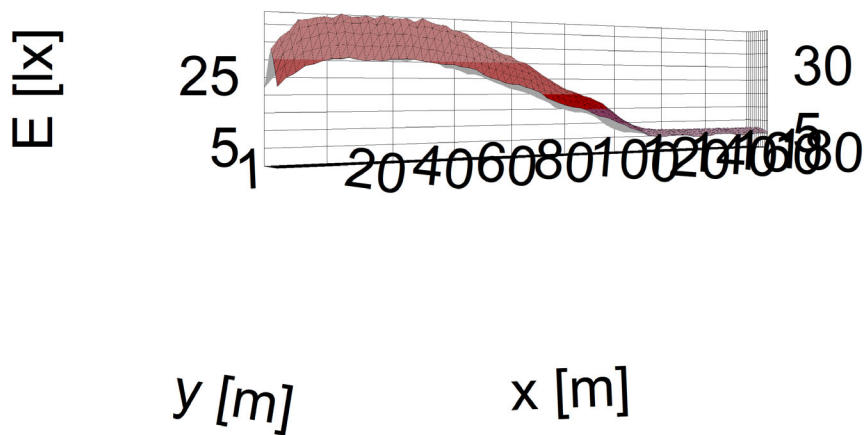
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4 EXIT

4.3 Calculation results, EXIT

4.3.1 3D mountain plot, Adaptation (L), S1: 100%, Obs. 1



Illuminance [lx]

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 [Signature 1]
 [Signature 2]
 [Signature 3]
 [Signature 4]

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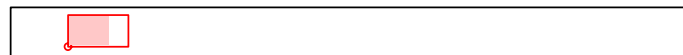


4 EXIT

4.4 Calculation results, EXIT

4.4.1 Table, EXIT END (L), S1: 100%, Obs. 1

[m]	(18.9)	20.5	22	23.2	24.2	25.4	26.3	26.8	27.7	28.6	28.9	29.2	29.3	29.1
9.92	21.9	23.5	25	26.2	27.2	28.5	29.4	30	31.1	31.9	32.4	32.5	32.6	32.6
8.75	24.9	26.6	28.1	29.5	30.8	31.9	32.7	33.4	34.4	35.3	35.9	36.1	36	36.1
7.58	27.8	29.5	31.3	32.8	33.9	34.8	35.7	36.4	37.5	38.5	39	39.2	39.2	39.4
6.42	29.2	31.1	33.3	35.2	35.9	36.9	37.7	38.2	39.5	41	41.2	41.3	41.3	41.1
5.25	27.7	29.6	31.6	33	34	35.1	35.6	36.4	37.7	38.9	39.3	39.5	39.3	39.2
4.08	26	27.7	29.1	30.4	31.6	32.2	32.7	33.4	34.6	35.5	36.1	36.2	36.1	36.2
2.92	23.8	25.2	26.5	27.5	28.3	28.9	29.4	30.1	31.1	31.8	32.3	32.6	32.6	32.7
1.75	20.9	22.1	23.3	24.3	24.9	25.4	25.8	26.4	27.1	27.9	28.3	28.6	28.7	28.9
0.58	0.50	1.50	2.50	3.50	4.50	5.50	6.50	7.50	8.50	9.50	10.50	11.50	12.50	13.50



Part1

Observer location 1 : x = -60, y = 1.75, z = 1.5 (dx = 60.50)
Average luminance $\bar{L}_m$: 32.8 cd/m²
Minimum luminance L_{min} : 18.9 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.58
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.7

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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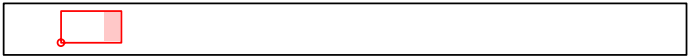


4 EXIT

4.4 Calculation results, EXIT

4.4.1 Table, EXIT END (L), S1: 100%, Obs. 1

29.5	29.6	29.5	29.5	29.5	29.3
32.9	33.1	32.9	33	33.2	33.1
36.5	36.6	36.7	36.9	36.8	36.7
39.9	40.2	40.4	40.5	40.4	40.4
41.8	[42.8]	[42.8]	42.4	42.3	42
39.9	40.6	40.6	40.6	40.4	40.3
36.8	37.3	37.7	37.8	37.6	37.5
33.3	33.7	34	34.2	34.1	34.2
29.5	30	30.2	30.2	30.1	30.2
14.50	15.50	16.50	17.50	18.50	19.50 [m]



Part2

[Handwritten signatures]

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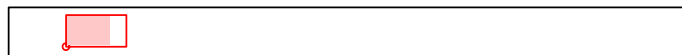
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4.4 Calculation results, EXIT

4.4.2 Table, EXIT END (E), S1: 100%

[m]	(247)	268	287	305	320	335	349	359	369	376	380	382	381	378	376
9.92															
8.75	281	304	324	340	357	375	389	400	412	418	421	424	422	420	418
7.58	317	342	363	381	398	416	431	443	453	461	464	466	466	465	463
6.42	353	378	400	419	436	451	467	478	488	495	500	501	503	503	503
5.25	373	401	425	444	462	477	489	500	510	517	522	524	525	526	528
4.08	361	387	407	425	439	451	463	473	482	490	494	496	498	500	503
2.92	340	362	379	393	404	412	420	427	434	440	444	448	450	453	459
1.75	308	327	342	353	361	368	372	378	385	390	393	398	400	403	410
0.58	274	290	302	312	319	325	329	333	338	342	346	350	353	357	363
	0.50	1.50	2.50	3.50	4.50	5.50	6.50	7.50	8.50	9.50	10.50	11.50	12.50	13.50	14.50
	Illuminance [lx]														



Part1

Height reference plane	:	0.00 m
Average illuminance	$\bar{E}_m$	: 418 lx
Minimum illuminance	E_{min}	: 247 lx
Maximum illuminance	E_{max}	: 533 lx
Uniformity U_o	$E_{min}/\bar{E}_m$	: 1 : 1.69 (0.59)
Diversity U_d	E_{min}/E_{max}	: 1 : 2.16 (0.46)

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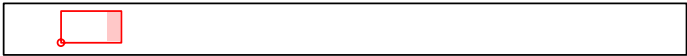


4.4 Calculation results, EXIT

4.4.2 Table, EXIT END (E), S1: 100%

373	370	369	368	368
415	410	410	411	410
459	456	457	457	458
501	501	502	504	506
529	530	532	[533]	[533]
505	508	510	513	515
464	468	472	476	478
417	420	426	430	431
369	373	378	381	383
5.50	16.50	17.50	18.50	19.50

[m]



Part2

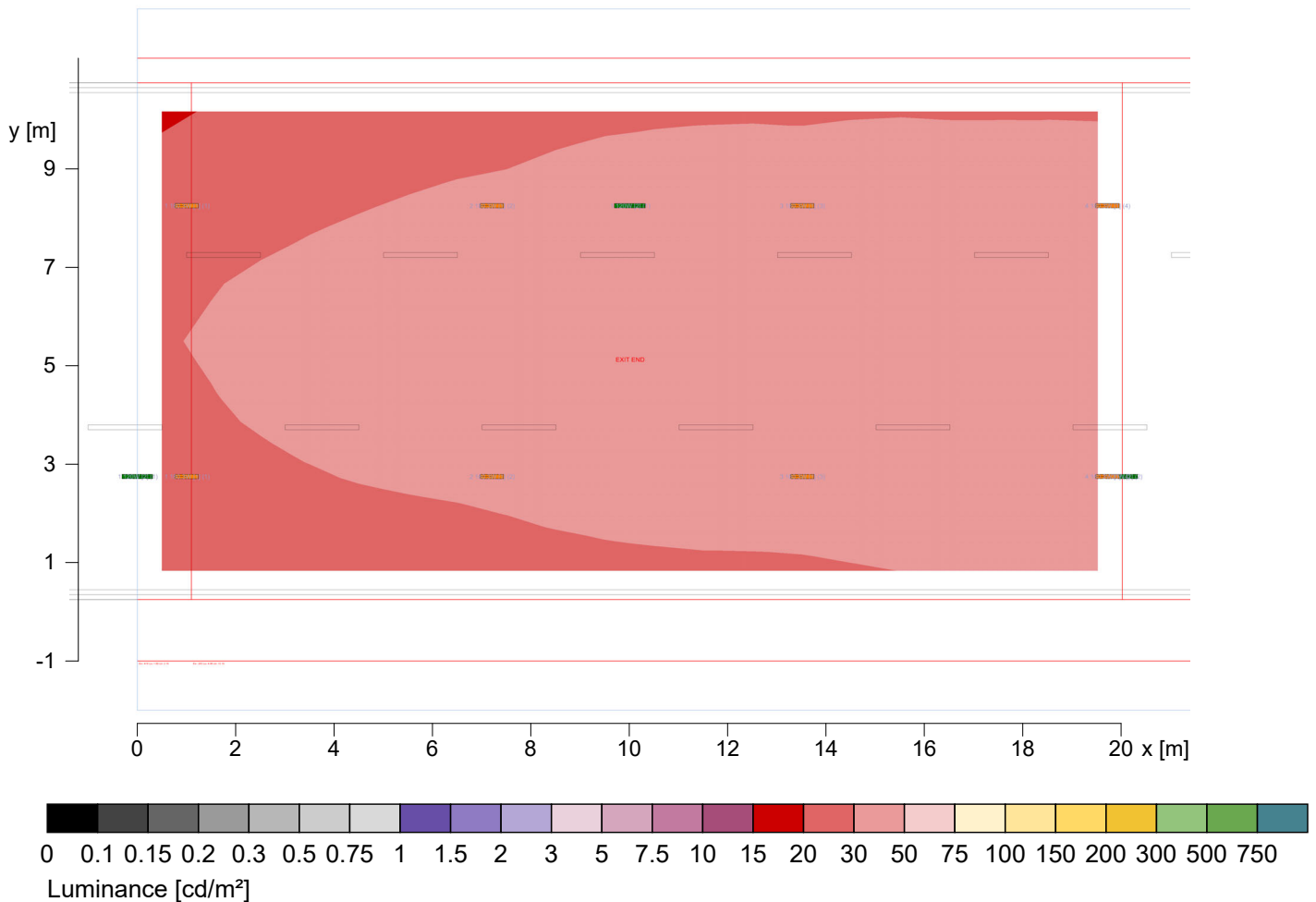
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4.4 Calculation results, EXIT

4.4.3 Pseudo colours, EXIT END (L), S1: 100%, Obs. 1



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4.4.4 Pseudo colours, EXIT END (E), S1: 100%



Imanhuwa
~~Adai~~
Robo
Em. Soro
Adai

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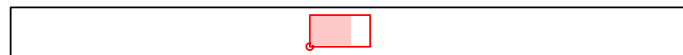
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4 EXIT

4.5 Calculation results, EXIT

4.5.1 Table, EXIT MID (L), S1: 100%, Obs. 1

[m]	21.3	21.1	20.8	20.5	20.5	20.4	19.9	19.2	18.9	18.6	18.2	17.8	17.4	17
9.92	21.3	21.1	20.8	20.5	20.5	20.4	19.9	19.2	18.9	18.6	18.2	17.8	17.4	17
8.75	24	23.7	23.2	22.6	22.5	22.3	21.7	21.2	21.1	20.8	20.3	19.7	19.1	18.6
7.58	26.5	26.1	25.6	25.1	24.9	24.6	24.1	23.3	23.1	22.7	22.1	21.5	20.9	20.4
6.42	29.1	28.6	28.1	27.6	27.2	26.8	26	25.2	24.8	24.4	23.8	23.2	22.6	22.1
5.25	[30.5]	30.1	29.6	29.1	28.8	28.3	27.3	26.3	25.8	25.5	25	24.4	23.7	23.2
4.08	29.1	28.7	28.2	27.7	27.3	26.7	25.8	25.2	24.8	24.5	24	23.3	22.6	22.1
2.92	27.2	26.8	26.2	25.6	25.2	24.6	23.7	23	22.9	22.6	22	21.3	20.6	20.2
1.75	24.6	24.3	23.9	23.3	22.8	22.1	21.3	20.8	20.7	20.3	19.8	19.2	18.7	18.2
0.58	21.7	21.5	21.2	20.8	20.4	19.7	18.9	18.3	18.1	17.8	17.5	17	16.6	16.4
	80.50	81.50	82.50	83.50	84.50	85.50	86.50	87.50	88.50	89.50	90.50	91.50	92.50	93.50



Part1

Observer location 1 : x = 20, y = 1.75, z = 1.5 (dx = 60.50)
Average luminance $\bar{L}_m$: 21.7 cd/m²
Minimum luminance L_{min} : 14.7 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.68
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.71

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4 EXIT

4.5 Calculation results, EXIT

4.5.1 Table, EXIT MID (L), S1: 100%, Obs. 1

16.5	15.8	15.1	14.9	14.8	(14.7)
18	17.4	16.8	16.9	16.9	16.8
19.9	19.3	18.8	18.7	18.6	18.4
21.6	21.1	20.5	20.4	20.5	20.4
22.9	22.5	21.7	21.2	21.1	21
21.8	21.2	20.7	20.3	20.3	20.2
19.8	19.6	19.4	19.2	19.2	19
17.9	17.8	17.7	17.6	17.5	17.4
16.2	16.1	15.7	15.6	15.5	15.4
94.50	95.50	96.50	97.50	98.50	99.50 [m]



Part2

-please put your own address here-

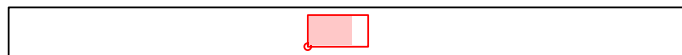
Object : BBMP ROAD TUNNEL PROJECT
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4.5 Calculation results, EXIT

4.5.2 Table, EXIT MID (E), S1: 100%

[m]	267	265	262	260	258	256	254	251	248	244	237	228	219	210	202
9.92	301	299	294	288	287	284	280	278	276	271	262	251	241	231	223
8.75	337	334	328	321	318	315	310	306	302	297	287	275	264	255	246
7.58	373	370	362	353	347	340	334	328	323	316	305	294	283	274	266
6.42	[395]	391	382	375	366	358	350	342	335	327	316	305	295	287	280
5.25	382	378	369	359	349	339	330	323	316	309	298	287	278	270	265
4.08	358	353	343	333	323	310	298	290	284	276	266	256	248	243	241
2.92	324	319	310	300	290	278	265	258	251	244	235	227	221	216	216
1.75	286	282	275	266	257	246	236	227	220	214	207	200	196	193	193
0.58															
	80.50	81.50	82.50	83.50	84.50	85.50	86.50	87.50	88.50	89.50	90.50	91.50	92.50	93.50	94.50
	Illuminance [lx]														



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 274 lx
Minimum illuminance E_{min} : 179 lx
Maximum illuminance E_{max} : 395 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.53 (0.65)
Diversity U_d E_{min}/E_{max} : 1 : 2.21 (0.45)

[Signatures]

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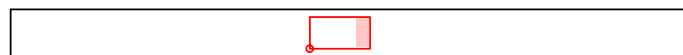


4.5 Calculation results, EXIT

4.5.2 Table, EXIT MID (E), S1: 100%

194	188	185	182	(179)
214	209	207	205	202
238	233	231	230	227
261	257	257	256	253
275	273	271	270	267
263	262	262	263	261
242	244	247	249	247
218	221	224	227	226
195	197	200	201	200
5.50	96.50	97.50	98.50	99.50

[m]



Part2

[Handwritten signatures]

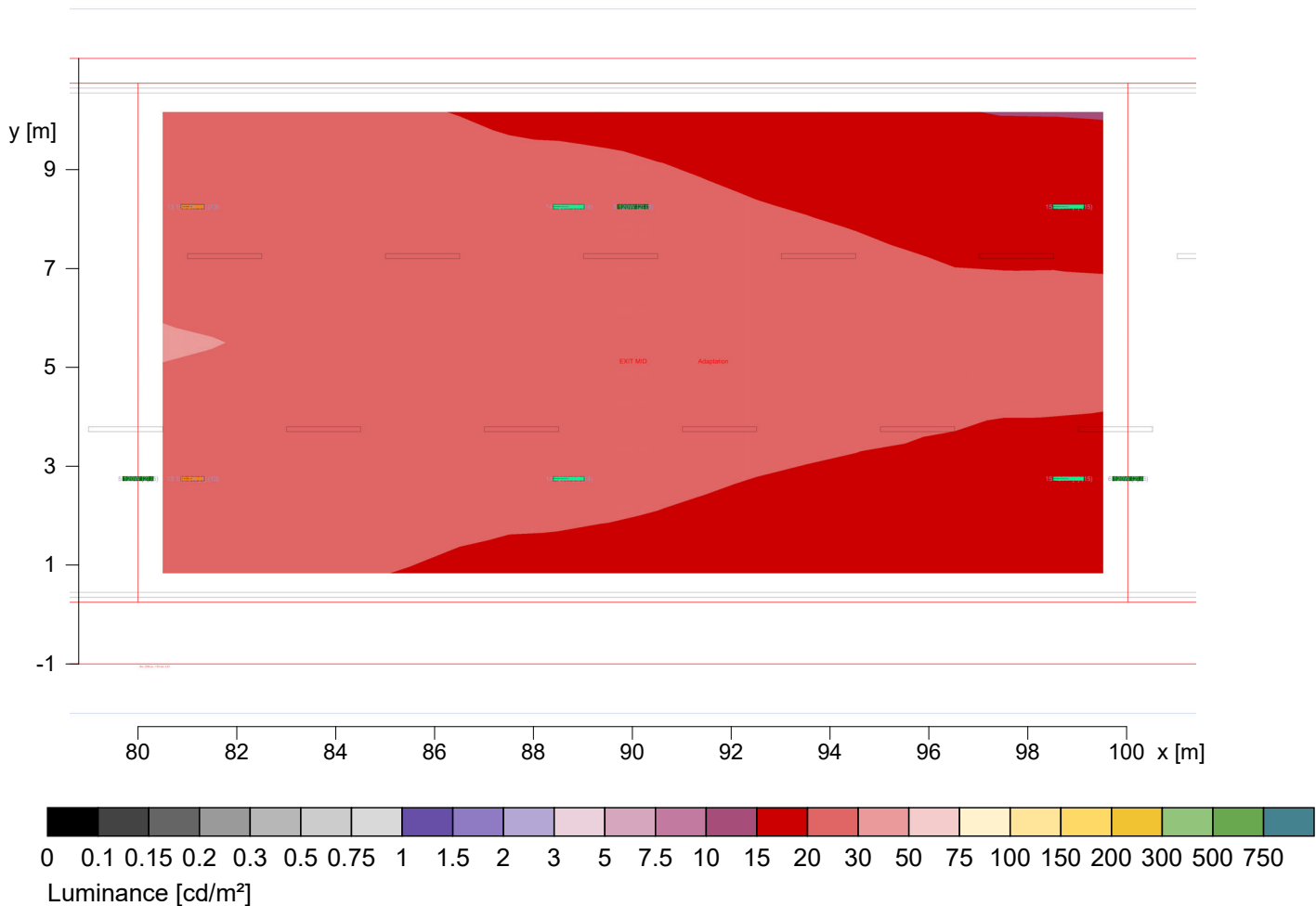
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024



4.5 Calculation results, EXIT

4.5.3 Pseudo colours, EXIT MID (L), S1: 100%, Obs. 1



Observer location 1 : x = 20, y = 1.75, z = 1.5 (dx = 6)

Average luminance $\bar{L}_m$: 21.7 cd/m²

Minimum luminance L_{min} : 14.7 cd/m²

Overall uniformity U_o : 0.68

Longitudinal uniformity U_l : 0.71

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4.5.4 Pseudo colours, EXIT MID (E), S1: 100%



Imanhuwa
~~Adai~~
Robo
Em. Soro
Adai

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

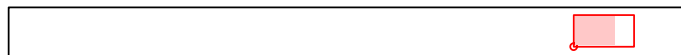


4 EXIT

4.6 Calculation results, EXIT

4.6.1 Table, EXIT START (L), S1: 100%, Obs. 1

[m]	5.49	5.58	5.58	5.52	5.41	5.32	5.19	4.94	4.72	4.71	4.79	4.87	4.87	4.83
9.92	6.09	6.22	6.21	6.11	5.96	5.89	5.74	5.5	5.28	5.4	5.55	5.64	5.64	5.54
8.75	6.67	6.76	6.78	6.69	6.51	6.47	6.42	6.24	6.06	6.14	6.22	6.29	6.28	6.18
7.58	6.98	7.1	7.1	7.07	6.91	6.93	6.99	6.9	6.85	6.91	7	7.13	7.14	6.99
6.42	7.24	7.36	[7.41]	7.4	7.3	7.22	7.29	7.37	7.32	7.15	7.2	7.32	7.37	7.32
5.25	6.95	7.12	7.17	7.02	6.86	6.82	6.91	6.97	6.91	6.8	6.91	7.02	7.01	6.97
4.08	6.3	6.4	6.39	6.29	6.2	6.22	6.32	6.45	6.54	6.58	6.6	6.7	6.72	6.64
2.92	5.64	5.72	5.72	5.64	5.53	5.55	5.71	5.88	6.04	6.08	6.1	6.22	6.22	6.13
1.75	4.81	4.91	4.96	4.9	4.86	4.97	5.18	5.41	5.48	5.45	5.46	5.54	5.54	5.5
0.58	168.50	169.50	170.50	171.50	172.50	173.50	174.50	175.50	176.50	177.50	178.50	179.50	180.50	181.50



Part1

Observer location 1 : x = 108, y = 1.75, z = 1.5 (dx = 60.50)
Average luminance $\bar{L}_m$: 6.18 cd/m²
Minimum luminance L_{min} : 4.65 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.75
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.85

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



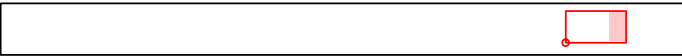
4 EXIT

4.6 Calculation results, EXIT

4.6.1 Table, EXIT START (L), S1: 100%, Obs. 1

4.81	4.84	5	5.29	5.35	5.32
5.41	5.4	5.54	5.74	5.86	5.82
6.08	6.07	6.15	6.28	6.35	6.36
6.81	6.79	6.8	6.83	6.8	6.63
7.2	7.17	7.15	7.19	7.22	6.99
6.84	6.8	6.78	6.82	6.63	6.68
6.48	6.41	6.35	6.17	5.95	6.03
6	5.94	5.81	5.56	5.29	5.37
5.43	5.35	5.25	4.97	4.72	(4.65)
182.50	183.50	184.50	185.50	186.50	187.50

[m]



Part2

[Handwritten signatures]

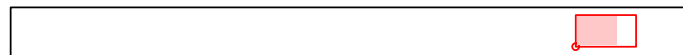
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024



4.6 Calculation results, EXIT

4.6.2 Table, EXIT START (E), S1: 100%

[m]	76.9	79	79	77	73.4	69.4	65.3	61.1	58	55.7	54.5	54.2	54.1	54.4
9.92	84.9	87.6	87.6	84.9	81	77.3	72.9	68.2	64.4	62.7	62.4	62.1	62.1	62.3
8.75	91.2	93.7	93.7	91.3	87.6	84.7	80.8	76.2	73.3	72.2	72.3	72.6	72.6	72.2
7.58	92.8	94.4	94.4	92.9	90.5	89.2	86.8	84.9	83.7	84	84.9	86.1	86.1	84.9
6.42	93.3	94.5	[94.6]	93.3	92.5	91.2	90.4	90	89.9	91	92	93.1	93.1	92
5.25	84.8	86.3	86.4	84.9	83.8	83.6	84.4	85.8	87.9	89.2	91.6	93.1	93.1	91.6
4.08	71.8	72.3	72.3	71.9	71.7	72.9	76.1	80.5	84.1	86.8	90.1	92.3	92.2	90
2.92	61.7	61.5	61.5	61.8	62.1	63.8	68	73	77.3	80.7	84.3	86.9	86.9	84.3
1.75	53.2	(52.8)	52.9	53.3	54.6	57.4	61.1	65.6	69.6	73	75.9	77.9	77.9	75.9
0.58	168.50	169.50	170.50	171.50	172.50	173.50	174.50	175.50	176.50	177.50	178.50	179.50	180.50	181.50
	Illuminance [lx]													



Part1

Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 77.7 lx
Minimum illuminance	E_{min} : 52.8 lx
Maximum illuminance	E_{max} : 94.6 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.47 (0.68)
Diversity U_d	E_{min}/E_{max} : 1 : 1.79 (0.56)

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 16.32KM
 Project number : 81942
 Date : 23.09.2024

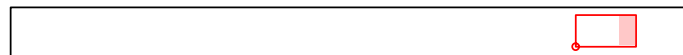


4.6 Calculation results, EXIT

4.6.2 Table, EXIT START (E), S1: 100%

55.5	57.7	60.8	64.9	68.8	72.6
62.5	64.2	67.9	72.5	76.7	80.2
72.1	73	75.9	80.4	84.1	86.8
83.9	83.4	84.6	86.4	88.6	89.7
90.8	89.6	89.6	90	90.6	91.7
89.1	87.7	85.5	84	83.1	83.1
86.7	83.9	80.2	75.7	72.4	71
80.6	77.1	72.7	67.7	63.3	61.4
72.9	69.4	65.3	60.8	56.9	54
182.50	183.50	184.50	185.50	186.50	187.50

[m]



Part2

[Handwritten signatures]

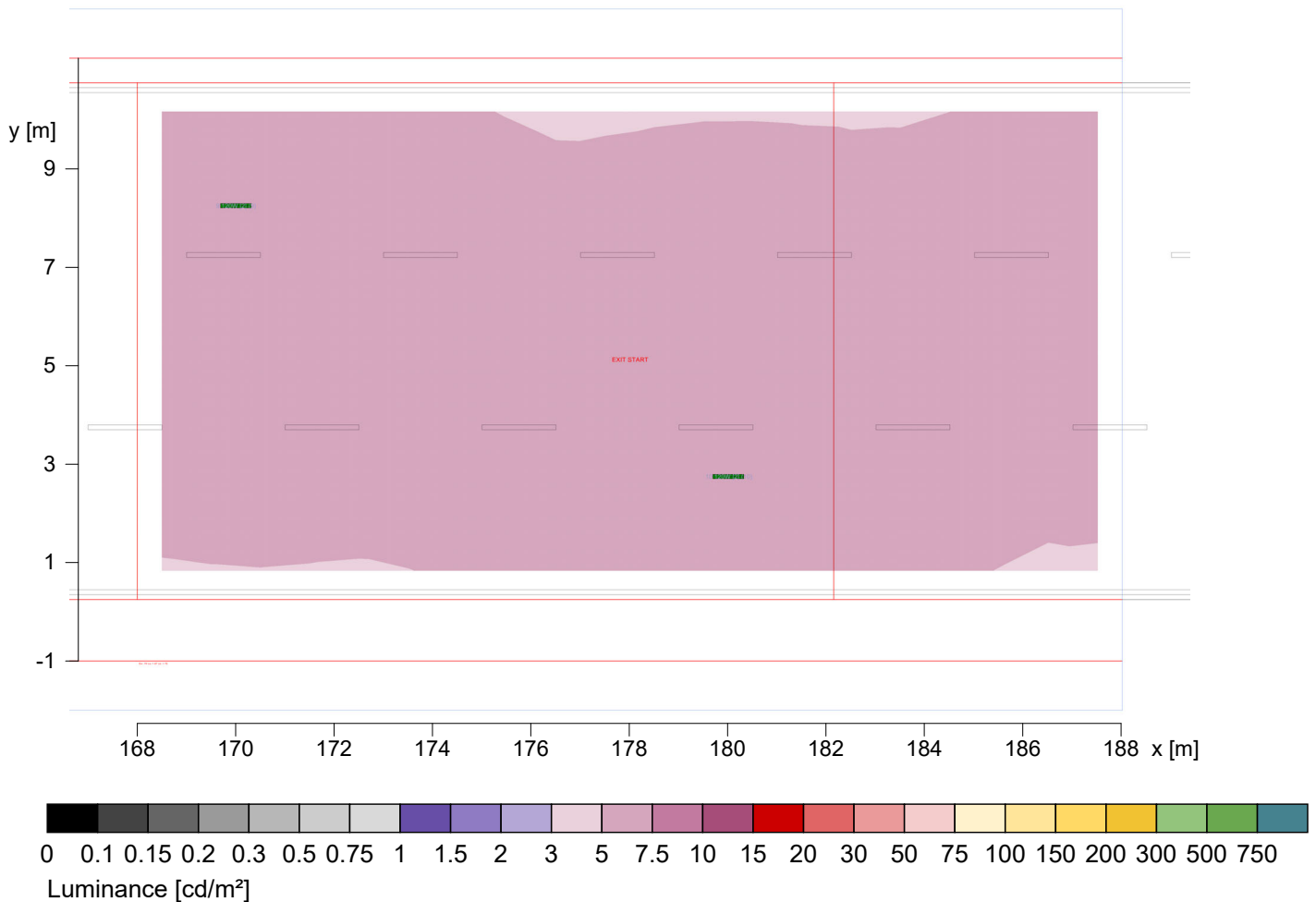
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 16.32KM
Project number : 81942
Date : 23.09.2024

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4.6 Calculation results, EXIT

4.6.3 Pseudo colours, EXIT START (L), S1: 100%, Obs. 1



-please put your own address here-

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4.6.4 Pseudo colours, EXIT START (E), S1: 100%



Imanhuwa
~~Adai~~
Robo
Em. Soro
Adai

Amelia

Adri

Rob

Emma

James

APPENDIX - 2

Signature

Adan

Rohs

Chen

Signature

Amelia

Adri

Rob

Emma

James

BBMP ROAD TUNNEL PROJECT

Installation : MAIN TUNNEL 220M ENTRY

Project number : 81942

Customer :

Processed by : BAJAJ

Date : 23.09.2024

Project description:
Tunnel designed

220m MAIN TUNNEL

Tunnel Main Road Width assumed - 7.0m Main Carriageway + 0.5m FOOTPATH + 1.25m FOOTPATH

BOTTOM OF LIGHT - 6.5m from road level

Total Length of the Tunnel - 220m

SPEED - 80KMPH

ROAD - CONCRETE ROAD R1 - 0.10

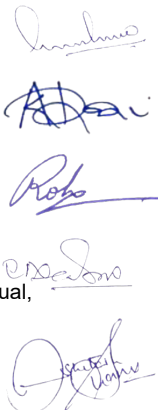
THRESHOLD -288cd/m², TRANSITION - 115cd/m², INTERIOR 1 - 0 cd/m², INTERIOR 2 - 4 cd/m². EXIT - 0 cd/m²

NIGHT TIME - 4.0cd/m²

EMERGENCY - MIN 2 LUX AND AVG 10

The following values are based on precise calculations performed on calibrated lamps and luminaires, and their configurations, whereby gradual, unavoidable deviations can occur in practice. All guarantee claims are excluded for the specified data.

This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.



Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
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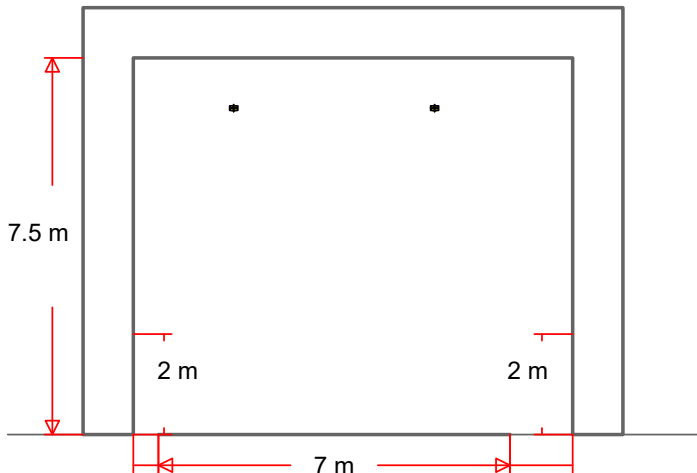
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1 Tunnel

1.1 Description, Tunnel

1.1.1 Project data



Geometry tunnel

Length of the tunnel : 220 m
 Length of the tunnel (calculation model) : 220 m
 Height of the tunnel : 7.5 m

Width of the carriageway : 7 m
 Number of lanes : 2
 Covering / material : R1, q0 = 0.09

Marginal strip left	:	0.5 m	Marginal strip right	:	1.25 m
Height of the wall (right)	:	2 m	Height of the wall (left)	:	2 m
Covering / material	:	diffus 30%	Covering / material	:	diffus 30%

Calculation specifications

Speed : 80 km/h
 Length of the threshold zone : 107 m
 Luminance threshold zone : 288 cd/m²
 Luminance interior zone : 4 cd/m²

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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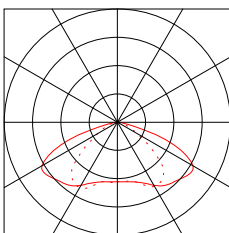
1 Tunnel

1.1 Description, Tunnel

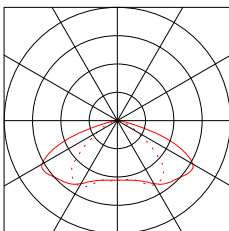
1.1.1 Project data

LDC in use

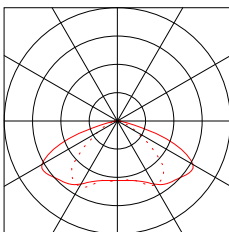
1 **Bajaj**
Order No. : s
Luminaire name : E230315 BJTU S 390L NW SYM PC
Equipment : 1 x Unknown 300.1 W / 37053 lm
Maintenance factor: 0.85



2
Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3
Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

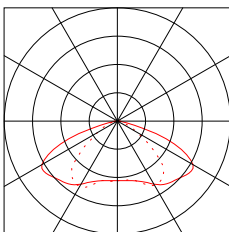
RELUX®

1 Tunnel

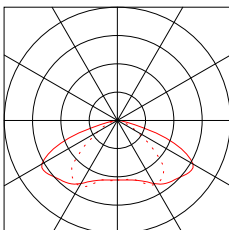
1.1 Description, Tunnel

1.1.1 Project data

6 Order No. : s
Luminaire name : E230315 BJTU S 108L NW SYM PC
Equipment : 1 x Unknown 80 W / 9976 lm
Maintenance factor: 0.85



7 Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



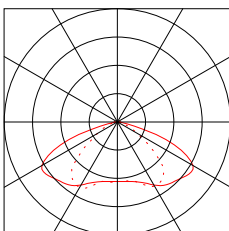
1.1 Description, Tunnel

1.1.2 Luminaire list

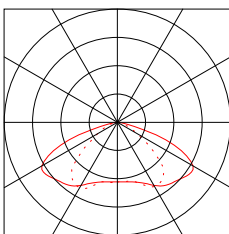
Adaptation LDC in use

Bajaj

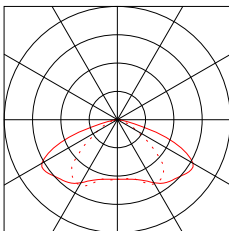
1 144 x Order No. : s
Luminaire name : E230315 BJTU S 390L NW SYM PC
Equipment : 1 x Unknown 300.1 W / 37053 lm
Maintenance factor: 0.85



2 28 x Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3 16 x Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



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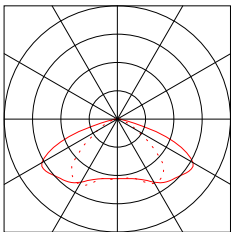
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

7 18 x Order No. : s
 Luminaire name : E230315 BJTU S 162L NW SYM PC
 Equipment : 1 x Unknown 120 W / 14964 lm
 Maintenance factor: 0.85



Row of luminaires: Row 3.1

Number of luminaires: 103
 Basic position: x=0.80m y=5.50m, z=6.50m
 Rotation: z=180.0° C0=0.0° C90=0.0°

System power (total): 27.5kW
 -variable distances-

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.60	300.1W / 37.05kln1	100%	0%
2	0.80	300.1W / 37.05kln1	100%	0%
3	2.40	300.1W / 37.05kln1	100%	0%
4	3.20	300.1W / 37.05kln1	100%	0%
5	4.50	300.1W / 37.05kln1	100%	0%
6	5.70	300.1W / 37.05kln1	100%	0%
7	6.90	300.1W / 37.05kln1	100%	0%
8	8.10	300.1W / 37.05kln1	100%	0%
9	9.30	300.1W / 37.05kln1	100%	0%
10	10.60	300.1W / 37.05kln1	100%	0%
11	11.80	300.1W / 37.05kln1	100%	0%
12	13.00	300.1W / 37.05kln1	100%	0%
13	14.20	300.1W / 37.05kln1	100%	0%
14	15.40	300.1W / 37.05kln1	100%	0%
15	16.70	300.1W / 37.05kln1	100%	0%
16	17.90	300.1W / 37.05kln1	100%	0%
17	19.10	300.1W / 37.05kln1	100%	0%
18	20.30	300.1W / 37.05kln1	100%	0%
19	21.50	300.1W / 37.05kln1	100%	0%
20	22.80	300.1W / 37.05kln1	100%	0%
21	24.00	300.1W / 37.05kln1	100%	0%
22	25.20	300.1W / 37.05kln1	100%	0%
23	26.40	300.1W / 37.05kln1	100%	0%
24	27.60	300.1W / 37.05kln1	100%	0%
25	28.90	300.1W / 37.05kln1	100%	0%
26	30.10	300.1W / 37.05kln1	100%	0%
27	31.30	300.1W / 37.05kln1	100%	0%
28	32.50	300.1W / 37.05kln1	100%	0%
29	33.70	300.1W / 37.05kln1	100%	0%
30	35.00	300.1W / 37.05kln1	100%	0%
31	36.20	300.1W / 37.05kln1	100%	0%

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

32	37.40	300.1W / 37.05kln1	100%	0%
33	38.60	300.1W / 37.05kln1	100%	0%
34	39.80	300.1W / 37.05kln1	100%	0%
35	41.10	300.1W / 37.05kln1	100%	0%
36	42.30	300.1W / 37.05kln1	100%	0%
37	43.50	300.1W / 37.05kln1	100%	0%
38	44.70	300.1W / 37.05kln1	100%	0%
39	45.90	300.1W / 37.05kln1	100%	0%
40	47.20	300.1W / 37.05kln1	100%	0%
41	48.40	300.1W / 37.05kln1	100%	0%
42	49.60	300.1W / 37.05kln1	100%	0%
43	50.80	300.1W / 37.05kln1	100%	0%
44	52.00	300.1W / 37.05kln1	100%	0%
45	53.30	300.1W / 37.05kln1	100%	0%
46	54.50	300.1W / 37.05kln1	100%	0%
47	55.70	300.1W / 37.05kln1	100%	0%
48	56.90	300.1W / 37.05kln1	100%	0%
49	58.10	300.1W / 37.05kln1	100%	0%
50	59.40	300.1W / 37.05kln1	100%	0%
51	60.60	300.1W / 37.05kln1	100%	0%
52	61.90	300.1W / 37.05kln1	100%	0%
53	63.20	300.1W / 37.05kln1	100%	0%
54	64.50	300.1W / 37.05kln1	100%	0%
55	65.80	300.1W / 37.05kln1	100%	0%
56	67.20	300.1W / 37.05kln1	100%	0%
57	68.50	300.1W / 37.05kln1	100%	0%
58	69.90	300.1W / 37.05kln1	100%	0%
59	71.30	300.1W / 37.05kln1	100%	0%
60	72.80	300.1W / 37.05kln1	100%	0%
61	74.30	300.1W / 37.05kln1	100%	0%
62	75.80	300.1W / 37.05kln1	100%	0%
63	77.30	300.1W / 37.05kln1	100%	0%
64	78.90	300.1W / 37.05kln1	100%	0%
65	80.50	300.1W / 37.05kln1	100%	0%
66	82.20	300.1W / 37.05kln1	100%	0%
67	83.90	300.1W / 37.05kln1	100%	0%
68	85.70	300.1W / 37.05kln1	100%	0%
69	87.50	300.1W / 37.05kln1	100%	0%
70	89.30	300.1W / 37.05kln1	100%	0%
71	91.20	300.1W / 37.05kln1	100%	0%
72	93.20	300.1W / 37.05kln1	100%	0%
73	95.00	240W / 31.12klm 1	100%	0%
74	96.80	240W / 31.12klm 1	100%	0%
75	98.60	240W / 31.12klm 1	100%	0%
76	100.60	240W / 31.12klm 1	100%	0%
77	102.60	240W / 31.12klm 1	100%	0%
78	104.70	240W / 31.12klm 1	100%	0%
79	107.00	240W / 31.12klm 1	100%	0%
80	109.40	240W / 31.12klm 1	100%	0%
81	111.90	240W / 31.12klm 1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

82	114.60	240W / 31.12klm 1	100%	0%
83	117.50	240W / 31.12klm 1	100%	0%
84	120.80	240W / 31.12klm 1	100%	0%
85	124.40	240W / 31.12klm 1	100%	0%
86	128.30	240W / 31.12klm 1	100%	0%
87	131.50	180.3W / 22.56klm1	100%	0%
88	135.00	180.3W / 22.56klm1	100%	0%
89	138.70	180.3W / 22.56klm1	100%	0%
90	142.70	180.3W / 22.56klm1	100%	0%
91	147.10	180.3W / 22.56klm1	100%	0%
92	151.90	180.3W / 22.56klm1	100%	0%
93	157.10	180.3W / 22.56klm1	100%	0%
94	162.90	180.3W / 22.56klm1	100%	0%
95	167.20	120W / 14.96klm 1	100%	0%
96	171.70	120W / 14.96klm 1	100%	0%
97	176.50	120W / 14.96klm 1	100%	0%
98	181.70	120W / 14.96klm 1	100%	0%
99	187.40	120W / 14.96klm 1	100%	0%
100	193.50	120W / 14.96klm 1	100%	0%
101	200.10	120W / 14.96klm 1	100%	0%
102	207.40	120W / 14.96klm 1	100%	0%
103	215.40	120W / 14.96klm 1	100%	0%

Row of luminaires: Row 4.1

Number of luminaires: 103

System power (total): 27.5kW

Basic position: x=0.80m y=1.50m, z=6.50m

-variable distances-

Rotation: z=180.0° C0=0.0° C90=0.0°

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.60	300.1W / 37.05klm1	100%	0%
2	0.80	300.1W / 37.05klm1	100%	0%
3	2.40	300.1W / 37.05klm1	100%	0%
4	3.20	300.1W / 37.05klm1	100%	0%
5	4.50	300.1W / 37.05klm1	100%	0%
6	5.70	300.1W / 37.05klm1	100%	0%
7	6.90	300.1W / 37.05klm1	100%	0%
8	8.10	300.1W / 37.05klm1	100%	0%
9	9.30	300.1W / 37.05klm1	100%	0%
10	10.60	300.1W / 37.05klm1	100%	0%
11	11.80	300.1W / 37.05klm1	100%	0%
12	13.00	300.1W / 37.05klm1	100%	0%
13	14.20	300.1W / 37.05klm1	100%	0%
14	15.40	300.1W / 37.05klm1	100%	0%
15	16.70	300.1W / 37.05klm1	100%	0%
16	17.90	300.1W / 37.05klm1	100%	0%
17	19.10	300.1W / 37.05klm1	100%	0%
18	20.30	300.1W / 37.05klm1	100%	0%
19	21.50	300.1W / 37.05klm1	100%	0%
20	22.80	300.1W / 37.05klm1	100%	0%
21	24.00	300.1W / 37.05klm1	100%	0%

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1.1 Description, Tunnel

1.1.2 Luminaire list

22	25.20	300.1W / 37.05kln1	100%	0%
23	26.40	300.1W / 37.05kln1	100%	0%
24	27.60	300.1W / 37.05kln1	100%	0%
25	28.90	300.1W / 37.05kln1	100%	0%
26	30.10	300.1W / 37.05kln1	100%	0%
27	31.30	300.1W / 37.05kln1	100%	0%
28	32.50	300.1W / 37.05kln1	100%	0%
29	33.70	300.1W / 37.05kln1	100%	0%
30	35.00	300.1W / 37.05kln1	100%	0%
31	36.20	300.1W / 37.05kln1	100%	0%
32	37.40	300.1W / 37.05kln1	100%	0%
33	38.60	300.1W / 37.05kln1	100%	0%
34	39.80	300.1W / 37.05kln1	100%	0%
35	41.10	300.1W / 37.05kln1	100%	0%
36	42.30	300.1W / 37.05kln1	100%	0%
37	43.50	300.1W / 37.05kln1	100%	0%
38	44.70	300.1W / 37.05kln1	100%	0%
39	45.90	300.1W / 37.05kln1	100%	0%
40	47.20	300.1W / 37.05kln1	100%	0%
41	48.40	300.1W / 37.05kln1	100%	0%
42	49.60	300.1W / 37.05kln1	100%	0%
43	50.80	300.1W / 37.05kln1	100%	0%
44	52.00	300.1W / 37.05kln1	100%	0%
45	53.30	300.1W / 37.05kln1	100%	0%
46	54.50	300.1W / 37.05kln1	100%	0%
47	55.70	300.1W / 37.05kln1	100%	0%
48	56.90	300.1W / 37.05kln1	100%	0%
49	58.10	300.1W / 37.05kln1	100%	0%
50	59.40	300.1W / 37.05kln1	100%	0%
51	60.60	300.1W / 37.05kln1	100%	0%
52	61.90	300.1W / 37.05kln1	100%	0%
53	63.20	300.1W / 37.05kln1	100%	0%
54	64.50	300.1W / 37.05kln1	100%	0%
55	65.80	300.1W / 37.05kln1	100%	0%
56	67.20	300.1W / 37.05kln1	100%	0%
57	68.50	300.1W / 37.05kln1	100%	0%
58	69.90	300.1W / 37.05kln1	100%	0%
59	71.30	300.1W / 37.05kln1	100%	0%
60	72.80	300.1W / 37.05kln1	100%	0%
61	74.30	300.1W / 37.05kln1	100%	0%
62	75.80	300.1W / 37.05kln1	100%	0%
63	77.30	300.1W / 37.05kln1	100%	0%
64	78.90	300.1W / 37.05kln1	100%	0%
65	80.50	300.1W / 37.05kln1	100%	0%
66	82.20	300.1W / 37.05kln1	100%	0%
67	83.90	300.1W / 37.05kln1	100%	0%
68	85.70	300.1W / 37.05kln1	100%	0%
69	87.50	300.1W / 37.05kln1	100%	0%
70	89.30	300.1W / 37.05kln1	100%	0%
71	91.20	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
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1.1 Description, Tunnel

1.1.2 Luminaire list

72	93.20	300.1W / 37.05klm1	100%	0%
73	95.00	240W / 31.12klm 1	100%	0%
74	96.80	240W / 31.12klm 1	100%	0%
75	98.60	240W / 31.12klm 1	100%	0%
76	100.60	240W / 31.12klm 1	100%	0%
77	102.60	240W / 31.12klm 1	100%	0%
78	104.70	240W / 31.12klm 1	100%	0%
79	107.00	240W / 31.12klm 1	100%	0%
80	109.40	240W / 31.12klm 1	100%	0%
81	111.90	240W / 31.12klm 1	100%	0%
82	114.60	240W / 31.12klm 1	100%	0%
83	117.50	240W / 31.12klm 1	100%	0%
84	120.80	240W / 31.12klm 1	100%	0%
85	124.40	240W / 31.12klm 1	100%	0%
86	128.30	240W / 31.12klm 1	100%	0%
87	131.50	180.3W / 22.56klm1	100%	0%
88	135.00	180.3W / 22.56klm1	100%	0%
89	138.70	180.3W / 22.56klm1	100%	0%
90	142.70	180.3W / 22.56klm1	100%	0%
91	147.10	180.3W / 22.56klm1	100%	0%
92	151.90	180.3W / 22.56klm1	100%	0%
93	157.10	180.3W / 22.56klm1	100%	0%
94	162.90	180.3W / 22.56klm1	100%	0%
95	167.20	120W / 14.96klm 1	100%	0%
96	171.70	120W / 14.96klm 1	100%	0%
97	176.50	120W / 14.96klm 1	100%	0%
98	181.70	120W / 14.96klm 1	100%	0%
99	187.40	120W / 14.96klm 1	100%	0%
100	193.50	120W / 14.96klm 1	100%	0%
101	200.10	120W / 14.96klm 1	100%	0%
102	207.40	120W / 14.96klm 1	100%	0%
103	215.40	120W / 14.96klm 1	100%	0%

Interior LDC in use

6

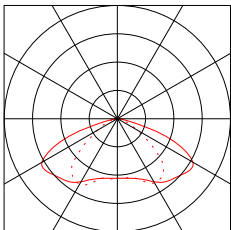
Bajaj

Order No. : s

Luminaire name : E230315 BJTU S 108L NW SYM PC

Equipment : 1 x Unknown 80 W / 9976 lm

Maintenance factor: 0.85



Object : BBMP ROAD TUNNEL PROJECT
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1.1 Description, Tunnel

1.1.2 Luminaire list

Row of luminaires: Row 1.1

Number of luminaires: 14
 Basic position: x=0.00m y=5.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.1kW (0.22 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

Row of luminaires: Row 2.1

Number of luminaires: 14
 Basic position: x=0.00m y=1.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.1kW (0.22 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%





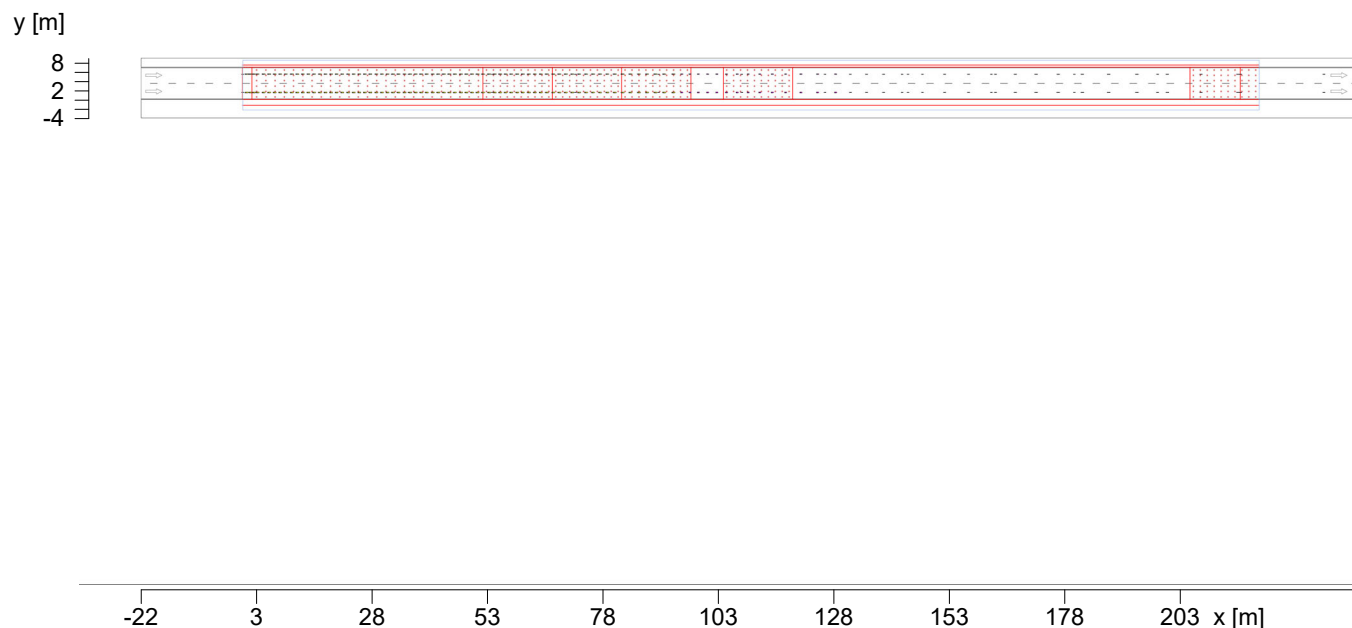


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RELUX®

1.1 Description, Tunnel

1.1.3 Floor plan



Handwritten signatures:
1. *[Signature]*
2. *[Signature]*
3. *[Signature]*
4. *[Signature]*
5. *[Signature]*

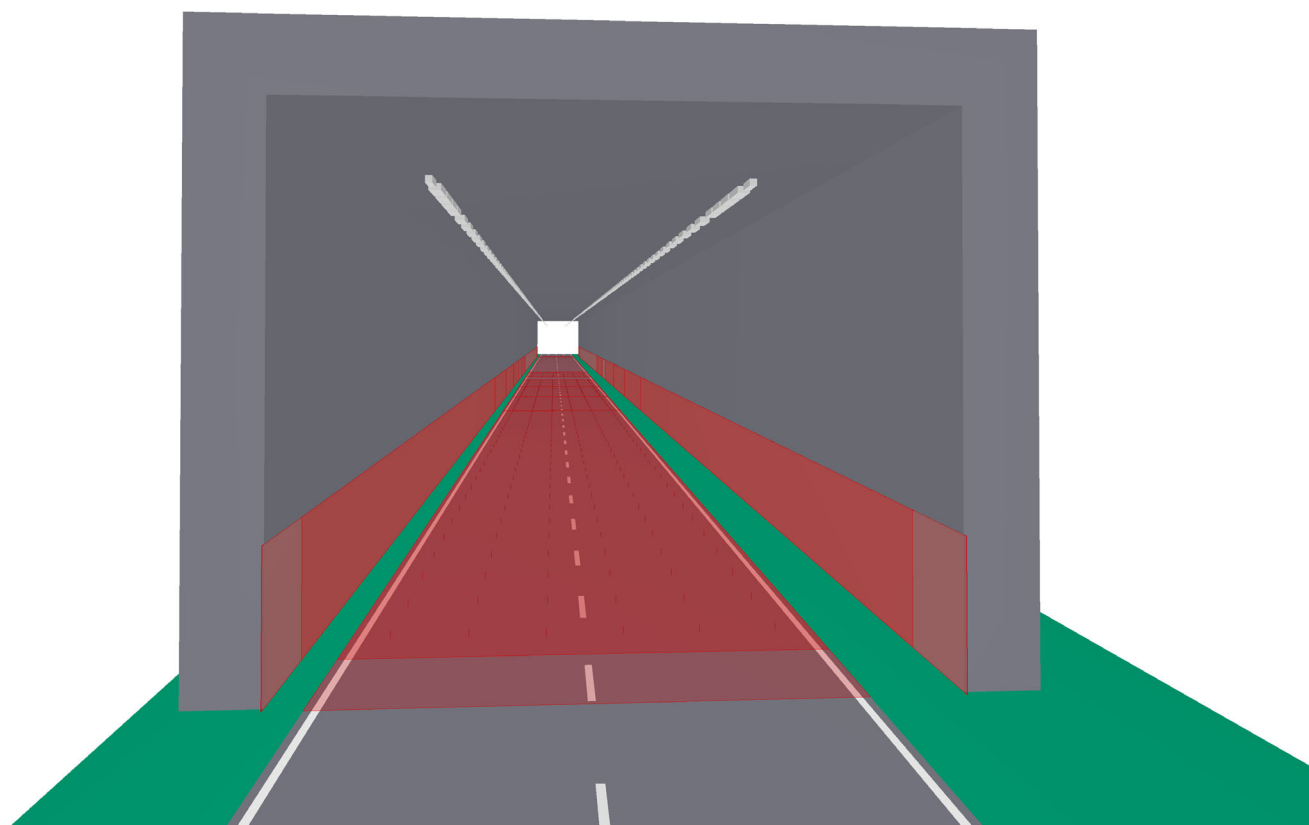
-please put your own address here-

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RELUX®

1.1 Description, Tunnel

1.1.4 3D view, View 1



Handwritten signatures:
1. *Shubh*
2. *Adar*
3. *Rob*
4. *CSA Son*
5. *Sanjay Kumar*

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: -0.10 m - 215.90 m Points: nx = 108, ny = 6, nz = 3

Observer (starting point coordinate) : x = -85.03 m; z = 1.50 m dx = 85.93 m (moving)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

TH1

Measuring range: 2.00 m - 52.00 m Points: nx = 25, ny = 6, nz = 3

Observer (starting point coordinate) : x = -58.00 m; z = 1.50 m dx = 61.00 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{E}_m$	:	287.79 cd/m ²	287.72 cd/m ²	
U _o	L _{min} / $\bar{E}_m$	: 0.69	0.68	0.4
U _I	L _{I,min} /L _{I,max}	: 0.73	0.73	0.6
f _{TI,max}	Max.	: 2 %	2 %	

Wall left (diffus 30%)

$\bar{E}_m$	:	201.04 cd/m ²
U _o	L _{min} / $\bar{E}_m$	: 0.68
L _{wall} /L _{fsp}	:	0.70

Wall right (diffus 30%)

$\bar{E}_m$	:	194.71 cd/m ²
U _o	L _{min} / $\bar{E}_m$	: 0.68
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	3595.65 lx
U _o	E _{min} / $\bar{E}_m$	: 0.71

Wall left

$\bar{E}_m$	:	2105.47 lx
U _o	E _{min} / $\bar{E}_m$	: 0.68

Wall right

$\bar{E}_m$	:	2039.15 lx
U _o	E _{min} / $\bar{E}_m$	: 0.68

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Object : BBMP ROAD TUNNEL PROJECT
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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TH2

Measuring range: 52.00 m - 67.00 m Points: nx = 10, ny = 6, nz = 3

Observer (starting point coordinate) : x = -8.00 m; z = 1.50 m dx = 60.75 m (fix)

y = 1.75 m

y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	280.36 cd/m ²	280.32 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.88	0.87	0.4
U _i	L _{i,min} /L _{i,max}	: 0.91	0.91	0.6
f _{TI,max}	Max.	: 2 %	2 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	194.66 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.84
L _{wall} /L _{fsp}	:	0.69

Wall right (diffus 30%)

$\bar{L}_m$	:	189.66 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.85
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	3522.09 lx
U _o	E _{min} / $\bar{E}_m$	: 0.87

Wall left

$\bar{E}_m$	:	2039.02 lx
U _o	E _{min} / $\bar{E}_m$	: 0.84

Wall right

$\bar{E}_m$	:	1986.77 lx
U _o	E _{min} / $\bar{E}_m$	: 0.85

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RELUX®

Object : BBMP ROAD TUNNEL PROJECT
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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TH4

Measuring range: 82.00 m - 97.00 m Points: nx = 10, ny = 6, nz = 3

Observer (starting point coordinate) : x = 22.00 m; z = 1.50 m dx = 60.75 m (fix)

y = 1.75 m

y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	191.44 cd/m ²	191.42 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.82	0.81	0.4
U _i	L _{i,min} /L _{i,max}	: 0.79	0.79	0.6
f _{TI,max}	Max.	: 2 %	2 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	133.19 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.79
L _{wall} /L _{fsp}	:	0.69

Wall right (diffus 30%)

$\bar{L}_m$	:	129.88 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.79
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	2412.60 lx
U _o	E _{min} / $\bar{E}_m$	: 0.82

Wall left

$\bar{E}_m$	:	1395.43 lx
U _o	E _{min} / $\bar{E}_m$	: 0.79

Wall right

$\bar{E}_m$	:	1360.79 lx
U _o	E _{min} / $\bar{E}_m$	: 0.79

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Object : BBMP ROAD TUNNEL PROJECT
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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TR START

Measuring range: 104.00 m - 119.00 m Points: nx = 10, ny = 6, nz = 3
Observer (starting point coordinate) : x = 44.00 m; z = 1.50 m dx = 60.75 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	120.68 cd/m ²	120.67 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.78	0.77	0.4
U _i	L _{i,min} /L _{i,max}	: 0.72	0.72	0.6
f _{TI,max}	Max.	: 2 %	2 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	83.75 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.75
L _{wall} /L _{fsp}	:	0.69

Wall right (diffus 30%)

$\bar{L}_m$	:	81.66 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.75
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	1518.49 lx
U _o	E _{min} / $\bar{E}_m$	: 0.77

Wall left

$\bar{E}_m$	:	877.56 lx
U _o	E _{min} / $\bar{E}_m$	: 0.75

Wall right

$\bar{E}_m$	:	855.81 lx
U _o	E _{min} / $\bar{E}_m$	: 0.75

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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TR END

Measuring range: 205.00 m - 220.00 m Points: nx = 10, ny = 6, nz = 3

Observer (starting point coordinate) : x = 145.00 m; z = 1.50 m dx = 60.75 m (fix)

y = 1.75 m

y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	19.44 cd/m ²	19.44 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.68	0.68	0.4
U _i	L _{i,min} /L _{i,max}	: 0.61	0.61	0.6
f _{TI,max}	Max.	: 3 %	3 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	14.24 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.64
L _{wall} /L _{fsp}	:	0.73

Wall right (diffus 30%)

$\bar{L}_m$	:	13.85 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.65
L _{wall} /L _{fsp}	:	0.72

Illuminance

Roadway

$\bar{E}_m$	:	256.15 lx
U _o	E _{min} / $\bar{E}_m$	: 0.67

Wall left

$\bar{E}_m$	:	149.22 lx
U _o	E _{min} / $\bar{E}_m$	: 0.64

Wall right

$\bar{E}_m$	:	145.15 lx
U _o	E _{min} / $\bar{E}_m$	: 0.65

qc: The backward reflection of the road was calculated.

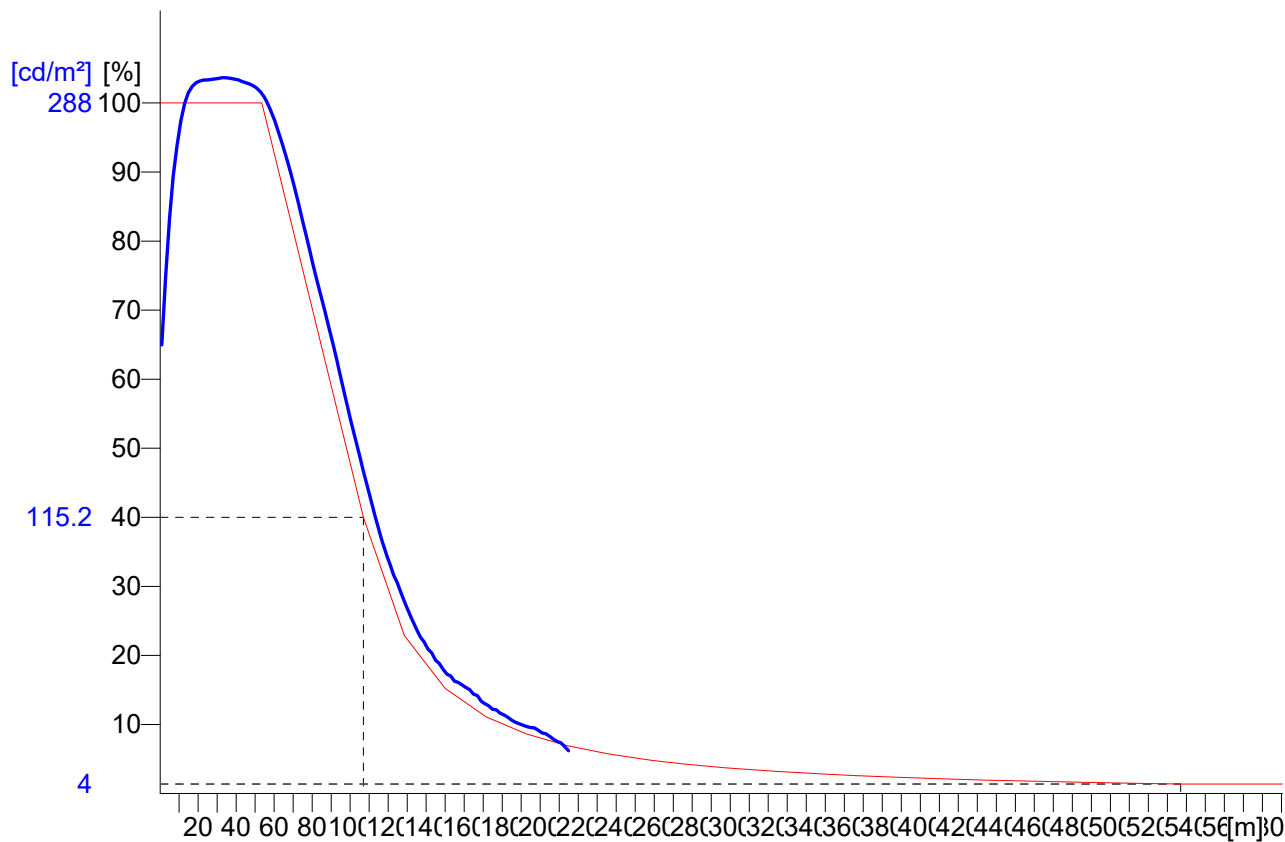
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
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1.2 Calculation results, Tunnel

1.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -85, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

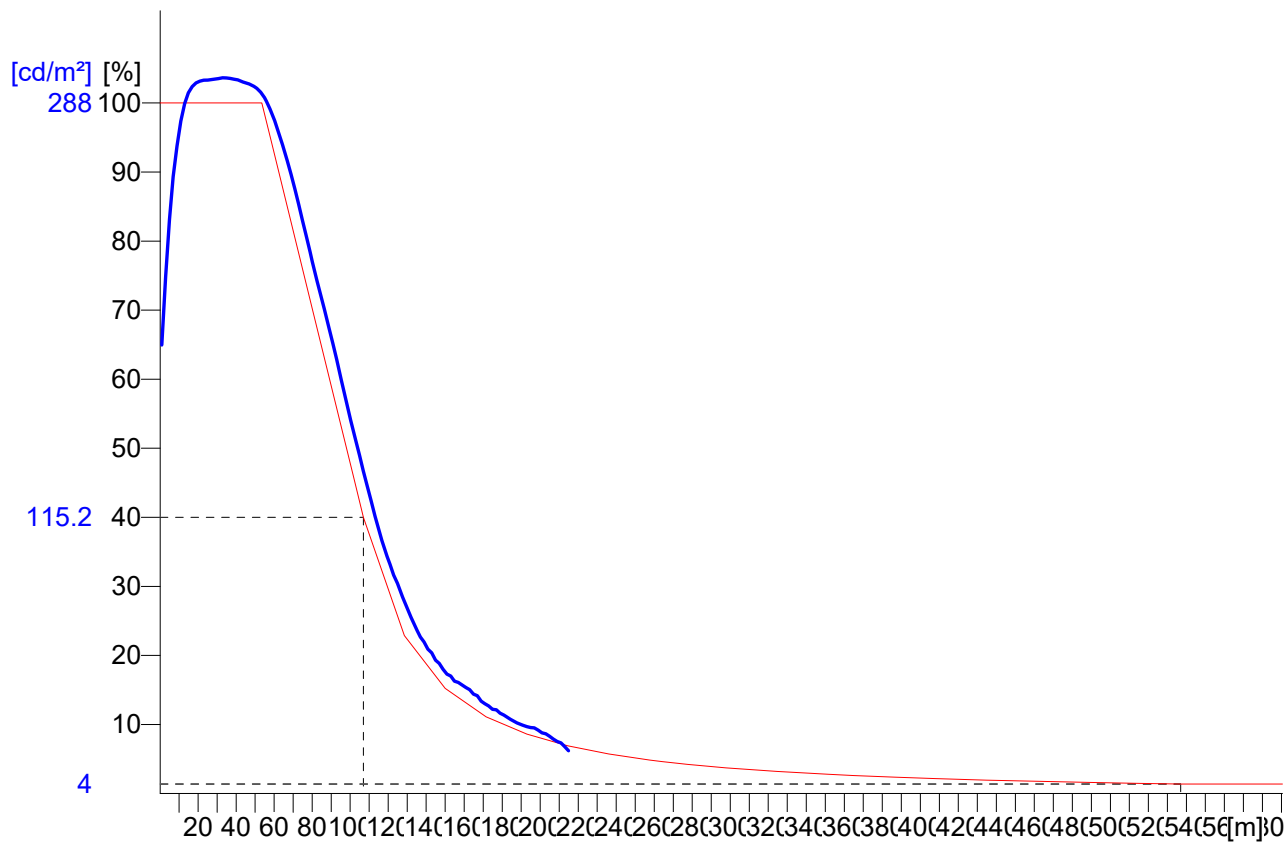
[Signatures]

Object : BBMP ROAD TUNNEL PROJECT
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1.2 Calculation results, Tunnel

1.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



Observer location 2 : x = -85, y = 5.25, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

[Handwritten signatures]

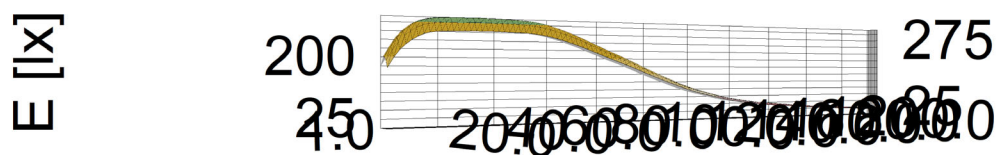
Object : BBMP ROAD TUNNEL PROJECT
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1 Tunnel

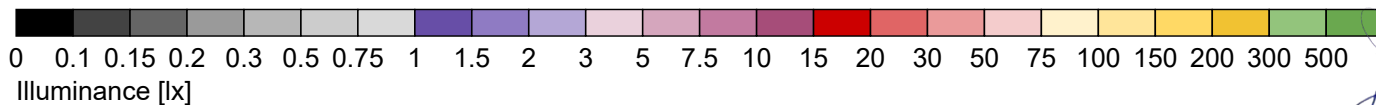
1.3 Calculation results, Tunnel

1.3.1 3D mountain plot, Adaptation (L), S1: 100%, Obs. 1



y [m]

x [m]



Illuminance [lx]

Handwritten signatures:
S. S. S.
A. S. S.
R. S. S.
S. S. S.
S. S. S.

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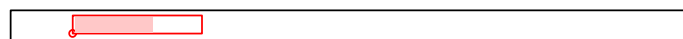


1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

[m]	(200)	222	238	251	261	268	273	276	277	278	278	279	279	279	280	280
6.42																
5.25	220	243	261	274	284	291	296	298	300	300	301	301	301	301	302	302
4.08	231	256	275	288	298	306	310	313	314	315	315	315	315	315	[316]	[316]
2.92	231	256	274	287	298	305	309	312	313	314	314	314	315	315	315	315
1.75	221	244	261	274	284	291	296	298	300	300	301	301	301	301	302	302
0.58	(200)	221	237	249	259	266	270	273	275	275	276	276	276	276	276	277
	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00



Part1

Observer location 1 : x = -58, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 288 cd/m²
Minimum luminance L_{min} : 200 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.69
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.73

[Handwritten signatures]

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1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

	280	280	280	279	279	279	278	277	276
	302	302	302	301	301	300	300	299	298
	[316]	[316]	[316]	315	314	314	314	312	311
	315	315	315	314	313	313	312	311	310
	301	302	301	301	300	299	299	298	297
	277	277	276	276	275	275	274	273	272
00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00
	[m]								



Part2

[Handwritten signatures]

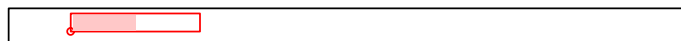
Object : BBMP ROAD TUNNEL PROJECT
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Project number : 81942
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1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

[m]	2630	2930	3140	3280	3370	3440	3470	3500	3510	3500	3500	3490	3490
6.42	2840	3170	3390	3530	3630	3690	3730	3750	3760	3760	3750	3750	3740
5.25	2930	3270	3510	3660	3760	3820	3860	3880	3890	3890	3880	3870	3870
4.08	2910	3250	3490	3630	3740	3800	3840	3860	3870	3870	3860	3850	3850
2.92	2820	3140	3360	3500	3600	3660	3700	3720	3730	3730	3720	3710	3710
1.75	(2560)	2850	3050	3190	3280	3340	3380	3400	3410	3410	3410	3400	3400
0.58													
	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00
	Illuminance [lx]												



Part1

Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3600 lx
Minimum illuminance	E_{min} : 2560 lx
Maximum illuminance	E_{max} : 3900 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.4 (0.71)
Diversity U_d	E_{min}/E_{max} : 1 : 1.52 (0.66)

[Handwritten signatures]

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1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

3490	3500	3510	3520	3520	3510	3500	3490	3490	3490	3480	3490
3750	3760	3770	3770	3780	3770	3750	3750	3740	3740	3740	3740
3880	3880	3890	[3900]	[3900]	3890	3890	3870	3870	3870	3870	3870
3860	3860	3870	3880	3880	3870	3860	3850	3850	3850	3850	3850
3710	3720	3740	3740	3740	3730	3720	3710	3710	3710	3710	3710
3400	3410	3420	3430	3430	3420	3410	3400	3400	3400	3400	3390
29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00 [m]



Part2

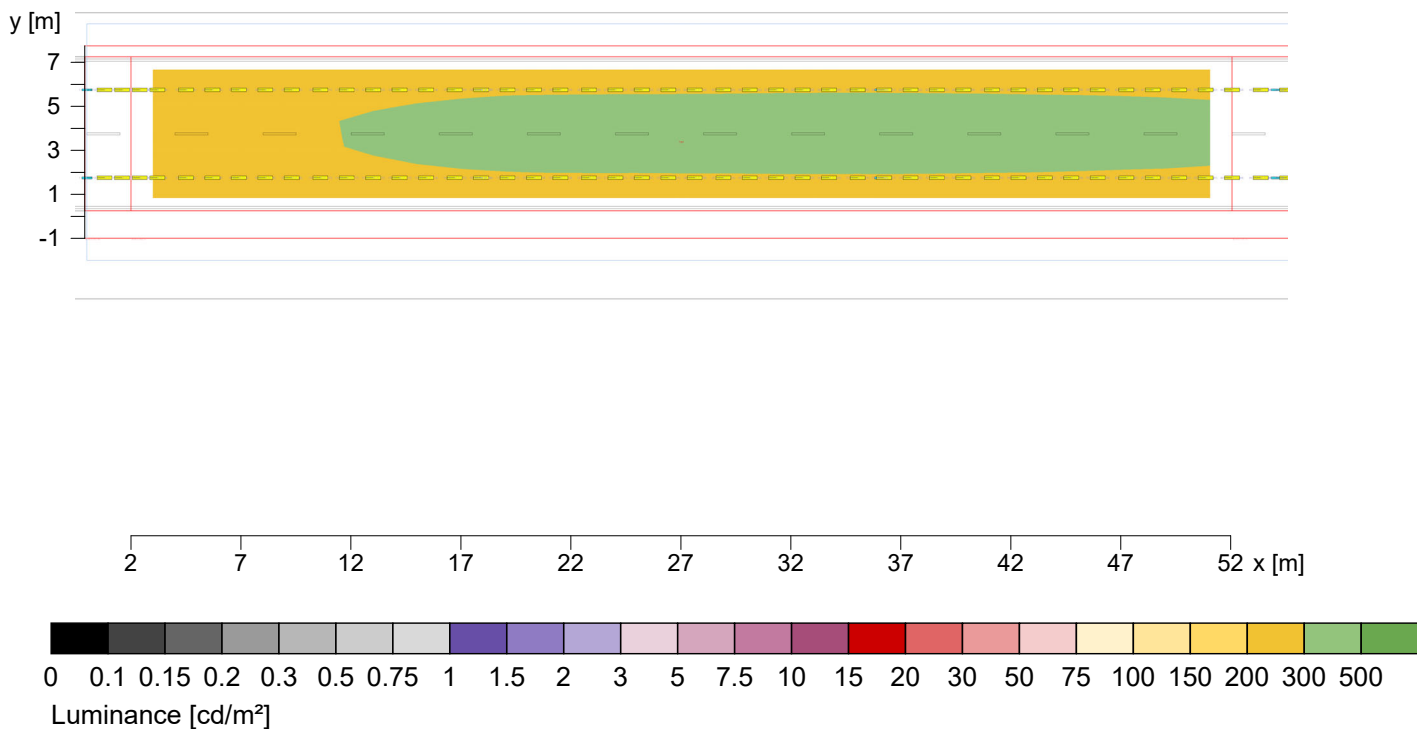
[Handwritten signatures]

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 Project number : 81942
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1.4 Calculation results, Tunnel

1.4.3 Pseudo colours, TH1 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = -58, y = 1.75, z = 1.5$ (dx = 6) : 288 cd/m²
 L_{min} : 200 cd/m²
 $L_{min}/\bar{L}_m$: 0.69
 $L_{l,min}/L_{l,max}$: 0.73

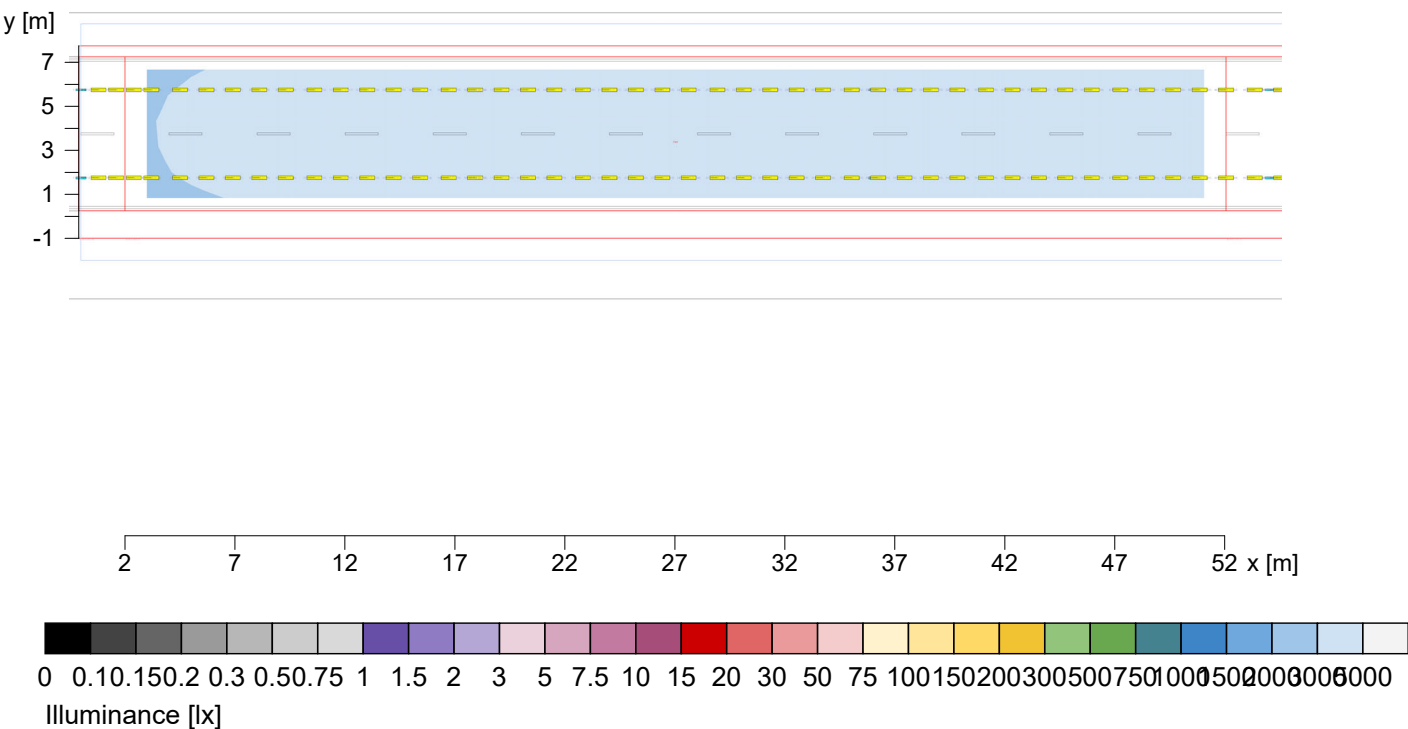
[Handwritten signatures]

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 Installation : MAIN TUNNEL 220M ENTRY
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1.4 Calculation results, Tunnel

1.4.4 Pseudo colours, TH1 (E), S1: 100%



Height reference plane		: 0.00 m
Average illuminance	$\bar{E}_m$	: 3600 lx
Minimum illuminance	E_{min}	: 2560 lx
Maximum illuminance	E_{max}	: 3900 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	: 1 : 1.4 (0.71)
Diversity U_d	E_{min}/E_{max}	: 1 : 1.52 (0.66)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
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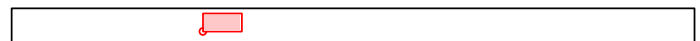


1 Tunnel

1.5 Calculation results, Tunnel

1.5.1 Table, TH2 (L), S1: 100%, Obs. 1

[m]										
6.42	272	271	270	267	265	262	259	255	252	248
5.25	295	294	292	289	287	283	280	276	272	268
4.08	[309]	307	306	303	300	297	293	289	285	280
2.92	308	307	305	302	300	296	292	288	284	280
1.75	295	294	292	289	287	283	280	276	272	268
0.58	270	269	267	265	263	260	257	253	250	(246)
	52.75	54.25	55.75	57.25	58.75	60.25	61.75	63.25	64.75	66.25



Observer location 1 : x = -8, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 280 cd/m²
Minimum luminance L_{min} : 246 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.88
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.91

[Signatures]

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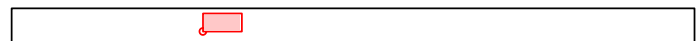
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



1.5 Calculation results, Tunnel

1.5.2 Table, TH2 (E), S1: 100%

[m]	3460	3450	3430	3400	3370	3330	3280	3240	3190	3150
6.42	3730	3720	3700	3670	3630	3580	3540	3490	3440	3390
5.25	3840	3830	3800	3770	3730	3690	3640	3590	3540	3490
4.08	3700	3690	3670	3640	3600	3550	3500	3460	3410	3360
2.92	3380	3370	3350	3320	3290	3250	3210	3160	3120	(3080)
1.75	52.75	54.25	55.75	57.25	58.75	60.25	61.75	63.25	64.75	66.25
0.58	Illuminance [lx]									



Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 3520 lx
Minimum illuminance E_{min} : 3080 lx
Maximum illuminance E_{max} : 3860 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.15 (0.87)
Diversity U_d E_{min}/E_{max} : 1 : 1.25 (0.8)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

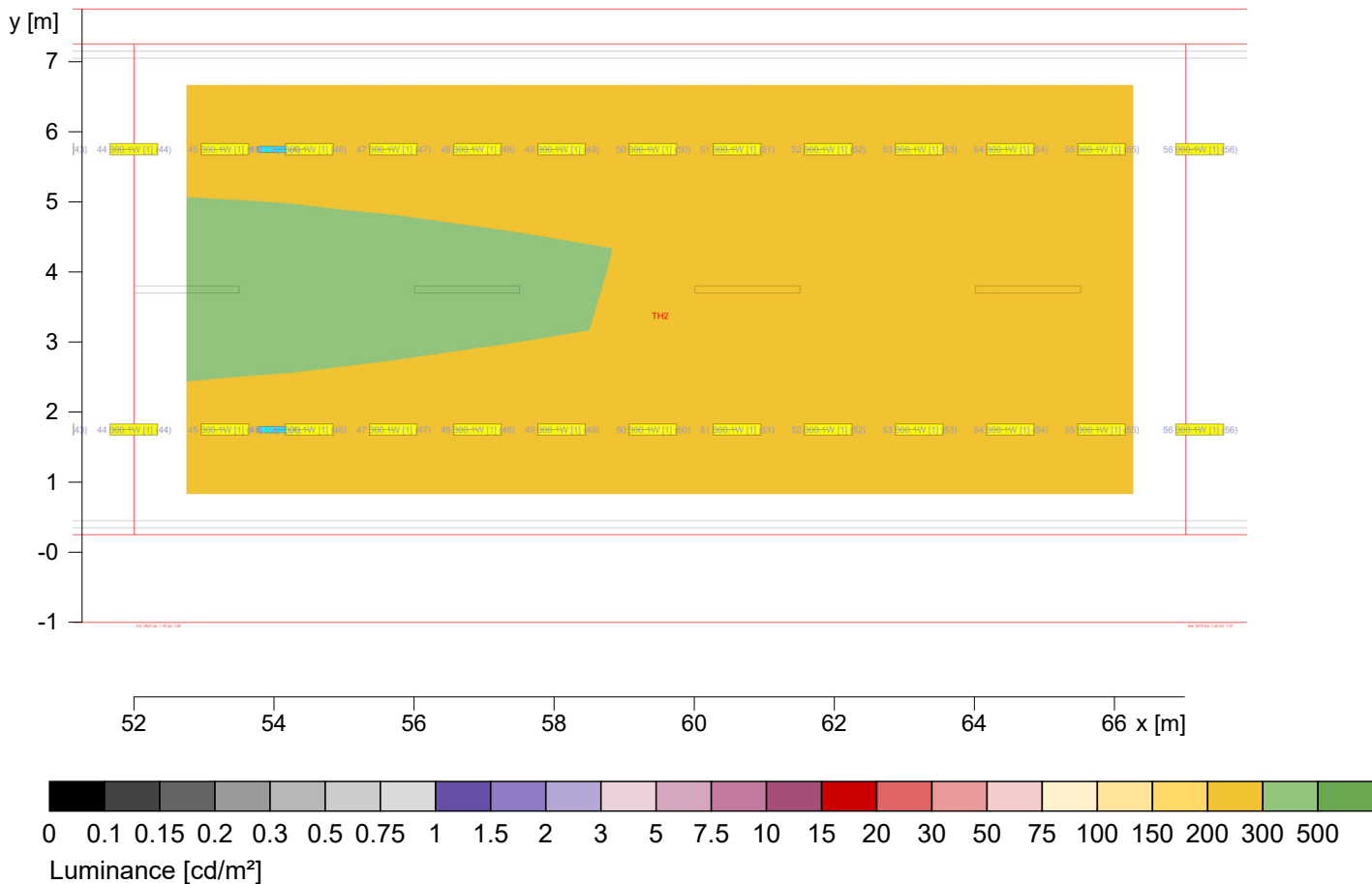
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1.5 Calculation results, Tunnel

1.5.3 Pseudo colours, TH2 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: x = -8, y = 1.75, z = 1.5 (dx = 60) : 280 cd/m²
 L_{min} : 246 cd/m²
 $L_{min}/\bar{L}_m$: 0.88
 $L_{l,min}/L_{l,max}$: 0.91

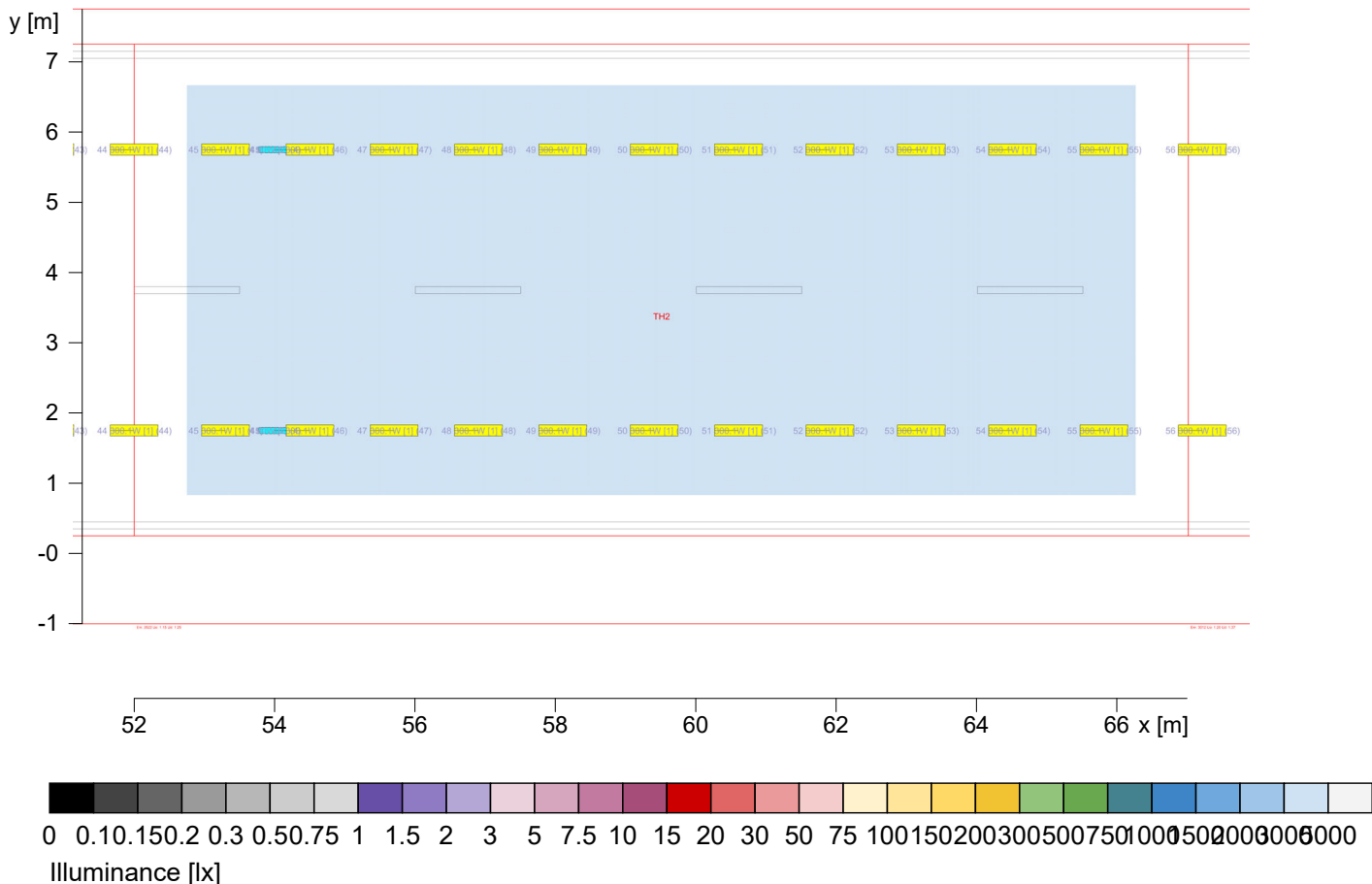
[Handwritten signatures and initials]

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1.5 Calculation results, Tunnel

1.5.4 Pseudo colours, TH2 (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 3520 lx
 E_{min} : 3080 lx
 E_{max} : 3860 lx
 $E_{min}/\bar{E}_m$: 1 : 1.15 (0.87)
 E_{min}/E_{max} : 1 : 1.25 (0.8)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
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Date : 23.09.2024



1 Tunnel

1.6 Calculation results, Tunnel

1.6.1 Table, TH3 (L), S1: 100%, Obs. 1

[m]	244	240	236	232	227	223	218	213	209	204
6.42	264	260	255	250	245	240	235	230	225	220
5.25	[276]	272	267	262	257	252	246	241	235	230
4.08	[276]	271	266	261	256	251	245	240	235	229
2.92	264	259	255	250	245	240	235	230	225	220
1.75	242	238	234	230	225	221	216	211	207	(202)
0.58	67.75	69.25	70.75	72.25	73.75	75.25	76.75	78.25	79.75	81.25



Observer location 1 : x = 7, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 240 cd/m²
Minimum luminance L_{min} : 202 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.84
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.83

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
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Date : 23.09.2024



1.6 Calculation results, Tunnel

1.6.2 Table, TH3 (E), S1: 100%

[m]	3100	3050	3000	2950	2890	2820	2760	2700	2640	2580
6.42	3340	3290	3240	3180	3110	3040	2970	2900	2840	2770
5.25	3460	3400	3350	3290	3220	3150	3070	3000	2930	2870
4.08	3440	3390	3330	3270	3200	3130	3060	2980	2910	2850
2.92	3310	3260	3210	3150	3090	3020	2950	2880	2810	2750
1.75	3030	2990	2940	2880	2820	2760	2700	2640	2580	(2520)
0.58	67.75	69.25	70.75	72.25	73.75	75.25	76.75	78.25	79.75	81.25
Illuminance [lx]										



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3010 lx
Minimum illuminance	E_{min} : 2520 lx
Maximum illuminance	E_{max} : 3460 lx
Uniformity U_o	$E_{min}/\bar{E}_m$: 1 : 1.2 (0.84)
Diversity U_d	E_{min}/E_{max} : 1 : 1.37 (0.73)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

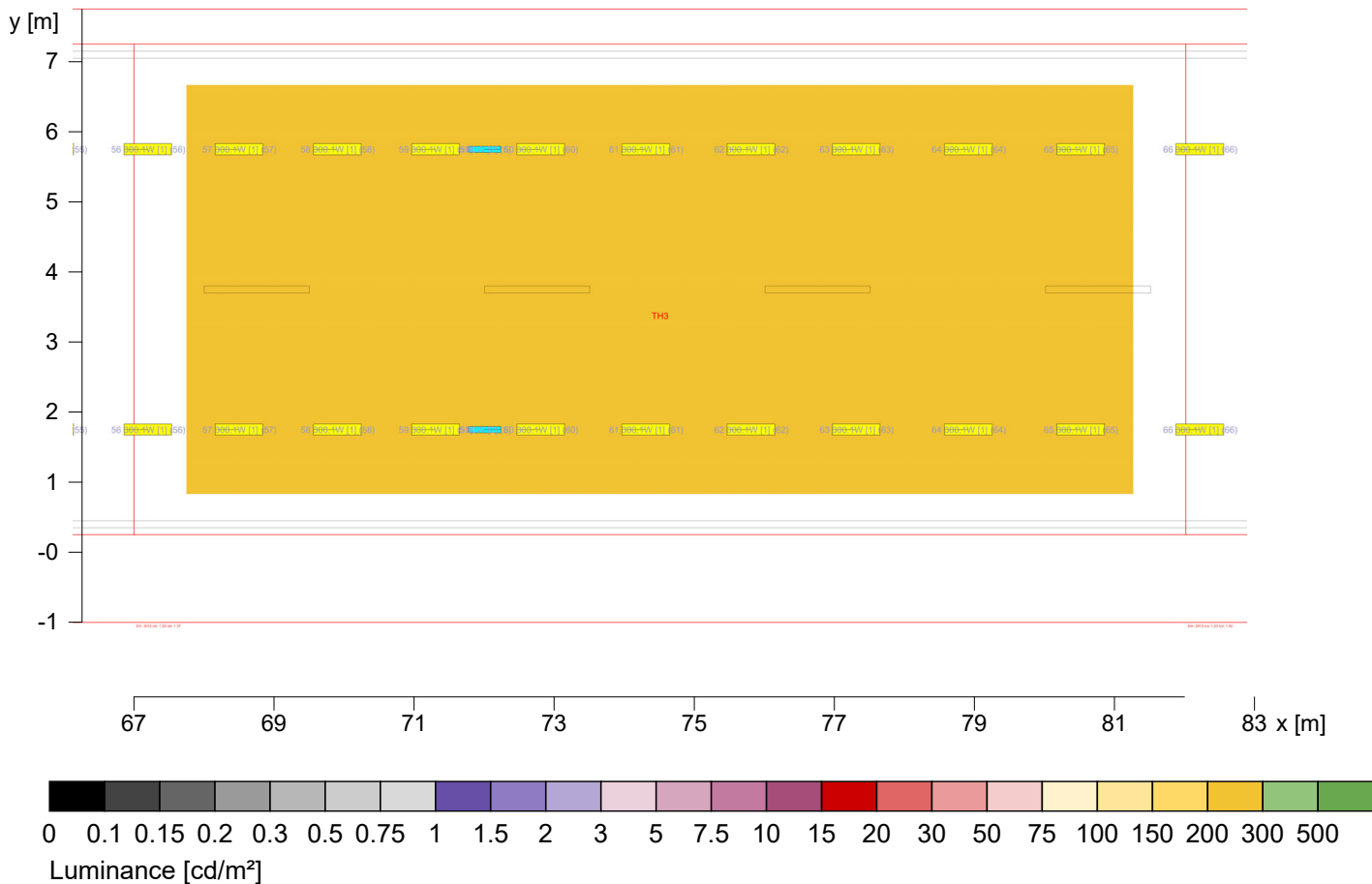
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1.6 Calculation results, Tunnel

1.6.3 Pseudo colours, TH3 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = 7, y = 1.75, z = 1.5$ ($dx = 60$)
 L_{min} : 240 cd/m^2
 $L_{min}/\bar{L}_m$: 202 cd/m^2
 $L_{l,min}/L_{l,max}$: 0.84
 $L_{l,min}/L_{l,max}$: 0.83

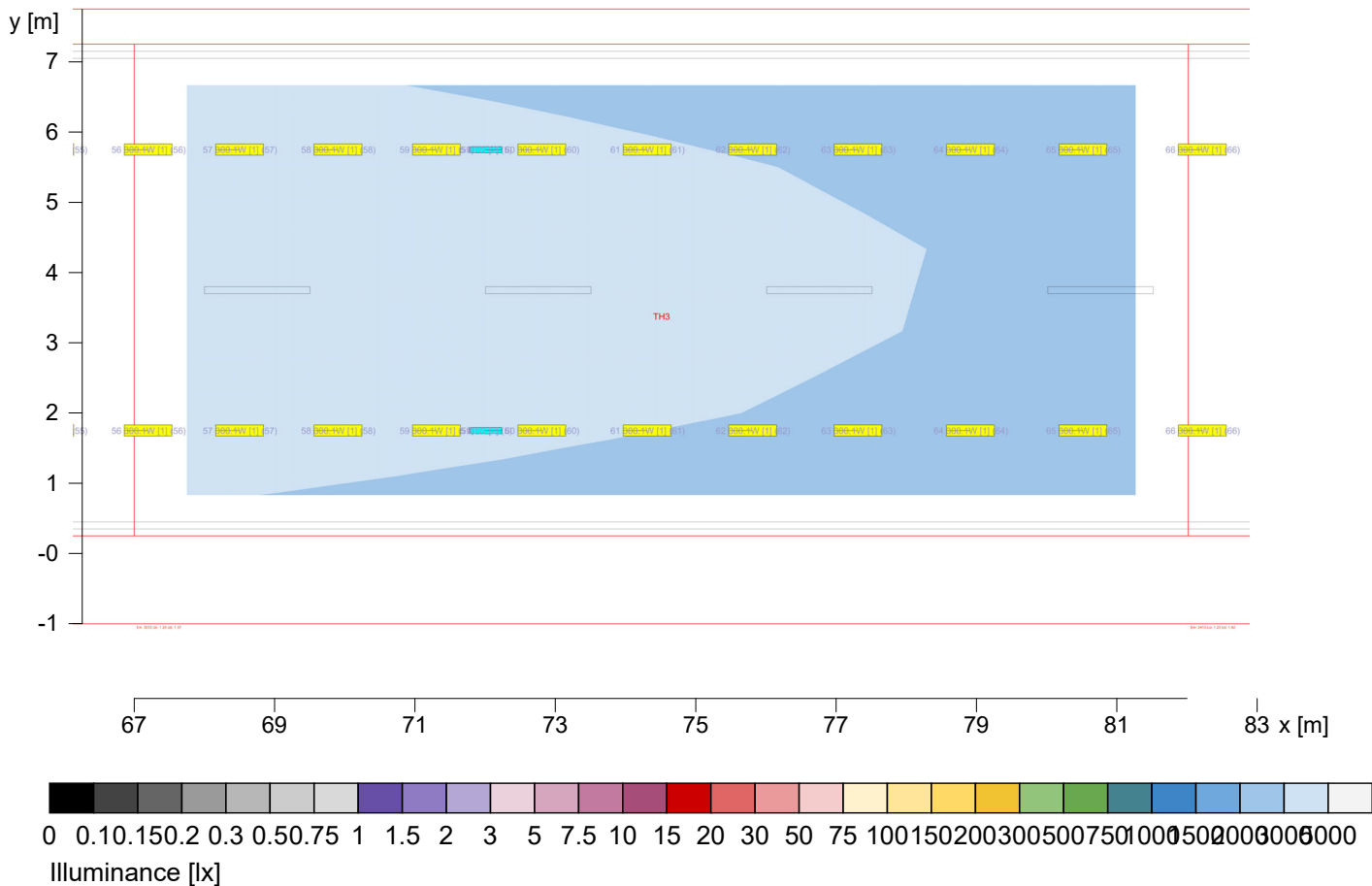
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.6 Calculation results, Tunnel

1.6.4 Pseudo colours, TH3 (E), S1: 100%



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3010 lx
Minimum illuminance	E_{min} : 2520 lx
Maximum illuminance	E_{max} : 3460 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.2 (0.84)
Diversity U_d	E_{min}/E_{max} : 1 : 1.37 (0.73)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.7 Calculation results, Tunnel

1.7.1 Table, TH4 (L), S1: 100%, Obs. 1

[m]	199	195	191	187	182	178	173	168	164	158
6.42	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘
5.25	215	211	206	201	197	192	187	182	176	171
	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘
4.08	[225]	220	216	210	205	200	195	190	184	179
	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘
2.92	224	220	215	210	205	200	195	189	184	178
	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘
1.75	215	210	206	201	196	191	186	181	176	171
	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘
0.58	197	193	189	185	180	176	171	167	162	(157)
	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘	└─┘
	82.75	84.25	85.75	87.25	88.75	90.25	91.75	93.25	94.75	96.25



Observer location 1 : x = 22, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 191 cd/m²
Minimum luminance L_{min} : 157 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.82
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.79

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1.7 Calculation results, Tunnel

1.7.2 Table, TH4 (E), S1: 100%

[m]	2520	2470	2420	2370	2320	2270	2210	2150	2080	2010
6.42	2710	2660	2610	2550	2500	2450	2380	2310	2240	2170
5.25	2790	2730	2680	2630	2570	2510	2450	2380	2310	2230
4.08	2690	2630	2580	2530	2480	2430	2360	2290	2220	2150
2.92	2460	2410	2360	2320	2270	2220	2160	2100	2030	(1970)
1.75										
0.58										
	82.75	84.25	85.75	87.25	88.75	90.25	91.75	93.25	94.75	96.25
	Illuminance [lx]									



Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 2410 lx
Minimum illuminance E_{min} : 1970 lx
Maximum illuminance E_{max} : 2800 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.23 (0.82)
Diversity U_d E_{min}/E_{max} : 1 : 1.42 (0.7)

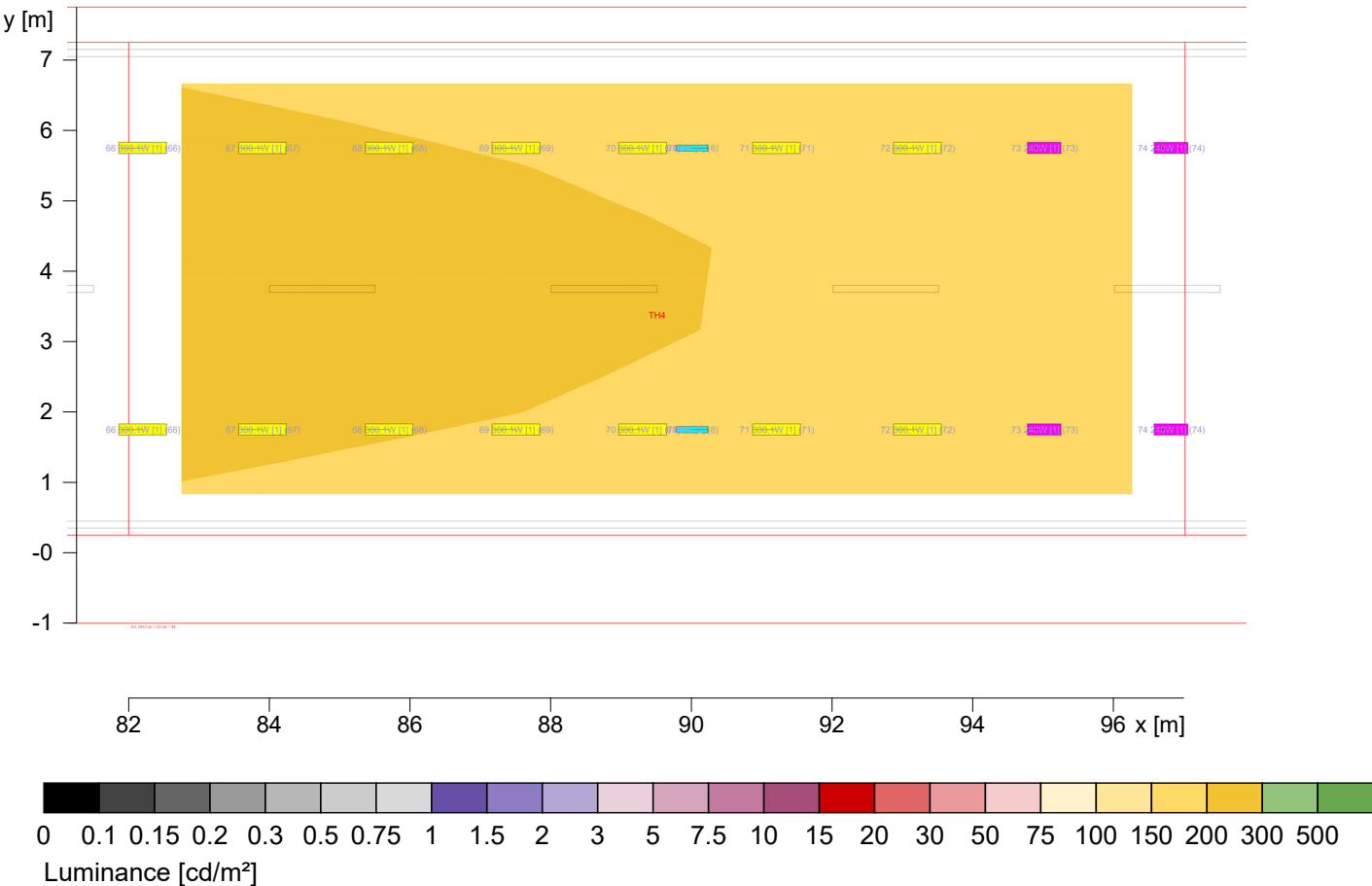
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.7 Calculation results, Tunnel

1.7.3 Pseudo colours, TH4 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = 22, y = 1.75, z = 1.5$ (dx = 6
 L_{min} : 191 cd/m²
 $L_{min}/\bar{L}_m$: 157 cd/m²
 $L_{l,min}/L_{l,max}$: 0.82
 $L_{l,min}/L_{l,max}$: 0.79

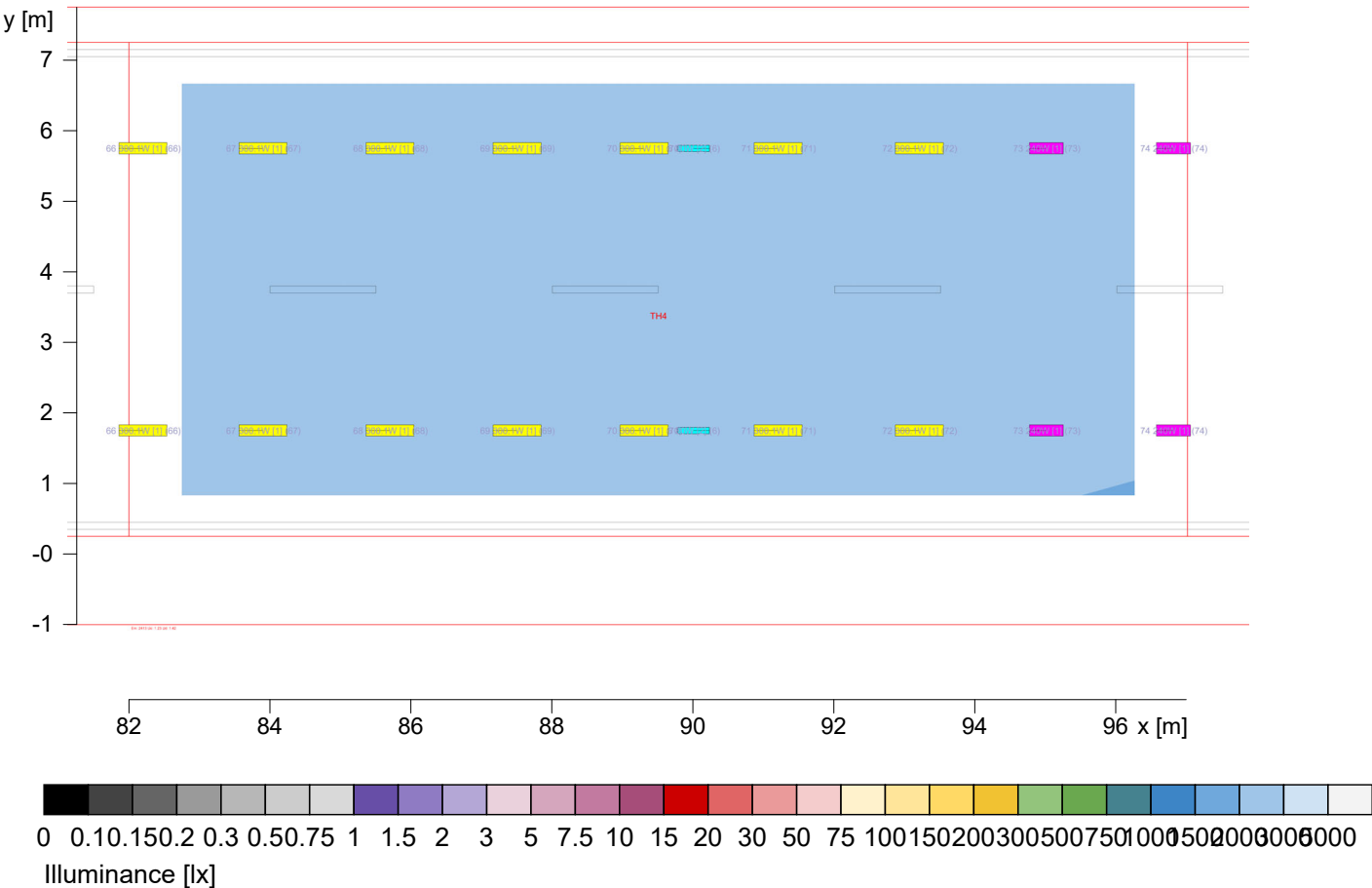
[Handwritten signatures and initials]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.7 Calculation results, Tunnel

1.7.4 Pseudo colours, TH4 (E), S1: 100%



Height reference plane	:	0.00 m
Average illuminance	$\bar{E}_m$	: 2410 lx
Minimum illuminance	E_{min}	: 1970 lx
Maximum illuminance	E_{max}	: 2800 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	: 1 : 1.23 (0.82)
Diversity U_d	E_{min}/E_{max}	: 1 : 1.42 (0.7)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

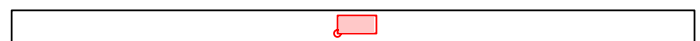


1 Tunnel

1.8 Calculation results, Tunnel

1.8.1 Table, TR START (L), S1: 100%, Obs. 1

[m]										
6.42	132	128	124	119	115	111	107	103	99	95
5.25	143	138	133	129	124	120	115	110	106	102
4.08	[149]	144	139	134	130	124	121	115	112	107
2.92	[149]	144	139	134	129	124	120	115	111	106
1.75	143	138	133	129	124	119	115	110	106	102
0.58	131	127	123	118	114	110	106	102	98	(94)
	104.75	106.25	107.75	109.25	110.75	112.25	113.75	115.25	116.75	118.25



Observer location 1 : x = 44, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 121 cd/m²
Minimum luminance L_{min} : 94.2 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.78
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.72

[Handwritten signatures]

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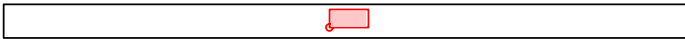
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.8 Calculation results, Tunnel

1.8.2 Table, TR START (E), S1: 100%

[m]	1680	1630	1580	1520	1470	1400	1350	1290	1240	1190
6.42	1810	1760	1700	1640	1580	1510	1450	1390	1330	1280
5.25	1810	1760	1700	1640	1580	1510	1450	1390	1330	1280
4.08	1880	1820	1760	1700	1630	1560	1500	1440	1380	1330
2.92	1870	1810	1750	1690	1620	1560	1490	1430	1370	1320
1.75	1800	1740	1690	1630	1570	1500	1440	1380	1320	1270
0.58	1650	1600	1550	1490	1430	1370	1320	1260	1210	(1170)
	104.75	106.25	107.75	109.25	110.75	112.25	113.75	115.25	116.75	118.25
Illuminance [lx]										



Height reference plane : 0.00 m
 Average illuminance $\bar{E}_m$: 1520 lx
 Minimum illuminance E_{min} : 1170 lx
 Maximum illuminance E_{max} : 1880 lx
 Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.3 (0.77)
 Diversity U_d E_{min}/E_{max} : 1 : 1.61 (0.62)

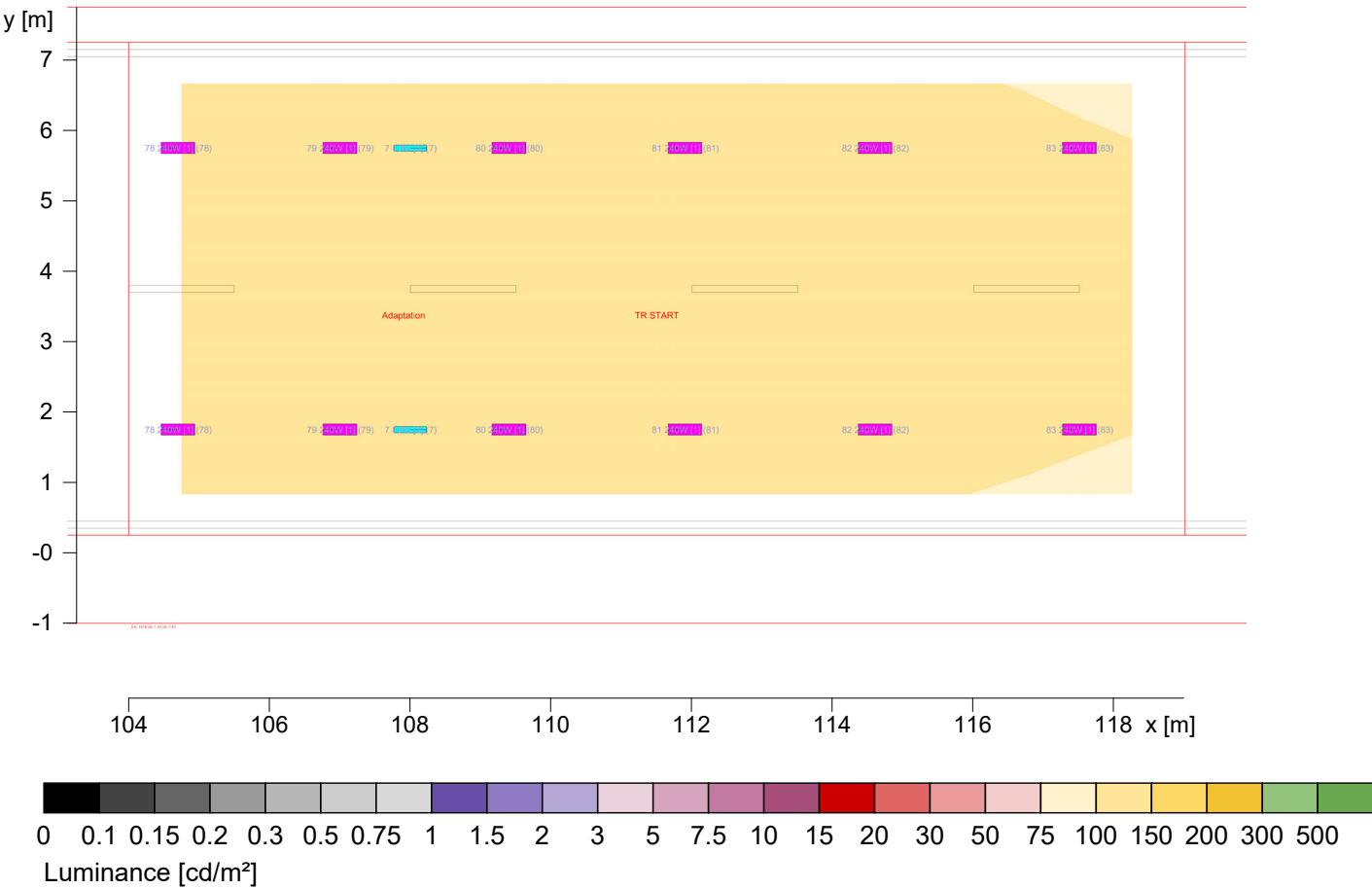
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



1.8 Calculation results, Tunnel

1.8.3 Pseudo colours, TR START (L), S1: 100%, Obs. 1



Observer location 1
Average luminance $\bar{L}_m$
Minimum luminance L_{min}
Overall uniformity U_o
Longitudinal uniformity U_l

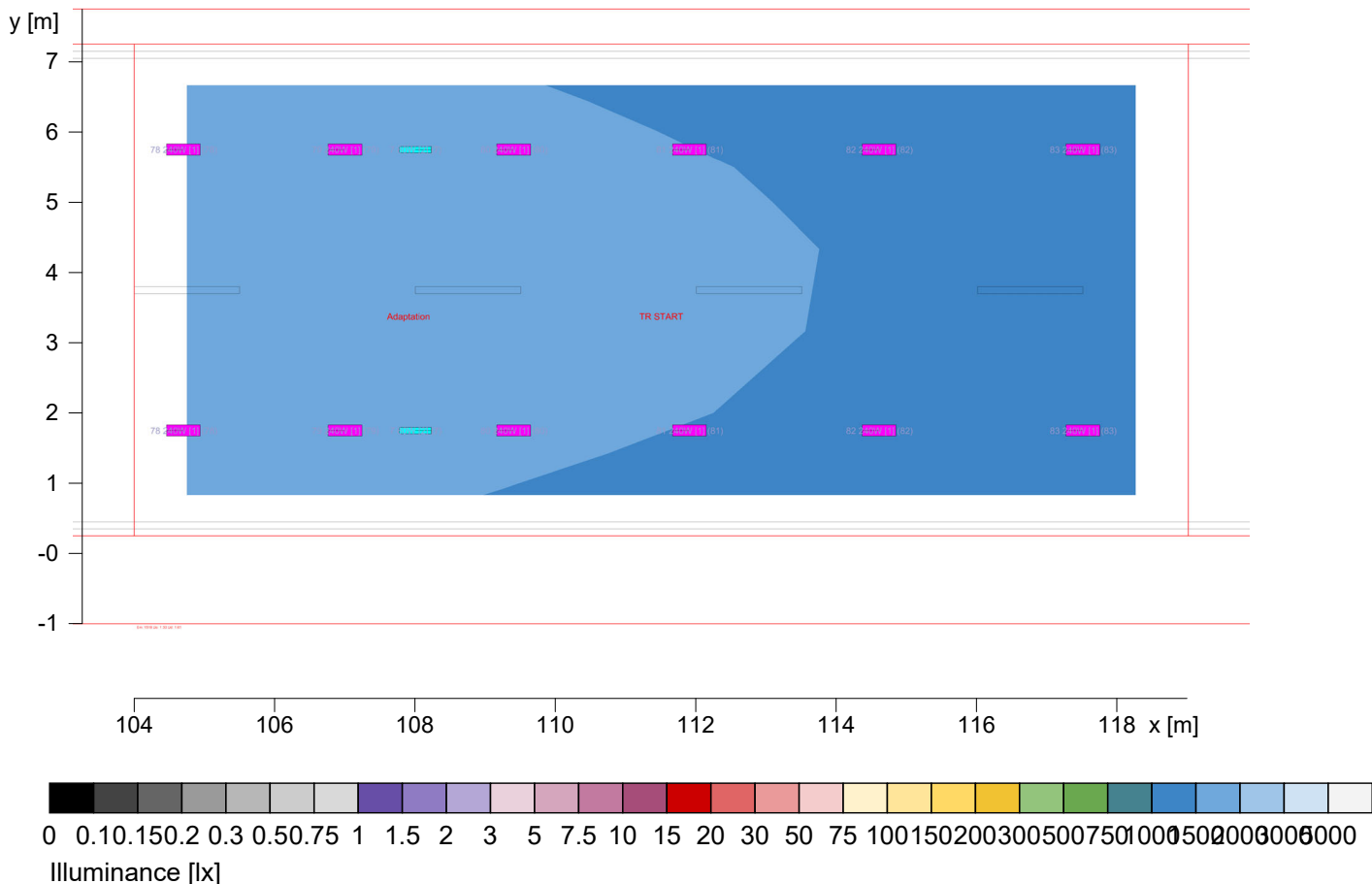
$\bar{L}_m$: 121 cd/m²
 L_{min} : 94.2 cd/m²
 $L_{min}/\bar{L}_m$: 0.78
 $L_{l,min}/L_{l,max}$: 0.72

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.8 Calculation results, Tunnel

1.8.4 Pseudo colours, TR START (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 1520 lx
 E_{min} : 1170 lx
 E_{max} : 1880 lx
 $E_{min}/\bar{E}_m$: 1 : 1.3 (0.77)
 E_{min}/E_{max} : 1 : 1.61 (0.62)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

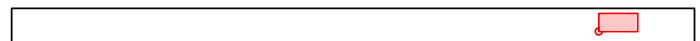


1 Tunnel

1.9 Calculation results, Tunnel

1.9.1 Table, TR END (L), S1: 100%, Obs. 1

[m]										
6.42	21.9	21.3	20.6	19.9	19.5	18.2	17.4	16.4	14.9	13.4
5.25	23.5	22.7	21.9	21.6	21.1	19.8	18.6	17.6	16	14.4
4.08	24.4	23.7	23.1	22.5	22.3	20.2	19	17.9	16.5	15
2.92	[24.5]	23.6	23	22.4	22.1	20.3	19	17.8	16.4	14.9
1.75	23.4	22.6	21.9	21.4	21	19.7	18.5	17.5	15.9	14.3
0.58	21.6	21	20.2	19.6	19.1	17.9	17.1	16.1	14.7	(13.2)
	205.75	207.25	208.75	210.25	211.75	213.25	214.75	216.25	217.75	219.25



Observer location 1 : x = 145, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 19.4 cd/m²
Minimum luminance L_{min} : 13.2 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.68
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.61

[Handwritten signatures]

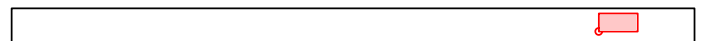
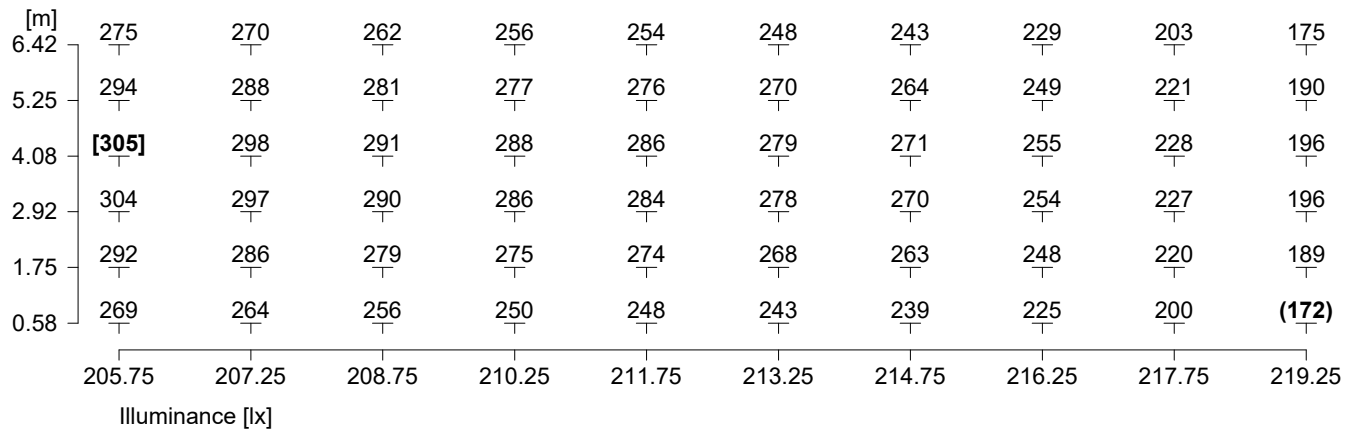
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



1.9 Calculation results, Tunnel

1.9.2 Table, TR END (E), S1: 100%



Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 256 lx
Minimum illuminance E_{min} : 172 lx
Maximum illuminance E_{max} : 305 lx
Uniformity U_0 $E_{min}/\bar{E}_m$: 1 : 1.49 (0.67)
Diversity U_d E_{min}/E_{max} : 1 : 1.77 (0.56)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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1.9.3 Pseudo colours, TR END (L), S1: 100%, Obs. 1

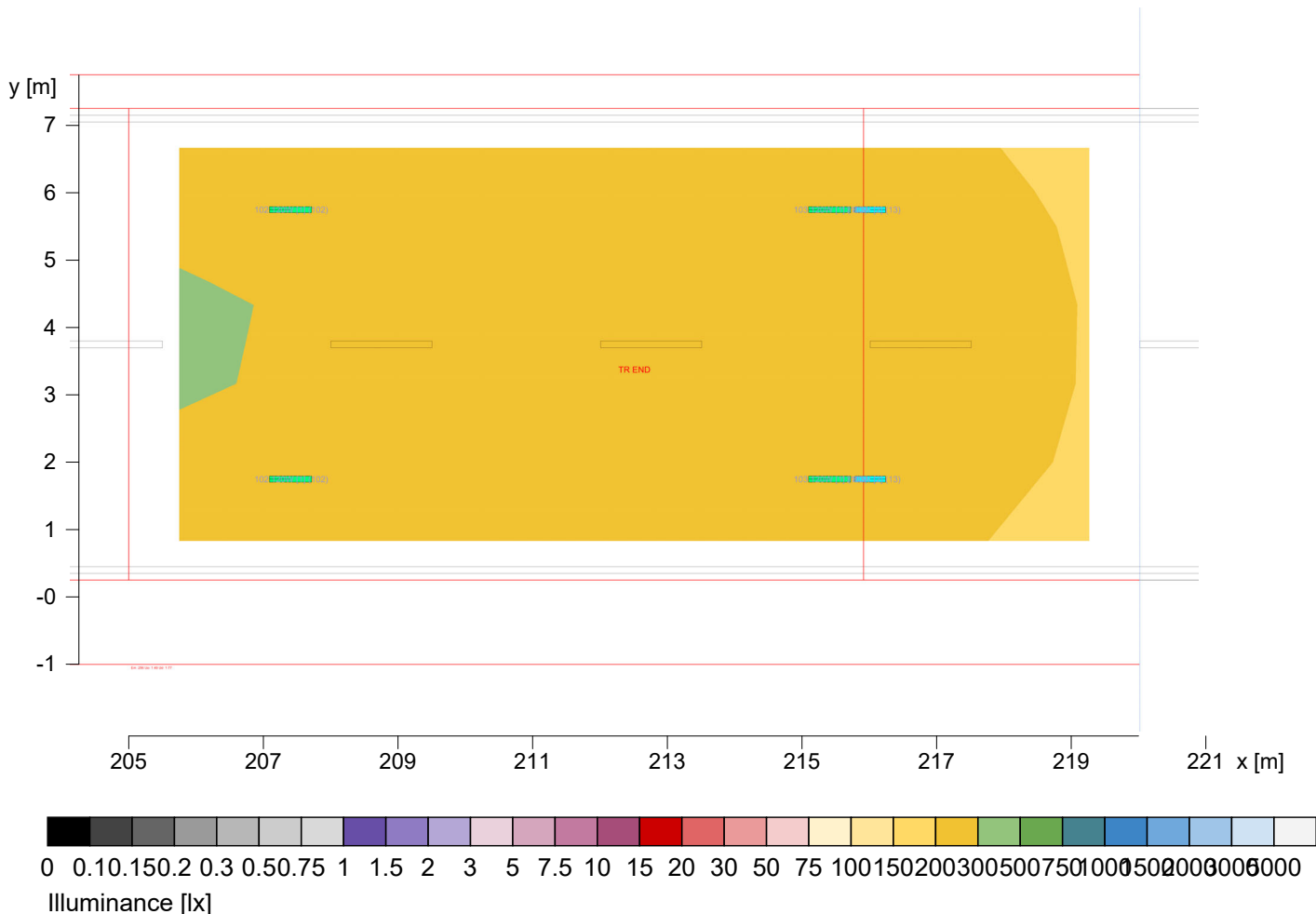


Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.9 Calculation results, Tunnel

1.9.4 Pseudo colours, TR END (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 256 lx
 E_{min} : 172 lx
 E_{max} : 305 lx
 $E_{min}/\bar{E}_m$: 1 : 1.49 (0.67)
 E_{min}/E_{max} : 1 : 1.77 (0.56)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



2 NIGHT TIME

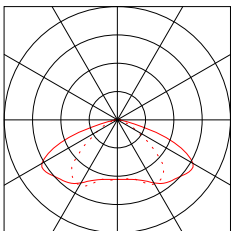
2.1 Description, NIGHT TIME

2.1.1 Luminaire list

Adaptation
 LDC in use

Interior
 LDC in use

Bajaj
 6 Order No. : s
 Luminaire name : E230315 BJTU S 108L NW SYM PC
 Equipment : 1 x Unknown 80 W / 9976 lm
 Maintenance factor: 0.85



Row of luminaires: Row 1.1

Number of luminaires: 14
 Basic position: x=0.00m y=5.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.1kW (0.22 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2 NIGHT TIME

2.1 Description, NIGHT TIME

2.1.1 Luminaire list

Row of luminaires: Row 2.1

Number of luminaires: 14

Basic position: x=0.00m y=1.50m, z=6.50m

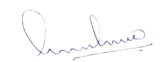
Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.1kW (0.22 km)

Constant distance: 18.00m

Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%







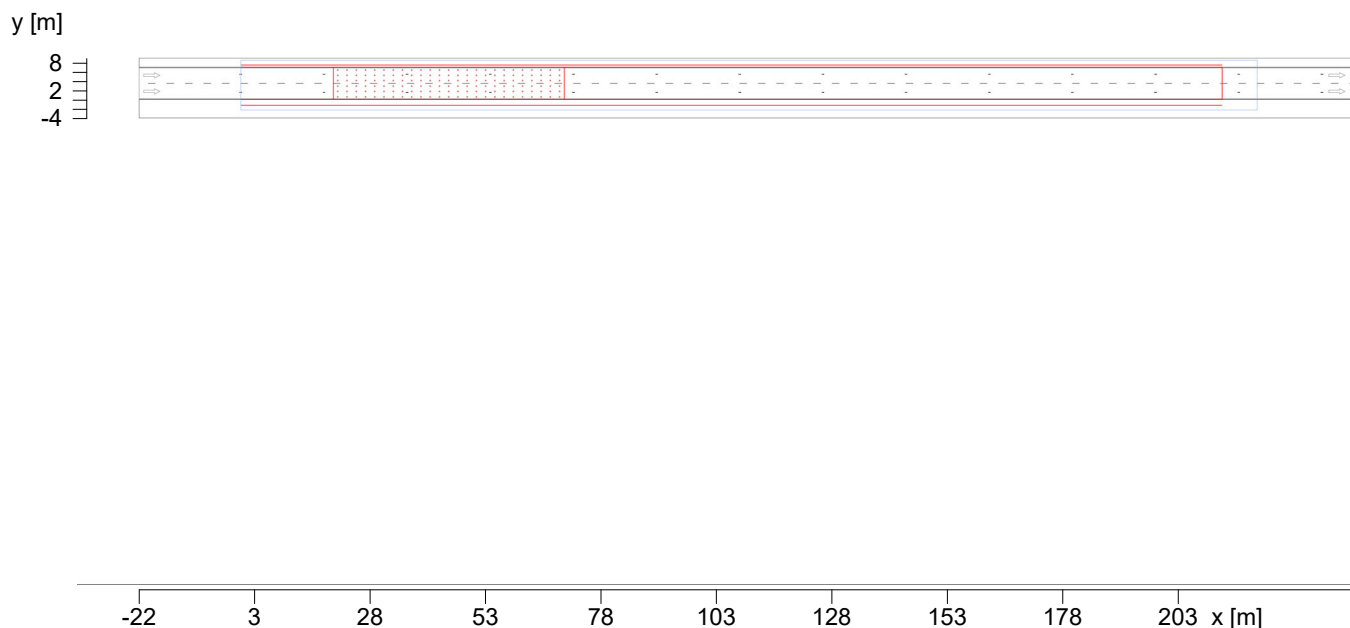
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2.1 Description, NIGHT TIME

2.1.2 Floor plan



[Handwritten signatures]

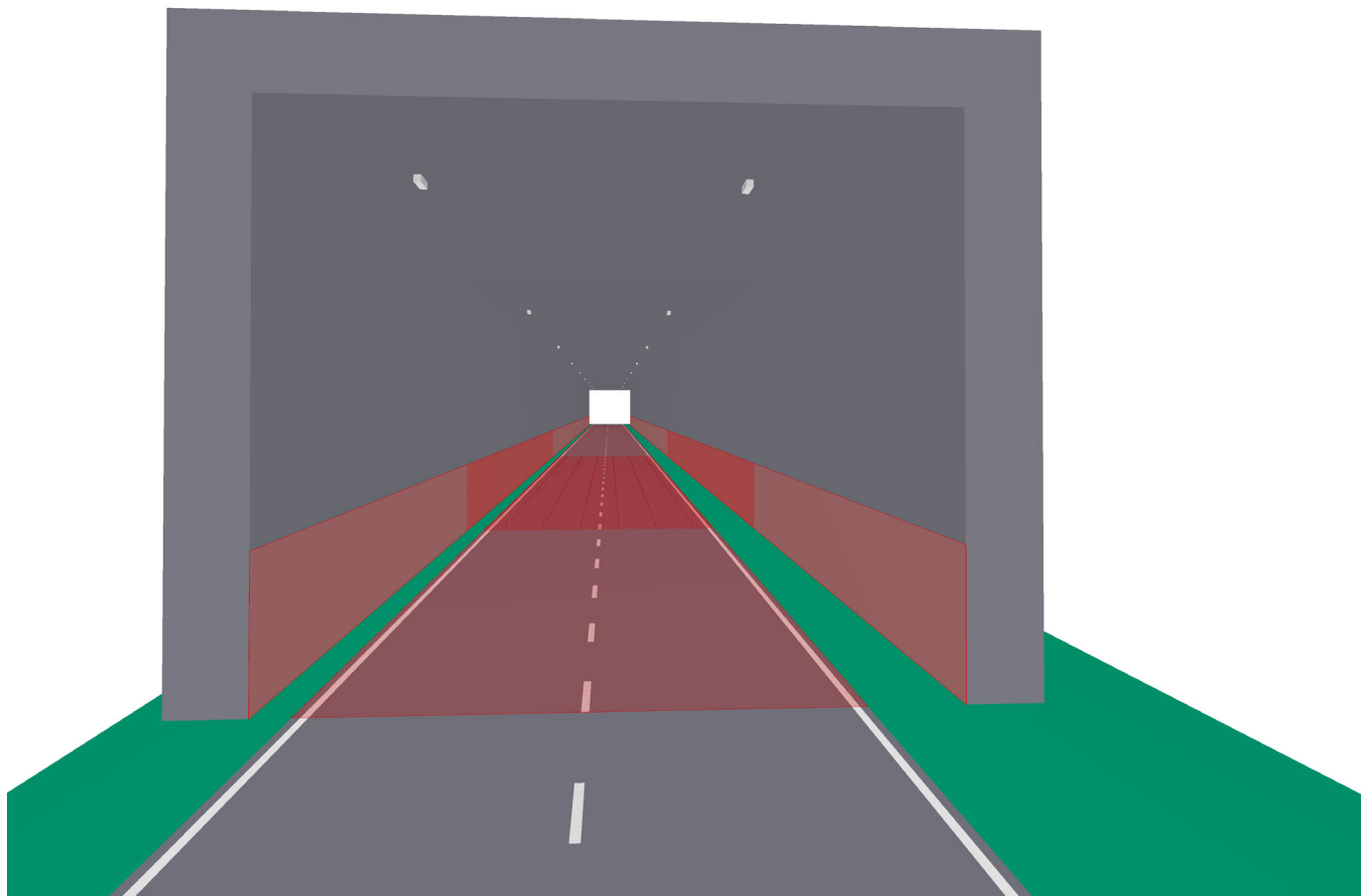
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
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2.1 Description, NIGHT TIME

2.1.3 3D view, View 1



Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2 NIGHT TIME

2.2 Calculation results, NIGHT TIME

2.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.00 m - 212.40 m Points: nx = 59, ny = 6, nz = 3

Observer (starting point coordinate) : x = -84.13 m; z = 1.50 m dx = 85.93 m (moving)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

NIGHT TIME

Measuring range: 20.00 m - 70.00 m Points: nx = 25, ny = 6, nz = 3

Observer (starting point coordinate) : x = -40.00 m; z = 1.50 m dx = 61.00 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{E}_m$	:	5.33 cd/m ²	5.33 cd/m ²	
U _o	L _{min} / $\bar{E}_m$	: 0.87	0.86	0.4
U _I	L _{I,min} /L _{I,max}	: 0.87	0.87	0.6
f _{TI,max}	Max.	: 6 %	6 %	

Wall left (diffus 30%)

$\bar{E}_m$	:	3.62 cd/m ²
U _o	L _{min} / $\bar{E}_m$	: 0.78
L _{wall} /L _{fsp}	:	0.68

Wall right (diffus 30%)

$\bar{E}_m$	:	3.51 cd/m ²
U _o	L _{min} / $\bar{E}_m$	: 0.76
L _{wall} /L _{fsp}	:	0.66

Illuminance

Roadway

$\bar{E}_m$	:	65.04 lx
U _o	E _{min} / $\bar{E}_m$	: 0.77

Wall left

$\bar{E}_m$	:	37.92 lx
U _o	E _{min} / $\bar{E}_m$	: 0.78

Wall right

$\bar{E}_m$	:	36.74 lx
U _o	E _{min} / $\bar{E}_m$	: 0.76

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
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2 NIGHT TIME

2.2 Calculation results, NIGHT TIME

2.2.1 Result overview, S1: 100%

qc: The backward reflecion of the road was calculated.







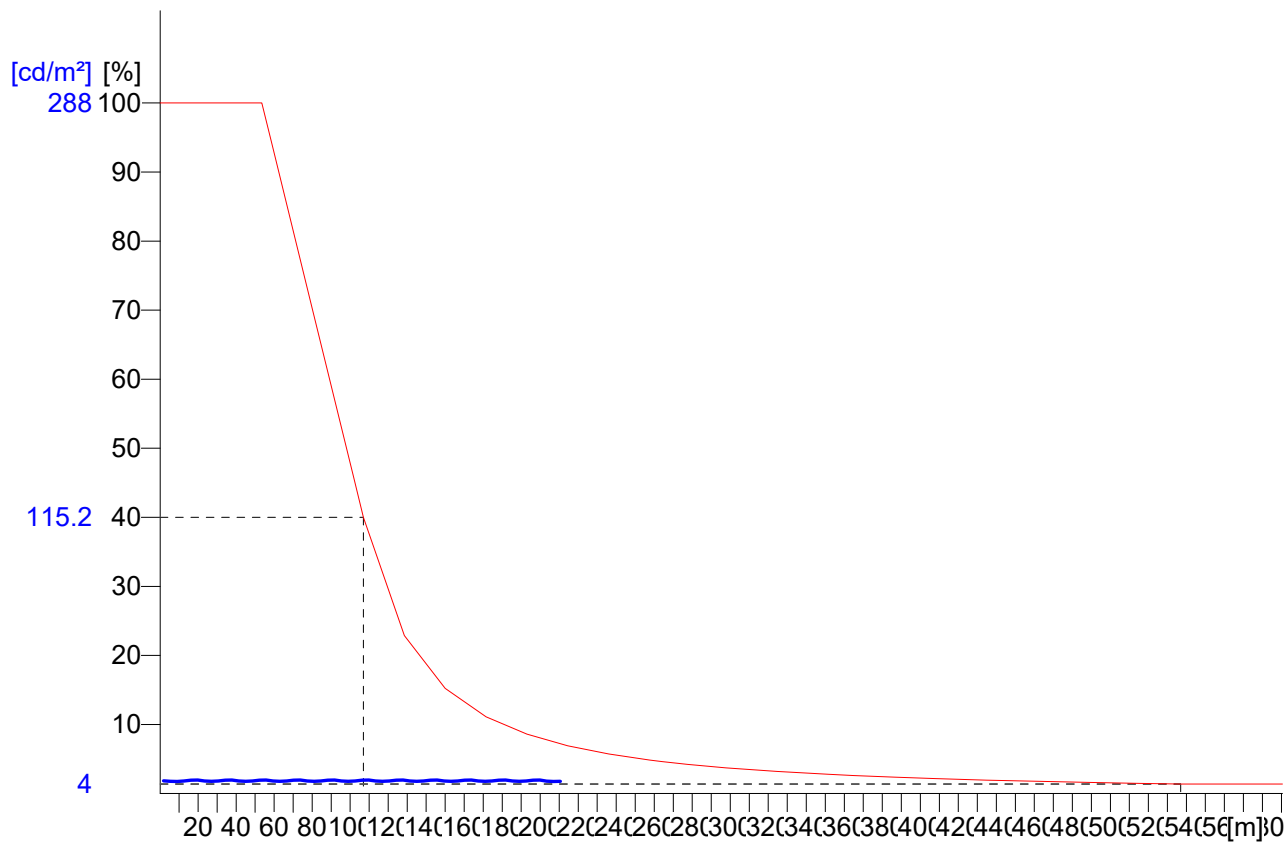
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
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2.2 Calculation results, NIGHT TIME

2.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -84.1, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

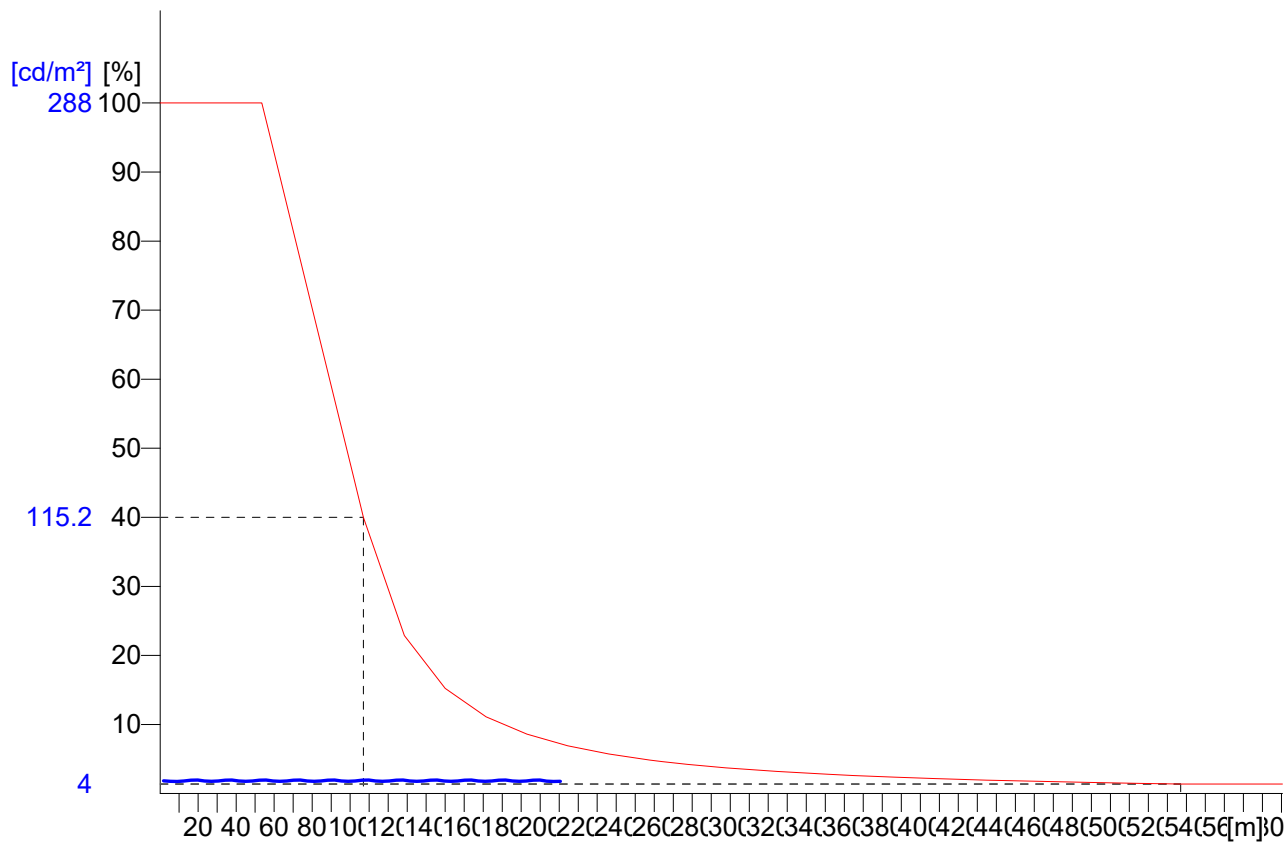
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
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2.2 Calculation results, NIGHT TIME

2.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



Observer location 2 : x = -84.1, y = 5.25, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2 NIGHT TIME

2.3 Calculation results, NIGHT TIME

2.3.1 Table, NIGHT TIME (L), S1: 100%, Obs. 1

[m]	5.07	4.84	(4.65)	4.77	4.7	4.91	5.17	5.33	5.33	5.1	4.87	4.68	4.78	4.72
6.42	5.52	5.33	5	5.03	5.04	5.38	5.64	5.77	5.79	5.54	5.35	5.02	5.04	5.06
5.25	5.8	5.59	5.33	5.37	5.41	5.67	5.84	5.88	5.91	5.81	5.6	5.33	5.38	5.42
4.08	5.83	5.62	5.33	5.39	5.44	5.69	5.93	5.91	[5.95]	5.83	5.62	5.33	5.39	5.44
2.92	5.57	5.37	5.04	5.06	5.09	5.4	5.67	5.75	5.77	5.58	5.38	5.04	5.06	5.09
1.75	5.11	4.9	4.69	4.75	4.72	4.91	5.16	5.27	5.29	5.12	4.91	4.7	4.76	4.72
0.58														
	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00



Part1

Observer location 1 : x = -40, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 5.33 cd/m²
Minimum luminance L_{min} : 4.65 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.87
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.87

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2 NIGHT TIME

2.3 Calculation results, NIGHT TIME

2.3.1 Table, NIGHT TIME (L), S1: 100%, Obs. 1

4.92	5.2	5.34	5.35	5.12	4.89	4.69	4.79	4.73	4.92	5.19
5.39	5.65	5.77	5.8	5.55	5.36	5.02	5.05	5.06	5.39	5.64
5.67	5.85	5.89	5.92	5.81	5.6	5.33	5.38	5.42	5.67	5.84
5.69	5.93	5.91	[5.95]	5.83	5.6	5.33	5.38	5.44	5.68	5.92
5.4	5.67	5.75	5.77	5.58	5.38	5.04	5.06	5.09	5.4	5.66
4.92	5.17	5.27	5.3	5.12	4.92	4.71	4.76	4.73	4.92	5.16
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00

[m]



Part2

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.2 Table, NIGHT TIME (E), S1: 100%

[m]	67.9	59	52.5	50.9	52.5	59	67.9	75.8	75.8	67.9	59	52.5	51	52.5
6.42														
5.25	73.8	63.6	55.4	52.8	55.4	63.6	73.9	82.7	82.7	73.9	63.6	55.5	52.8	55.5
4.08	76.3	66.3	57.9	55.5	57.9	66.3	76.3	84	84	76.3	66.3	57.9	55.5	57.9
2.92	76.8	66.4	58	55.4	58	66.5	76.8	84.4	84.4	76.8	66.5	58	55.4	58
1.75	74	63.7	55.3	52.5	55.3	63.7	74	82.3	82.3	74	63.7	55.3	52.5	55.3
0.58	67.1	58.5	51.8	(50)	51.8	58.6	67.1	74.7	74.7	67.1	58.6	51.9	(50)	51.9
	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00
	Illuminance [lx]													



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 65 lx
Minimum illuminance E_{min} : 50 lx
Maximum illuminance E_{max} : 84.4 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.3 (0.77)
Diversity U_d E_{min}/E_{max} : 1 : 1.69 (0.59)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.2 Table, NIGHT TIME (E), S1: 100%

59	67.9	75.8	75.8	67.9	59	52.5	50.9	52.5	59	67.9
63.6	73.9	82.7	82.7	73.9	63.6	55.5	52.8	55.5	63.6	73.9
66.3	76.3	84	84	76.3	66.3	57.9	55.5	57.9	66.3	76.3
66.5	76.8	[84.4]	[84.4]	76.8	66.5	58	55.4	58	66.5	76.8
63.7	74	82.4	82.4	74	63.7	55.3	52.5	55.3	63.7	74
58.6	67.1	74.7	74.7	67.1	58.6	51.9	(50)	51.8	58.6	67.1
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00 [m]



Part2

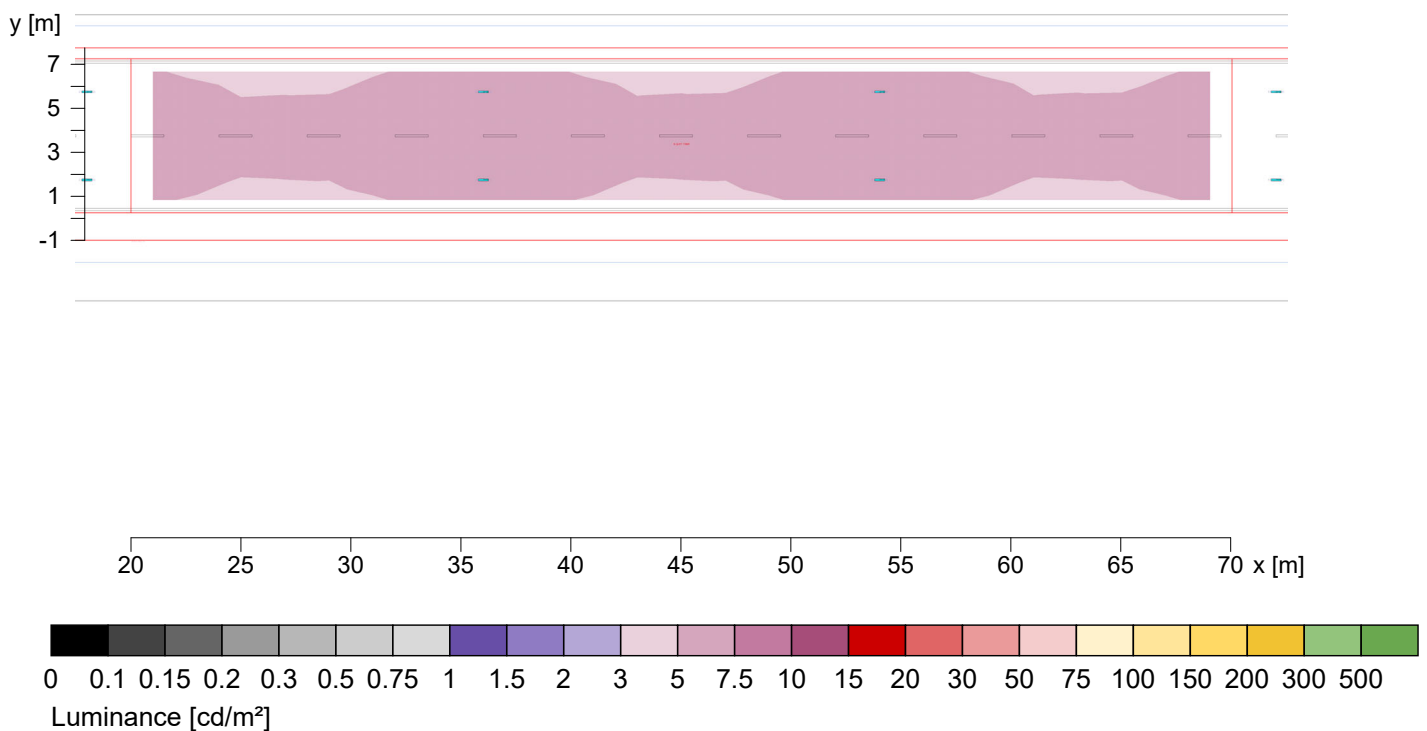
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.3 Pseudo colours, NIGHT TIME (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: $x = -40, y = 1.75, z = 1.5$ (dx = 6) : 5.33 cd/m²
 L_{min} : 4.65 cd/m²
 $L_{min}/\bar{L}_m$: 0.87
 $L_{l,min}/L_{l,max}$: 0.87

[Signatures]

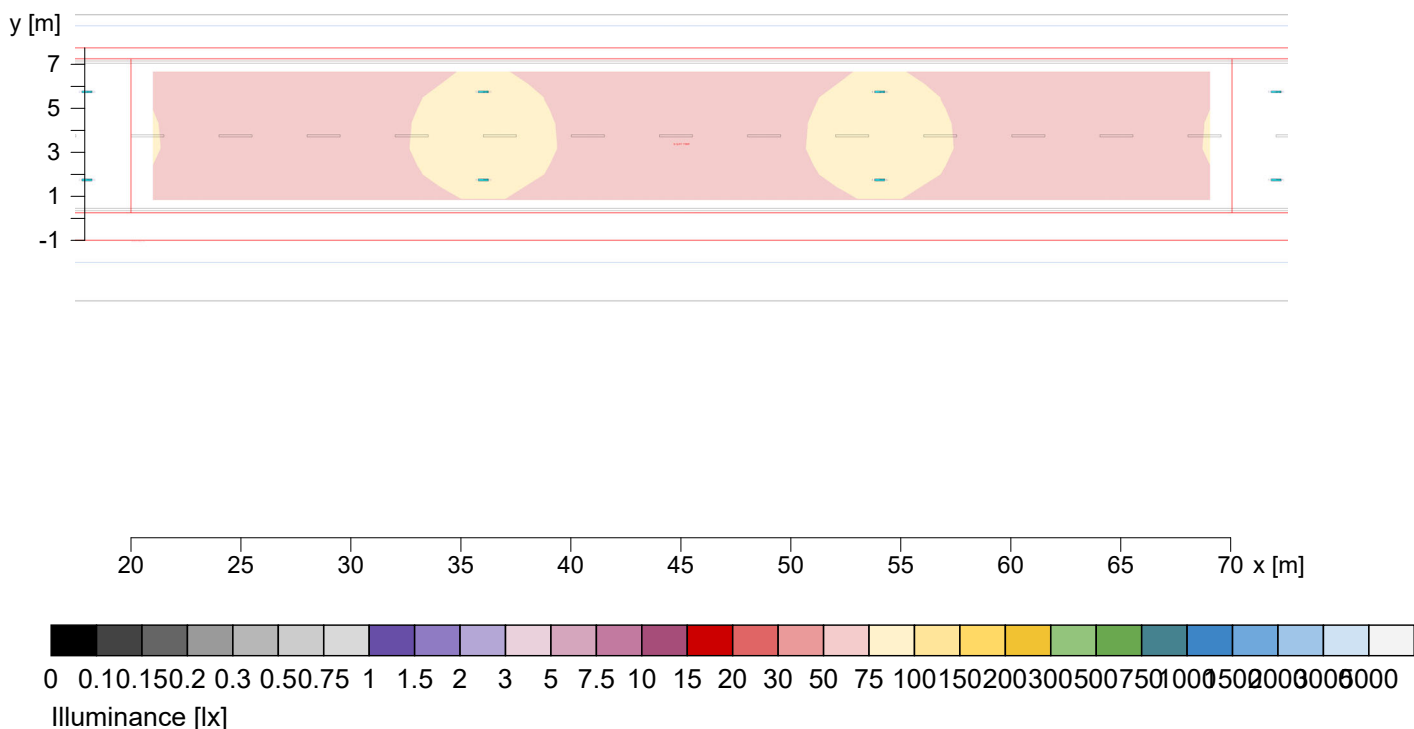
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.4 Pseudo colours, NIGHT TIME (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 65 lx
 E_{max} : 50 lx
 $E_{min}/\bar{E}_m$: 84.4 lx
 E_{min}/E_{max} : 1 : 1.3 (0.77)
 E_{min}/E_{max} : 1 : 1.69 (0.59)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



3 EMERGENCY

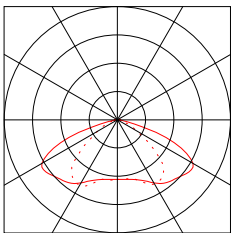
3.1 Description, EMERGENCY

3.1.1 Luminaire list

Adaptation
 LDC in use

Interior
 LDC in use

Bajaj
 6 Order No. : s
 Luminaire name : E230315 BJTU S 108L NW SYM PC
 Equipment : 1 x Unknown 80 W / 9976 lm
 Maintenance factor: 0.85



Row of luminaires: Row 2.1

Number of luminaires: 14
 Basic position: x=0.00m y=1.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.1kW (0.22 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

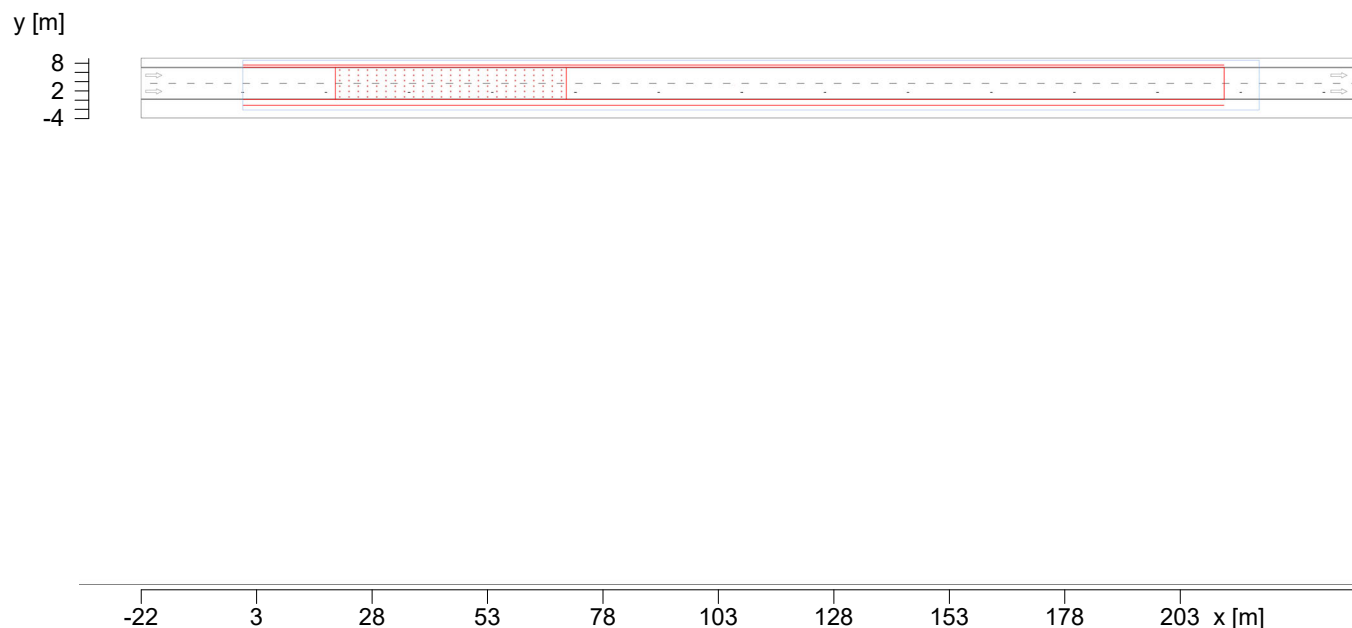
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

RELUX®

3.1 Description, EMERGENCY

3.1.2 Floor plan



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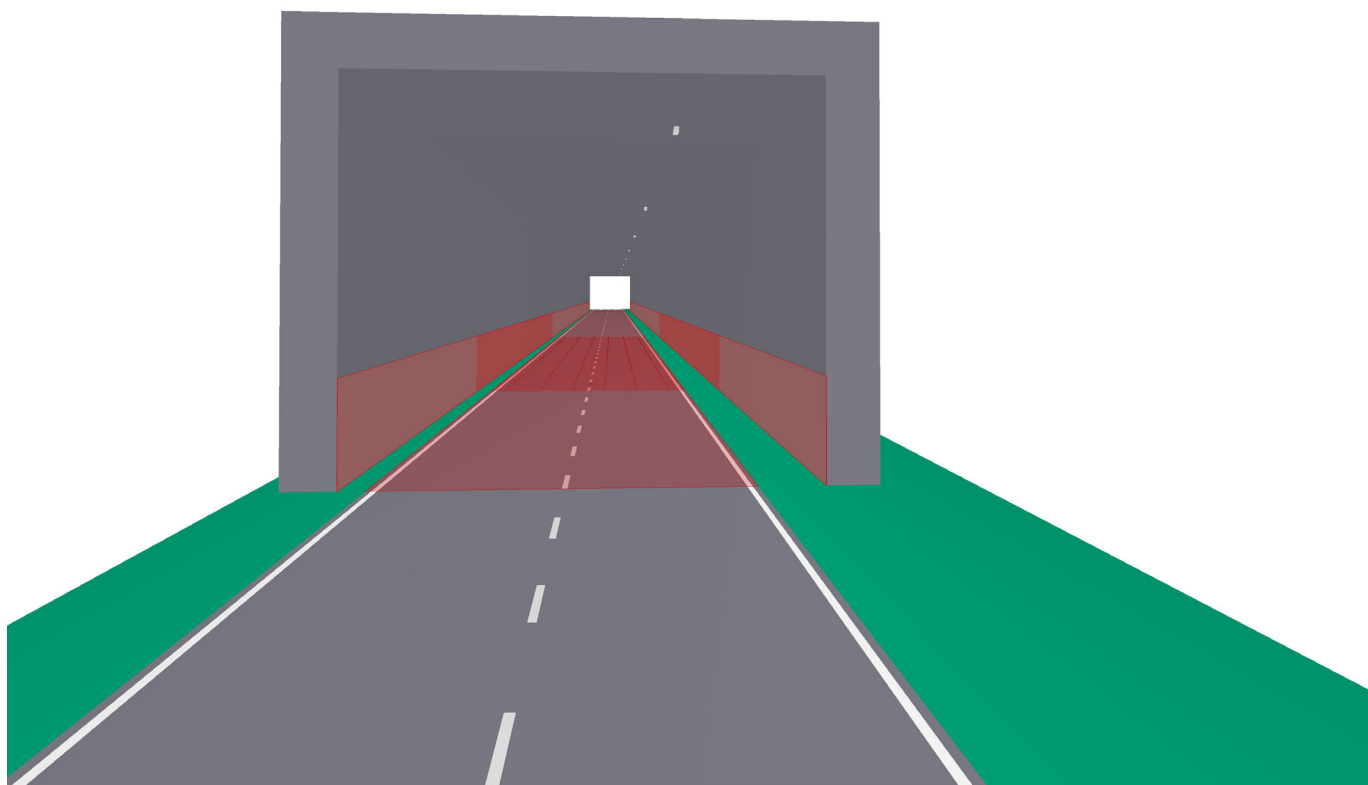
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

RELUX®

3.1 Description, EMERGENCY

3.1.3 3D view, View 1



Handwritten signatures:
1. *[Signature]*
2. *[Signature]*
3. *[Signature]*
4. *[Signature]*
5. *[Signature]*

-please put your own address here-

RELUX®

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

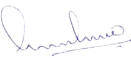
RELUX®

3 EMERGENCY

3.2 Calculation results, EMERGENCY

3.2.1 Result overview, S1: 100%

qc: The backward reflecion of the road was calculated.







-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMERGENCY (L), S1: 100%, Obs. 1

[m]	2.08	1.96	(1.95)	2.01	(1.95)	1.98	2.12	2.23	2.22	2.08	1.96	1.96	2.01	(1.95)
6.42	2.47	2.36	2.3	2.33	2.3	2.43	2.56	2.65	2.66	2.48	2.37	2.31	2.34	2.31
5.25	2.77	2.64	2.54	2.58	2.62	2.73	2.85	2.87	2.89	2.78	2.65	2.55	2.59	2.63
4.08	2.93	2.84	2.69	2.73	2.71	2.85	2.9	2.97	2.98	2.94	2.85	2.69	2.74	2.71
2.92	3.05	2.98	2.71	2.72	2.75	2.95	3.08	3.09	3.1	3.06	2.98	2.71	2.72	2.75
1.75	3.09	2.99	2.78	2.8	2.82	2.98	3.12	3.14	3.15	3.1	2.99	2.79	2.81	2.82
0.58	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00



Part1

Observer location 1 : x = -40, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 2.66 cd/m²
Minimum luminance L_{min} : 1.95 cd/m²
Overall uniformity U_o : 0.73
Longitudinal uniformity U_l : 0.87

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-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



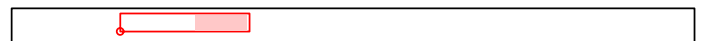
3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMERGENCY (L), S1: 100%, Obs. 1

1.98	2.12	2.23	2.23	2.09	1.96	1.96	2.01	(1.95)	1.98	2.12
2.44	2.57	2.66	2.67	2.49	2.37	2.31	2.34	2.31	2.44	2.57
2.74	2.86	2.88	2.89	2.78	2.66	2.55	2.59	2.63	2.74	2.87
2.85	2.9	2.97	2.98	2.94	2.83	2.7	2.74	2.71	2.85	2.9
2.95	3.08	3.09	3.1	3.06	2.98	2.71	2.72	2.75	2.95	3.07
2.98	3.12	3.14	[3.16]	3.1	3	2.79	2.81	2.82	2.98	3.12
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00

[m]



Part2

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMERGENCY (E), S1: 100%

[m]	27.7	24.8	23.5	(23.3)	23.5	24.8	27.7	30.6	30.6	27.7	24.8	23.5	(23.3)	23.5
6.42	33.5	29.4	27.2	26.3	27.2	29.4	33.5	37.4	37.4	33.5	29.4	27.2	26.3	27.2
5.25	37.1	32.4	28.9	27.8	28.9	32.4	37.1	41	41	37.1	32.4	28.9	27.8	28.9
4.08	38.4	33	28.6	27.4	28.6	33.1	38.4	42.6	42.6	38.4	33.1	28.6	27.5	28.6
2.92	40.1	34	28.1	26.4	28.1	34	40.1	45	45	40.2	34.1	28.2	26.4	28.2
1.75	40.5	34.4	29.1	27.7	29.1	34.4	40.5	[45.4]	[45.4]	40.5	34.4	29.2	27.7	29.2
0.58														
	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00
	Illuminance [lx]													



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 32.5 lx
Minimum illuminance E_{min} : 23.3 lx
Maximum illuminance E_{max} : 45.4 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.39 (0.72)
Diversity U_d E_{min}/E_{max} : 1 : 1.94 (0.51)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMERGENCY (E), S1: 100%

24.8	27.7	30.6	30.6	27.7	24.8	23.5	(23.3)	23.5	24.8	27.7
29.4	33.5	37.4	37.4	33.5	29.4	27.2	26.3	27.2	29.4	33.5
32.4	37.1	41	41	37.1	32.4	28.9	27.8	28.9	32.4	37.1
33.1	38.4	42.6	42.6	38.4	33.1	28.6	27.4	28.6	33.1	38.4
34.1	40.2	45	45	40.2	34.1	28.2	26.4	28.2	34	40.1
34.4	40.5	[45.4]	[45.4]	40.5	34.4	29.1	27.7	29.1	34.4	40.5
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00 [m]



Part2

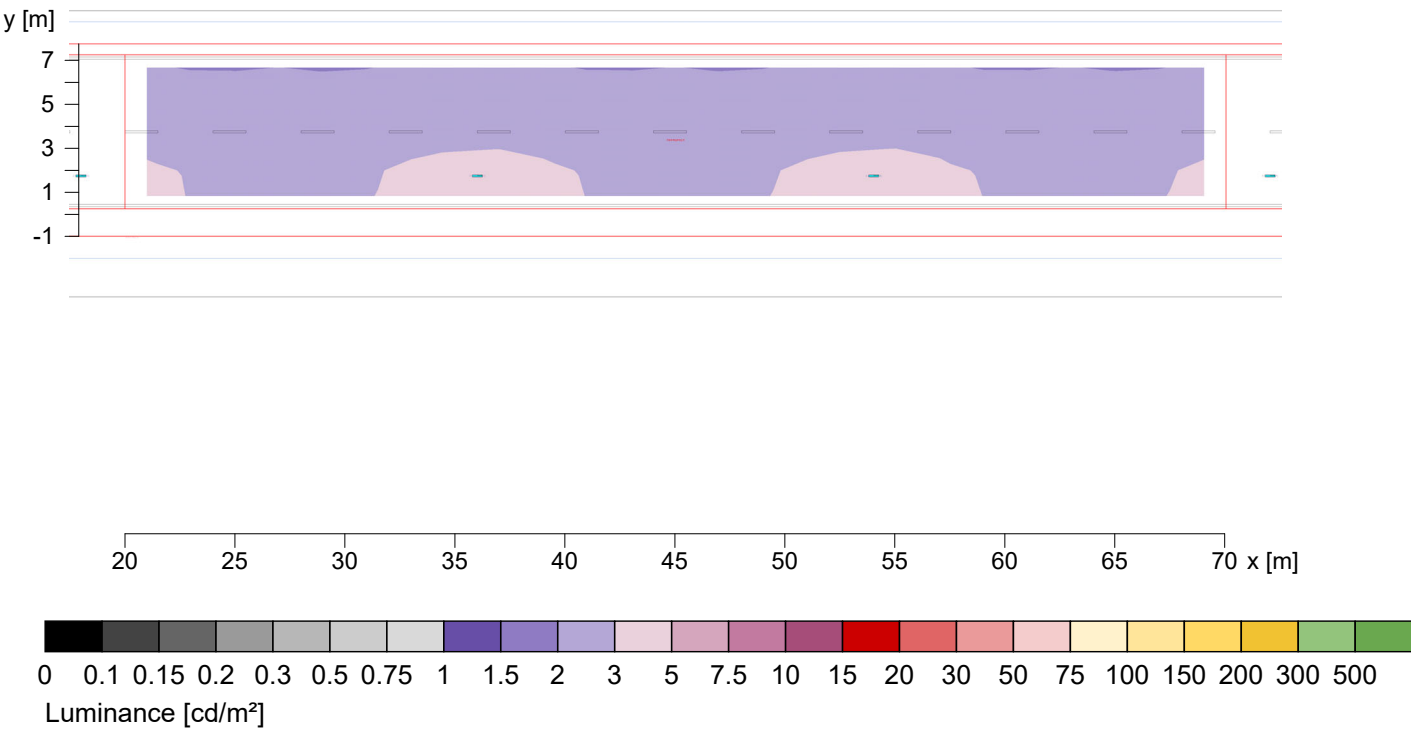
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.3 Pseudo colours, EMERGENCY (L), S1: 100%, Obs. 1



Observer location 1		: x = -40, y = 1.75, z = 1.5 (dx = 6
Average luminance	$\bar{L}_m$	: 2.66 cd/m²
Minimum luminance	L_{min}	: 1.95 cd/m²
Overall uniformity U_o	$L_{min}/\bar{L}_m$	: 0.73
Longitudinal uniformity U_l	$L_{l,min}/L_{l,max}$	: 0.87

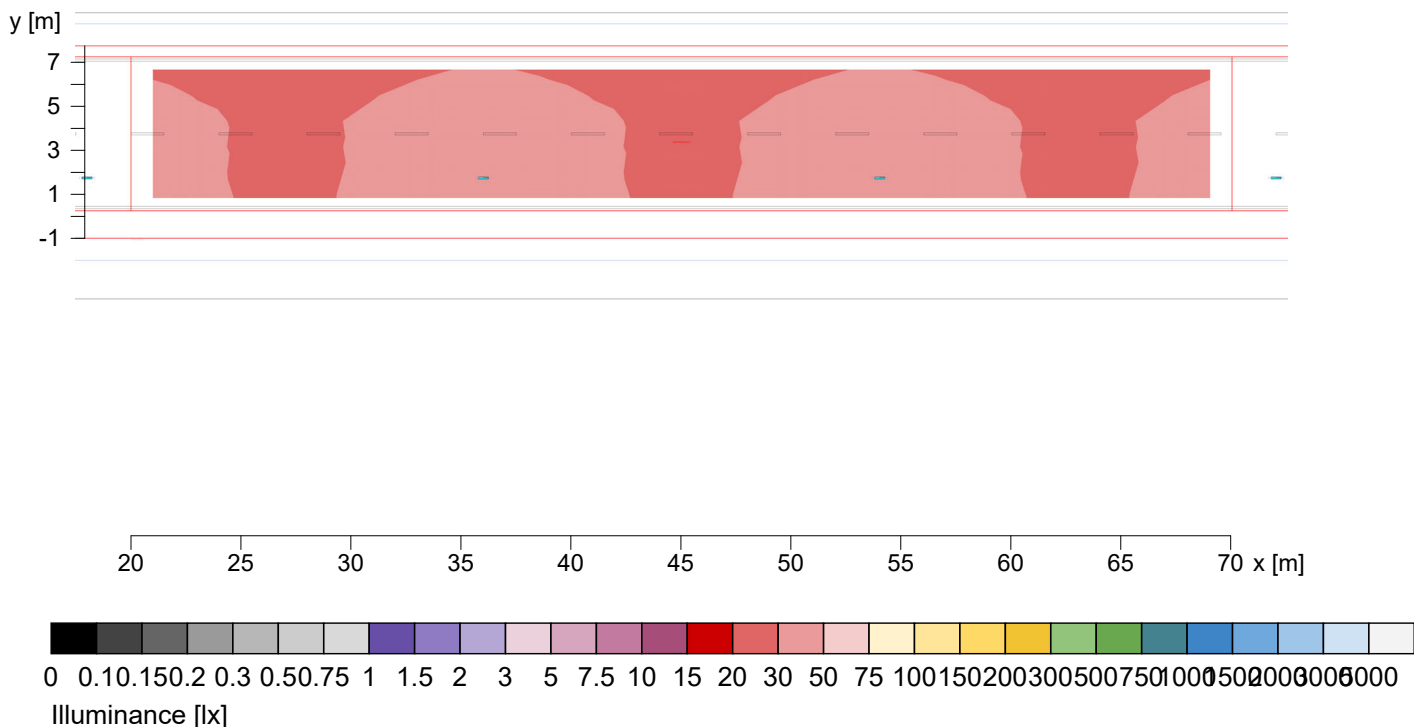
[Handwritten signatures and initials]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.4 Pseudo colours, EMERGENCY (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 32.5 lx
 E_{min} : 23.3 lx
 E_{max} : 45.4 lx
 $E_{min}/\bar{E}_m$: 1 : 1.39 (0.72)
 E_{min}/E_{max} : 1 : 1.94 (0.51)

[Handwritten signatures]

Amelia

Adri

Rob

Emma

James



APPENDIX - 3

Signature

Signature

Signature

Signature

Signature

Amelia

Adri

Rob

Emma

James

BBMP ROAD TUNNEL PROJECT

Installation : MAIN TUNNEL 233M EXIT

Project number : 81942

Customer :

Processed by : BAJAJ

Date : 23.09.2024

Project description:

Tunnel designed

233m MAIN TUNNEL

Tunnel Main Road Width assumed - 7.0m Main Carriageway + 0.5m FOOTPATH + 1.25m FOOTPATH

BOTTOM OF LIGHT - 6.5m from road level

Total Length of the Tunnel - 220m

SPEED - 80KMPH

ROAD - CONCRETE ROAD R1 - 0.10

THRESHOLD - 0cd/m², TRANSITION - 0cd/m², INTERIOR 1 - 0 cd/m², INTERIOR 2 - 4 cd/m². EXIT - 30 cd/m²

NIGHT TIME - 4.0cd/m²

EMERGENCY - MIN 2 LUX AND AVG 10

The following values are based on precise calculations performed on calibrated lamps and luminaires, and their configurations, whereby gradual, unavoidable deviations can occur in practice. All guarantee claims are excluded for the specified data.

This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



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1.6.3 Pseudo colours, EXIT START (L), S1: 100%, Obs. 1	34
1.6.4 Pseudo colours, EXIT START (E), S1: 100%	35

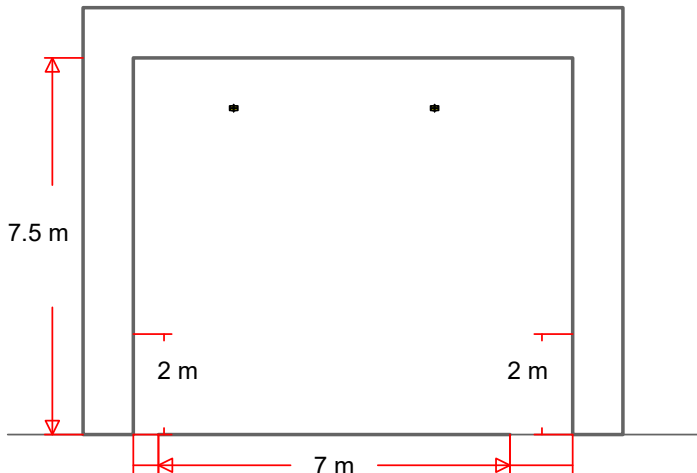
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 233M EXIT
 Project number : 81942
 Date : 23.09.2024



1 Tunnel

1.1 Description, Tunnel

1.1.1 Project data



Geometry tunnel

Length of the tunnel : 233 m
 Length of the tunnel (calculation model) : 233 m
 Height of the tunnel : 7.5 m

Width of the carriageway : 7 m
 Number of lanes : 2
 Covering / material : R1, q0 = 0.09

Marginal strip left	:	0.5 m	Marginal strip right	:	1.25 m
Height of the wall (right)	:	2 m	Height of the wall (left)	:	2 m
Covering / material	:	diffus 30%	Covering / material	:	diffus 30%

Calculation specifications

Speed : 80 km/h
 Length of the threshold zone : 107 m
 Luminance threshold zone : 30 cd/m²
 Luminance interior zone : 4 cd/m²

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



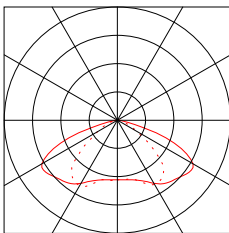
1 Tunnel

1.1 Description, Tunnel

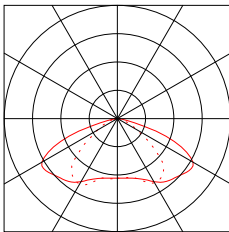
1.1.1 Project data

LDC in use

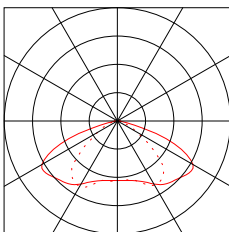
2 **Bajaj**
Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3
Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



5
Order No. : s
Luminaire name : E230315 BJTU S 108L NW SYM PC
Equipment : 1 x Unknown 80 W / 9976 lm
Maintenance factor: 0.85



[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024

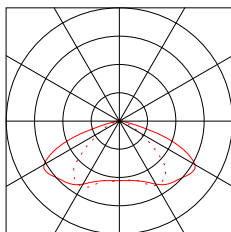
RELUX®

1 Tunnel

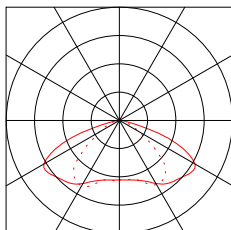
1.1 Description, Tunnel

1.1.1 Project data

6 Order No. : s
Luminaire name : E230315 BJTU S 108L NW SYM PC
Equipment : 1 x Unknown 80 W / 9976 lm
Maintenance factor: 0.85



7 Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1.1 Description, Tunnel

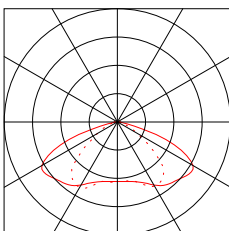
1.1.2 Luminaire list

Adaptation LDC in use

Bajaj

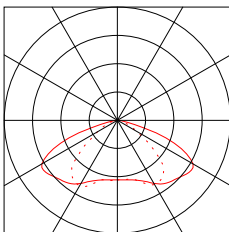
2 16 x

Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



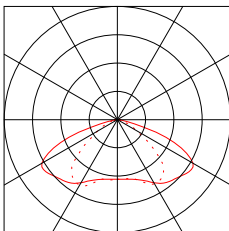
3 4 x

Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



7 4 x

Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



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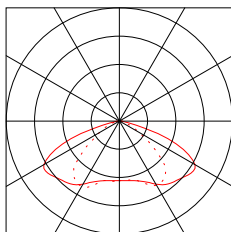
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 233M EXIT
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

5 6 x Order No. : s
 Luminaire name : E230315 BJTU S 108L NW SYM PC
 Equipment : 1 x Unknown 80 W / 9976 lm
 Maintenance factor: 0.85



Row of luminaires: Row 3.1

Number of luminaires: 15 System power (total): 2.8kW
 Basic position: x=1.60m y=5.50m, z=6.50m -variable distances-
 Rotation: z=180.0° C0=0.0° C90=0.0°

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.60	240W / 31.12klm	1 100%	0%
2	11.50	240W / 31.12klm	1 100%	0%
3	21.40	240W / 31.12klm	1 100%	0%
4	31.30	240W / 31.12klm	1 100%	0%
5	41.20	240W / 31.12klm	1 100%	0%
6	51.20	240W / 31.12klm	1 100%	0%
7	61.10	240W / 31.12klm	1 100%	0%
8	72.20	240W / 31.12klm	1 100%	0%
9	81.70	180.3W / 22.56klm	1 100%	0%
10	93.30	180.3W / 22.56klm	1 100%	0%
11	103.30	120W / 14.96klm	1 100%	0%
12	116.10	120W / 14.96klm	1 100%	0%
13	132.10	80W / 9.98klm	1 100%	0%
14	148.10	80W / 9.98klm	1 100%	0%
15	164.10	80W / 9.98klm	1 100%	0%

Row of luminaires: Row 4.1

Number of luminaires: 15 System power (total): 2.8kW
 Basic position: x=1.60m y=1.50m, z=6.50m -variable distances-
 Rotation: z=180.0° C0=0.0° C90=0.0°

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	1.60	240W / 31.12klm	1 100%	0%
2	11.50	240W / 31.12klm	1 100%	0%
3	21.40	240W / 31.12klm	1 100%	0%
4	31.30	240W / 31.12klm	1 100%	0%
5	41.20	240W / 31.12klm	1 100%	0%
6	51.20	240W / 31.12klm	1 100%	0%
7	61.10	240W / 31.12klm	1 100%	0%
8	72.20	240W / 31.12klm	1 100%	0%
9	81.70	180.3W / 22.56klm	1 100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
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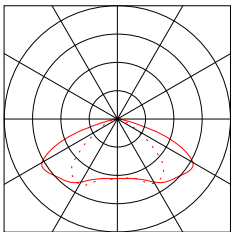
1.1 Description, Tunnel

1.1.2 Luminaire list

10	93.30	180.3W / 22.56klm1	100%	0%
11	103.30	120W / 14.96klm 1	100%	0%
12	116.10	120W / 14.96klm 1	100%	0%
13	132.10	80W / 9.98klm 1	100%	0%
14	148.10	80W / 9.98klm 1	100%	0%
15	164.10	80W / 9.98klm 1	100%	0%

Interior LDC in use

Bajaj
 6 Order No. : s
 Luminaire name : E230315 BJTU S 108L NW SYM PC
 Equipment : 1 x Unknown 80 W / 9976 lm
 Maintenance factor: 0.85



Row of luminaires: Row 1.1

Number of luminaires: 14
 Basic position: x=0.00m y=5.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 1.1kW (0.23 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

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1.1 Description, Tunnel

1.1.2 Luminaire list

Row of luminaires: Row 2.1

Number of luminaires: 14 System power (total): 1.1kW (0.23 km)
Basic position: x=0.00m y=1.50m, z=6.50m Constant distance: 18.00m
Rotation: z=0.0° C0=0.0° C90=0.0° Flicker frequency (v=80 km/h): 1.2 Hz

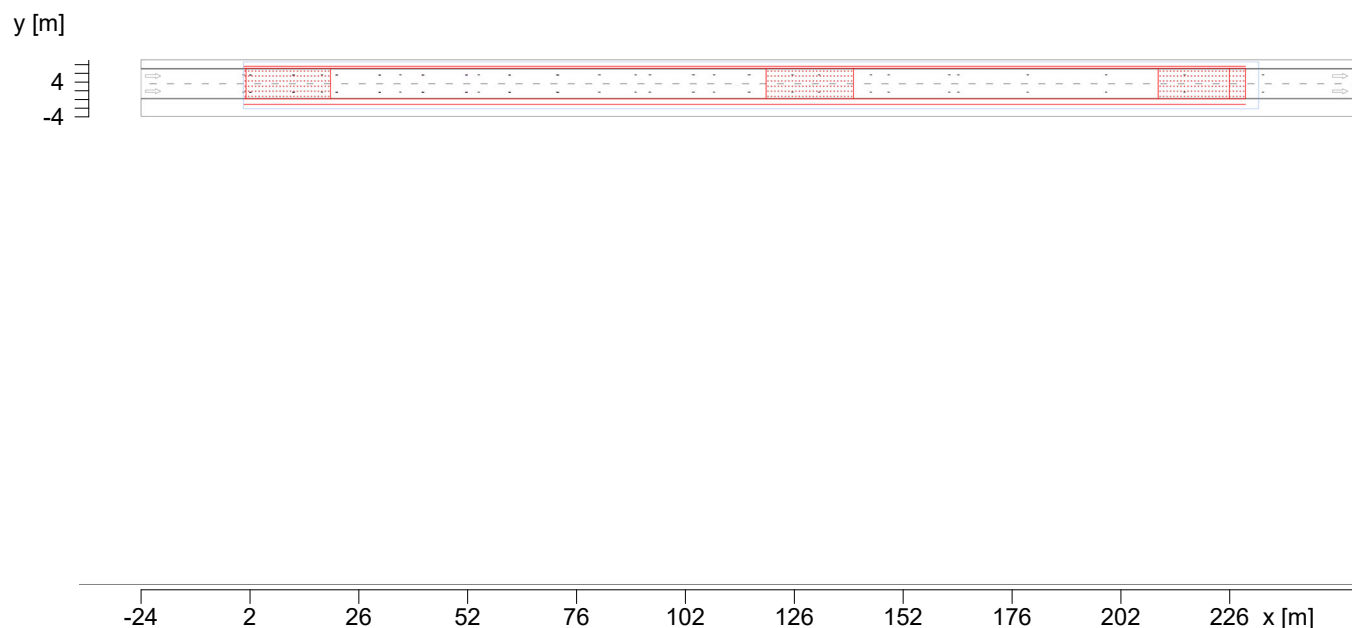
Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

Object : BBMP ROAD TUNNEL PROJECT
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1.1 Description, Tunnel

1.1.3 Floor plan



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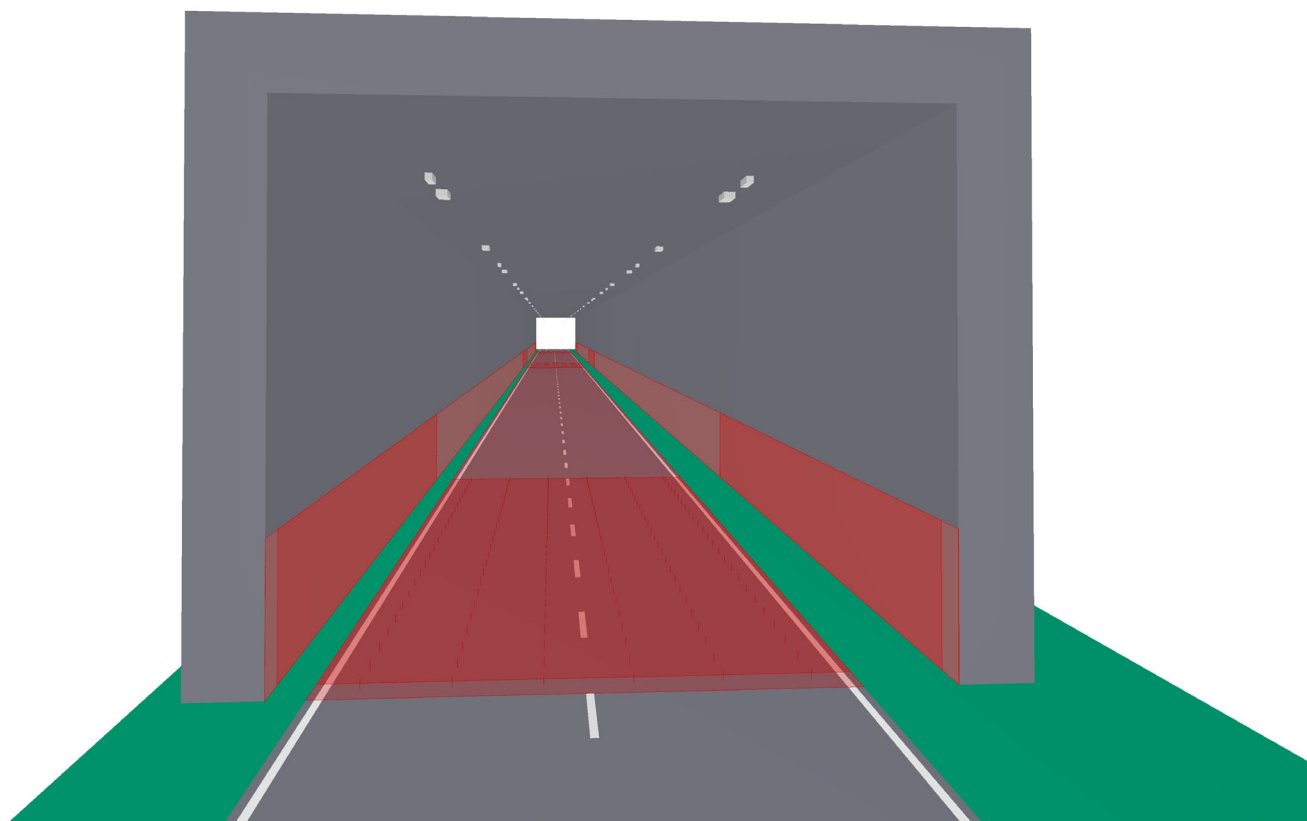
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Object : BBMP ROAD TUNNEL PROJECT
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RELUX®

1.1 Description, Tunnel

1.1.4 3D view, View 1



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3. *[Signature]*
4. *[Signature]*
5. *[Signature]*

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.61 m - 226.33 m Points: nx = 76, ny = 6, nz = 3

Observer (starting point coordinate) : x = -83.84 m; z = 1.50 m dx = 85.93 m (moving)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

EXIT END

Measuring range: 0.00 m - 20.00 m Points: nx = 25, ny = 6, nz = 3

Observer (starting point coordinate) : x = -60.00 m; z = 1.50 m dx = 60.40 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	33.17 cd/m ²	33.16 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.76	0.74	0.4
U _I	L _{I,min} /L _{I,max}	: 0.77	0.77	0.6
f _{TI,max}	Max.	: 3 %	3 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	23.22 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.76
L _{wall} /L _{fsp}	:	0.70

Wall right (diffus 30%)

$\bar{L}_m$	:	22.64 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.76
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	419.79 lx
U _o	E _{min} / $\bar{E}_m$	: 0.81

Wall left

$\bar{E}_m$	:	243.10 lx
U _o	E _{min} / $\bar{E}_m$	: 0.76

Wall right

$\bar{E}_m$	:	237.08 lx
U _o	E _{min} / $\bar{E}_m$	: 0.76

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

EXIT START

Measuring range: 210.00 m - 230.00 m Points: nx = 25, ny = 6, nz = 3
Observer (starting point coordinate) : x = 150.00 m; z = 1.50 m dx = 60.40 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	5.25 cd/m ²	5.25 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.87	0.86	0.4
U _i	L _{i,min} /L _{i,max}	: 0.84	0.84	0.6
f _{TI,max}	Max.	: 6 %	6 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	3.60 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.76
L _{wall} /L _{fsp}	:	0.69

Wall right (diffus 30%)

$\bar{L}_m$	:	3.51 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.75
L _{wall} /L _{fsp}	:	0.67

Illuminance

Roadway

$\bar{E}_m$	:	65.57 lx
U _o	E _{min} / $\bar{E}_m$	: 0.76

Wall left

$\bar{E}_m$	:	37.70 lx
U _o	E _{min} / $\bar{E}_m$	: 0.76

Wall right

$\bar{E}_m$	:	36.77 lx
U _o	E _{min} / $\bar{E}_m$	: 0.75

qc: The backward reflection of the road was calculated.

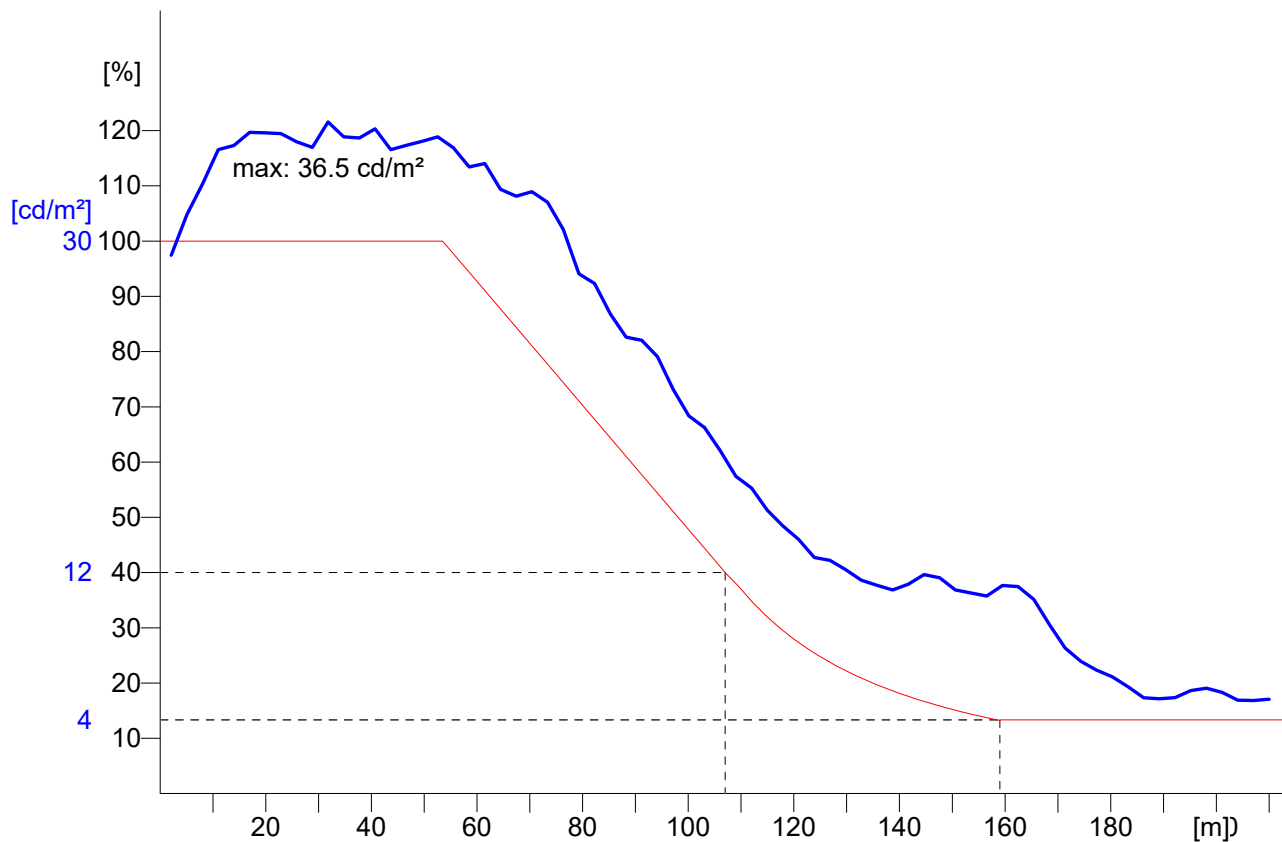
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1.2 Calculation results, Tunnel

1.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



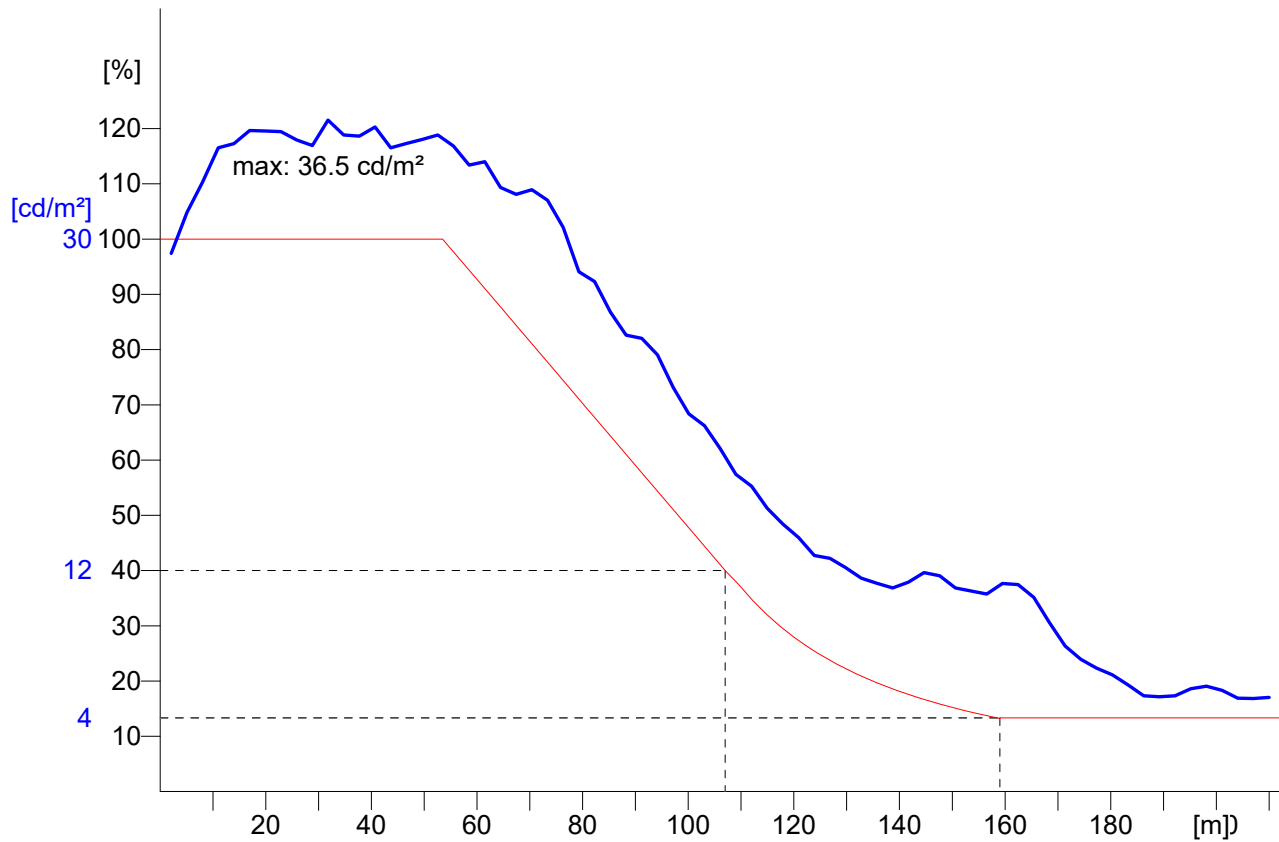
Observer location 1 : x = -83.8, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

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1.2 Calculation results, Tunnel

1.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



Observer location 2 : x = -83.8, y = 5.25, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

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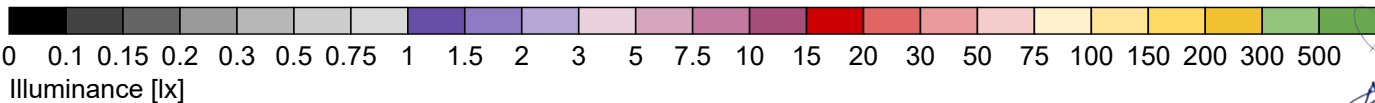
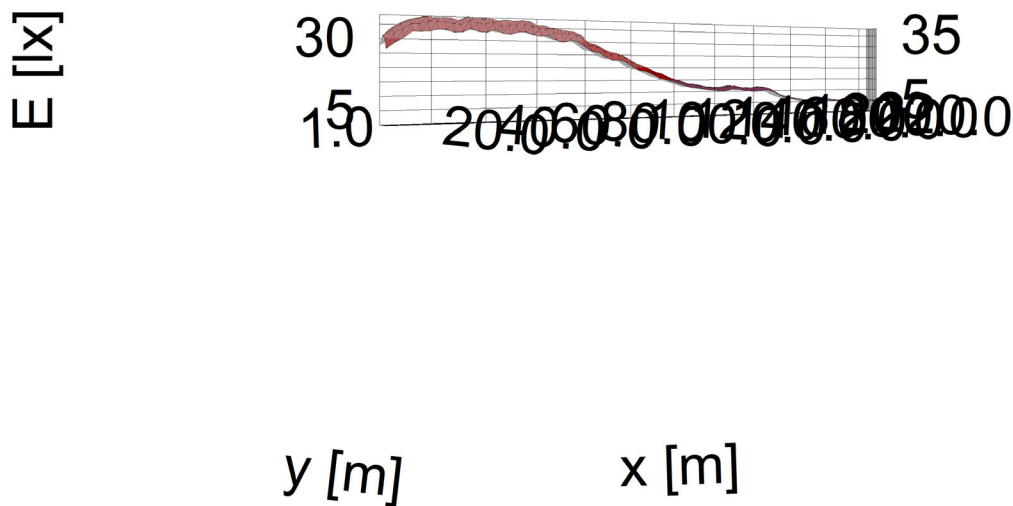
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
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1 Tunnel

1.3 Calculation results, Tunnel

1.3.1 3D mountain plot, Adaptation (L), S1: 100%, Obs. 1



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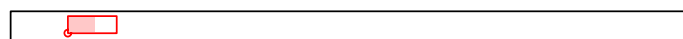


1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, EXIT END (L), S1: 100%, Obs. 1

[m]	(25.2)	26.4	27.2	27.8	28	28.4	28.9	29.4	30	30.4	30.7	31.1	31.8	32.5
6.42	27.7	28.9	29.8	30.2	30.6	31.1	31.9	32.7	33.1	33.3	33.5	33.8	34.3	34.9
5.25	28.8	30.1	31	31.8	32.5	33.2	33.8	34.5	35	35.4	35.3	35.3	35.8	36.6
4.08	28.7	30.2	31.1	31.9	32.5	33.1	33.7	34.4	35.1	35.2	35.2	35.2	35.8	36.6
2.92	27.8	29.1	29.9	30.4	30.8	31.3	31.9	32.5	33.1	33.2	33.4	33.9	34.5	35.1
1.75	25.3	26.5	27.2	27.8	28.1	28.4	28.8	29.3	29.7	30.1	30.6	31.1	31.7	32.4
0.58	0.40	1.20	2.00	2.80	3.60	4.40	5.20	6.00	6.80	7.60	8.40	9.20	10.00	10.80



Part1

Observer location 1 : x = -60, y = 1.75, z = 1.5 (dx = 60.40)
Average luminance $\bar{L}_m$: 33.2 cd/m²
Minimum luminance L_{min} : 25.2 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.76
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.77

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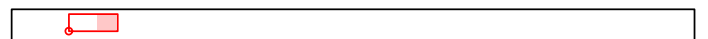
1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, EXIT END (L), S1: 100%, Obs. 1

32.7	32.8	32.7	32.6	32.6	32.7	33	33.1	32.9	32.9	33.1
35.5	35.5	35.3	35.2	35.5	35.9	36.3	36.1	35.9	35.9	35.8
36.9	37.1	37.2	37.4	37.5	37.7	37.9	[38.1]	37.8	37.1	37.2
36.9	37.1	37.3	37.3	37.5	37.6	37.9	38	37.6	37.1	37.2
35.6	35.6	35.5	35.3	35.4	35.8	36.1	36.1	35.8	35.9	36
32.6	32.8	32.6	32.5	32.4	32.5	32.6	32.7	32.6	32.9	33
11.60	12.40	13.20	14.00	14.80	15.60	16.40	17.20	18.00	18.80	19.60

[m]



Part2

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Object : BBMP ROAD TUNNEL PROJECT
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1.4 Calculation results, Tunnel

1.4.2 Table, EXIT END (E), S1: 100%

[m]	344	360	369	373	373	373	374	376	378	382	386	393	401	409	413	415
6.42	375	393	402	405	405	406	407	409	410	413	416	421	430	440	446	446
5.25	384	401	412	417	419	421	423	424	427	429	433	438	445	453	458	460
4.08	383	400	411	416	418	419	420	422	425	426	430	436	444	451	457	458
2.92	373	391	400	402	402	402	403	404	405	408	411	418	427	438	443	444
1.75	(339)	354	363	367	367	365	365	366	368	372	377	385	394	402	406	408
0.58	0.40	1.20	2.00	2.80	3.60	4.40	5.20	6.00	6.80	7.60	8.40	9.20	10.00	10.80	11.60	12.0
Illuminance [lx]																



Part1

Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 420 lx
Minimum illuminance	E_{min} : 339 lx
Maximum illuminance	E_{max} : 477 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.24 (0.81)
Diversity U_d	E_{min}/E_{max} : 1 : 1.41 (0.71)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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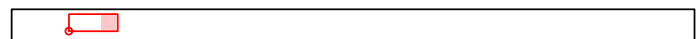
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
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1.4 Calculation results, Tunnel

1.4.2 Table, EXIT END (E), S1: 100%

413	412	413	415	417	421	423	426	428	
444	445	447	450	453	457	459	460	461	
460	461	463	466	470	472	474	475	[477]	
459	459	461	464	468	470	472	473	475	
442	442	443	446	448	452	455	457	459	
407	405	404	405	407	411	414	417	421	
40	13.20	14.00	14.80	15.60	16.40	17.20	18.00	18.80	19.60 [m]



Part2

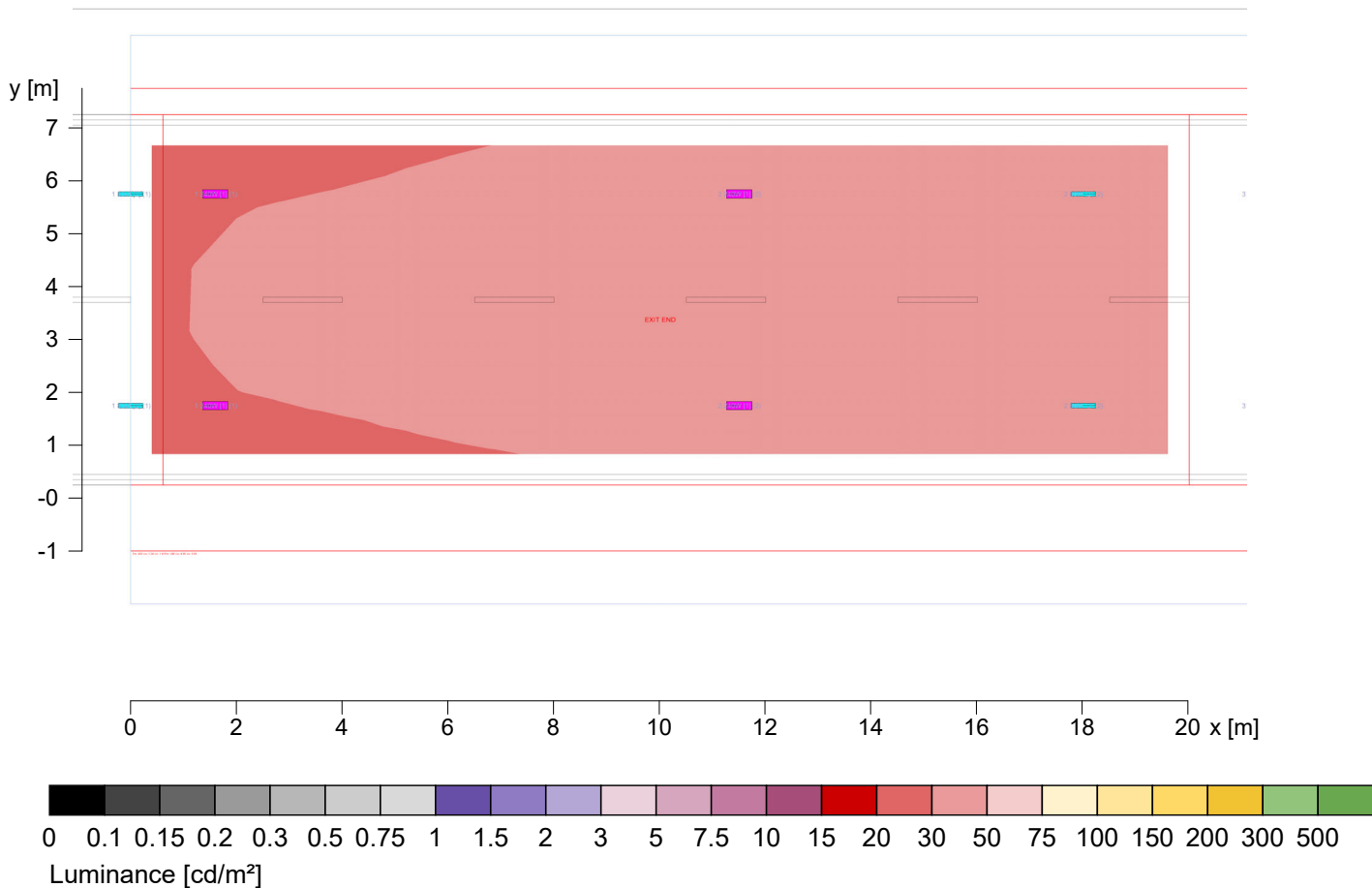
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Object : BBMP ROAD TUNNEL PROJECT
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1.4 Calculation results, Tunnel

1.4.3 Pseudo colours, EXIT END (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = -60, y = 1.75, z = 1.5$ (dx = 6) : 33.2 cd/m²
 L_{min} : 25.2 cd/m²
 $L_{min}/\bar{L}_m$: 0.76
 $L_{l,min}/L_{l,max}$: 0.77

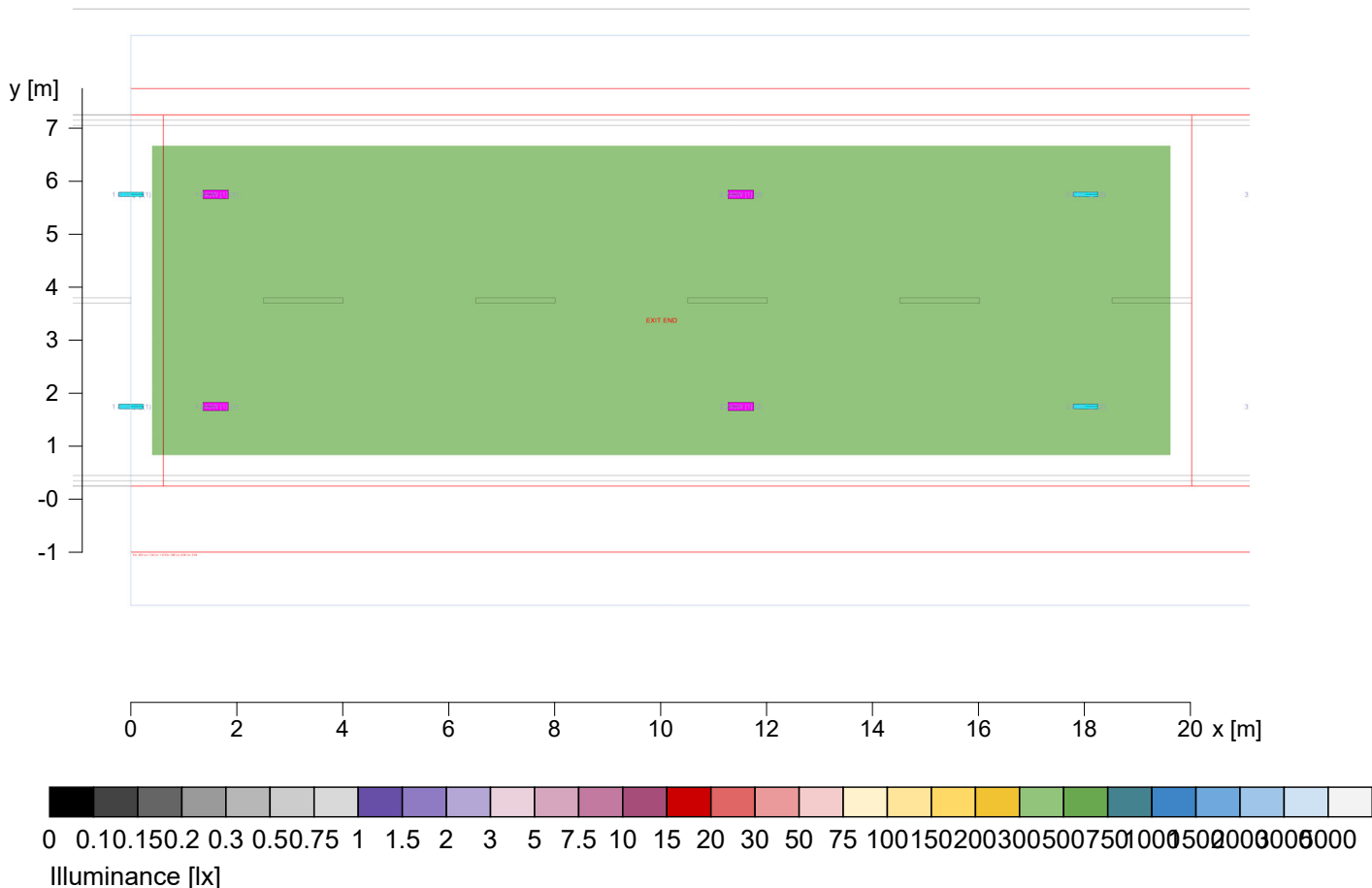
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Object : BBMP ROAD TUNNEL PROJECT
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1.4 Calculation results, Tunnel

1.4.4 Pseudo colours, EXIT END (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 420 lx
 E_{max} : 339 lx
 $E_{min}/\bar{E}_m$: 477 lx
 E_{min}/E_{max} : 1 : 1.24 (0.81)
 E_{min}/E_{max} : 1 : 1.41 (0.71)

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Object : BBMP ROAD TUNNEL PROJECT
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1 Tunnel

1.5 Calculation results, Tunnel

1.5.1 Table, EXIT MIDDLE (L), S1: 100%, Obs. 1

[m]	12.8	12.6	12.4	12.2	12	11.9	11.9	11.8	11.8	11.7	11.6	11.4	11.2	11.1
6.42	13.9	13.8	13.5	13.1	12.9	12.8	12.8	12.8	12.8	12.7	12.5	12.4	12.3	12.1
5.25	13.9	13.8	13.5	13.1	12.9	12.8	12.8	12.8	12.8	12.7	12.5	12.4	12.3	12.1
4.08	14.6	14.5	14.2	13.9	13.5	13.4	13.4	13.3	13.3	13.3	13.2	12.9	12.7	12.6
2.92	14.6	14.5	14.3	13.9	13.6	13.4	13.4	13.3	13.3	13.3	13.2	12.9	12.7	12.6
1.75	13.9	13.8	13.5	13.2	13	12.8	12.8	12.9	12.8	12.7	12.5	12.4	12.3	12.1
0.58	12.7	12.5	12.3	12.1	11.9	11.8	11.8	11.7	11.7	11.6	11.5	11.4	11.3	11.1
	120.40	121.20	122.00	122.80	123.60	124.40	125.20	126.00	126.80	127.60	128.40	129.20	130.00	130.80



Part1

Observer location 1 : x = 60, y = 1.75, z = 1.5 (dx = 60.40)
Average luminance $\bar{L}_m$: 12.1 cd/m²
Minimum luminance L_{min} : 10.2 cd/m²
Overall uniformity U_o : 0.84
Longitudinal uniformity U_l : 0.8

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Object : BBMP ROAD TUNNEL PROJECT
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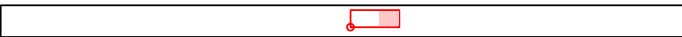
1 Tunnel

1.5 Calculation results, Tunnel

1.5.1 Table, EXIT MIDDLE (L), S1: 100%, Obs. 1

11	10.8	10.7	10.7	10.6	10.5	10.4	10.3	(10.2)	(10.2)	10.3
11.9	11.7	11.6	11.5	11.4	11.3	11.3	11.2	11.1	11.1	11.1
12.4	12.2	12.1	12	12	12	12	11.9	11.7	11.7	11.9
12.4	12.1	12.1	12	11.9	11.9	11.9	11.9	11.7	11.7	11.9
12	11.8	11.6	11.5	11.4	11.3	11.3	11.2	11.1	11.1	11.2
11	10.8	10.8	10.7	10.6	10.5	10.4	10.3	(10.2)	(10.2)	10.3
131.60	132.40	133.20	134.00	134.80	135.60	136.40	137.20	138.00	138.80	139.60

[m]



Part2

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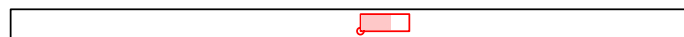
Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1.5 Calculation results, Tunnel

1.5.2 Table, EXIT MIDDLE (E), S1: 100%

[m]	156	153	151	149	149	150	151	151	151	150	148	146	144	142	140	137
6.42	169	165	163	161	160	161	163	164	164	162	161	159	157	154	152	148
5.25	[175]	172	169	167	166	167	168	168	168	167	166	164	162	159	156	152
4.08	174	172	169	167	167	167	168	168	168	167	165	164	162	159	156	152
2.92	174	172	169	167	167	167	168	168	168	167	165	164	162	159	156	152
1.75	167	164	162	160	159	160	162	163	163	161	160	158	156	154	151	148
0.58	153	150	148	147	147	148	149	149	149	147	146	144	143	141	138	135
	120.40	121.20	122.00	122.80	123.60	124.40	125.20	126.00	126.80	127.60	128.40	129.20	130.00	130.80	131.60	132
	Illuminance [lx]															



Part1

Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 148 lx
Minimum illuminance	E_{min} : 117 lx
Maximum illuminance	E_{max} : 175 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.26 (0.79)
Diversity U_d	E_{min}/E_{max} : 1 : 1.49 (0.67)

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 233M EXIT
 Project number : 81942
 Date : 23.09.2024

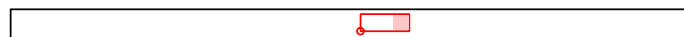


1.5 Calculation results, Tunnel

1.5.2 Table, EXIT MIDDLE (E), S1: 100%

134	130	126	124	121	119	119	120	123	
144	139	135	132	130	128	127	128	131	
148	144	140	137	135	133	133	134	137	
148	143	139	136	134	133	132	134	137	
143	138	134	131	129	127	127	128	131	
132	128	124	121	119	(117)	(117)	118	121	
.40	133.20	134.00	134.80	135.60	136.40	137.20	138.00	138.80	139.60

[m]



Part2

[Handwritten signatures]

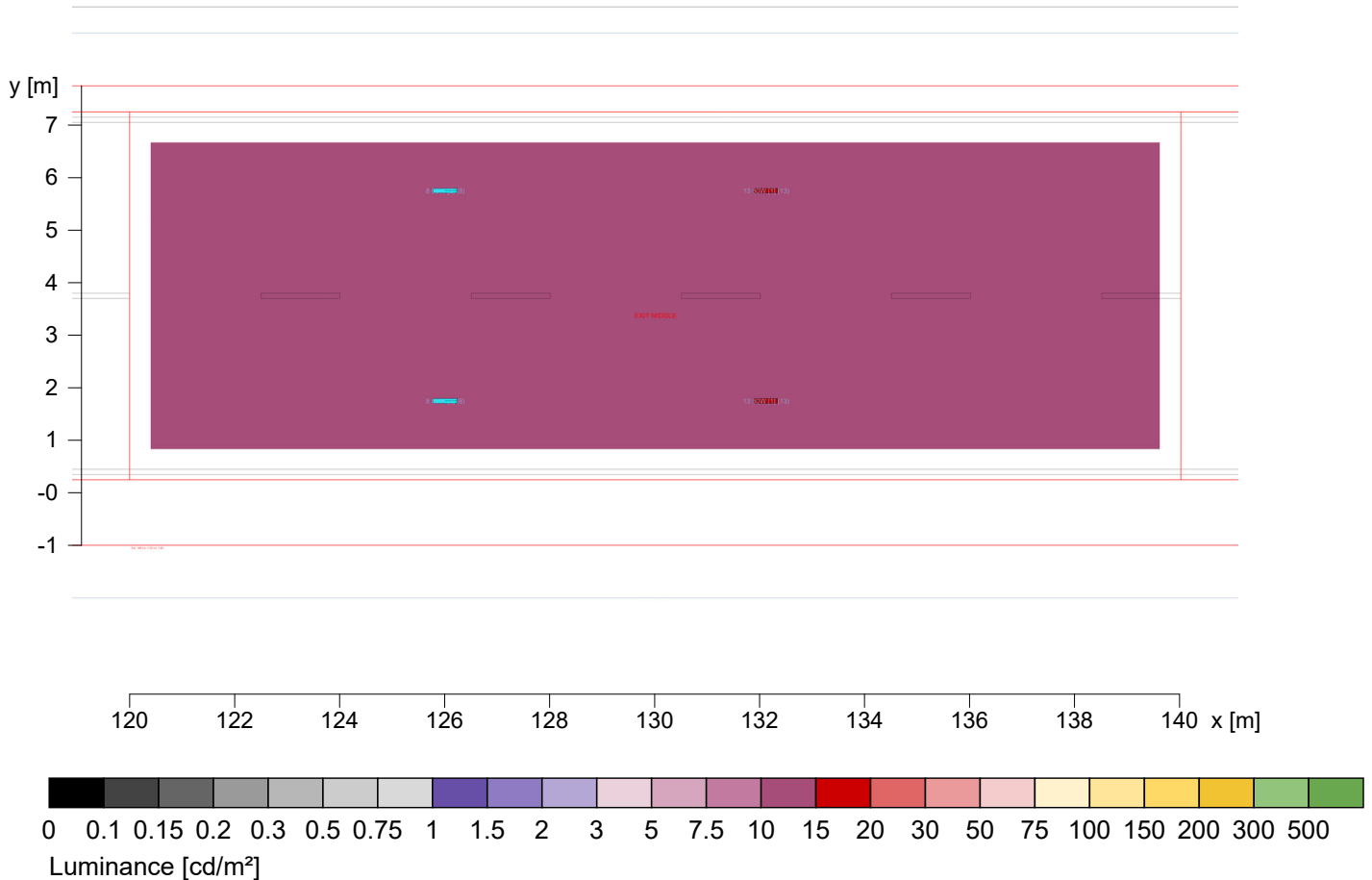
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1.5 Calculation results, Tunnel

1.5.3 Pseudo colours, EXIT MIDDLE (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: $x = 60, y = 1.75, z = 1.5$ (dx = 6) : 12.1 cd/m²
 L_{min} : 10.2 cd/m²
 $L_{min}/\bar{L}_m$: 0.84
 $L_{l,min}/L_{l,max}$: 0.8

[Signatures]

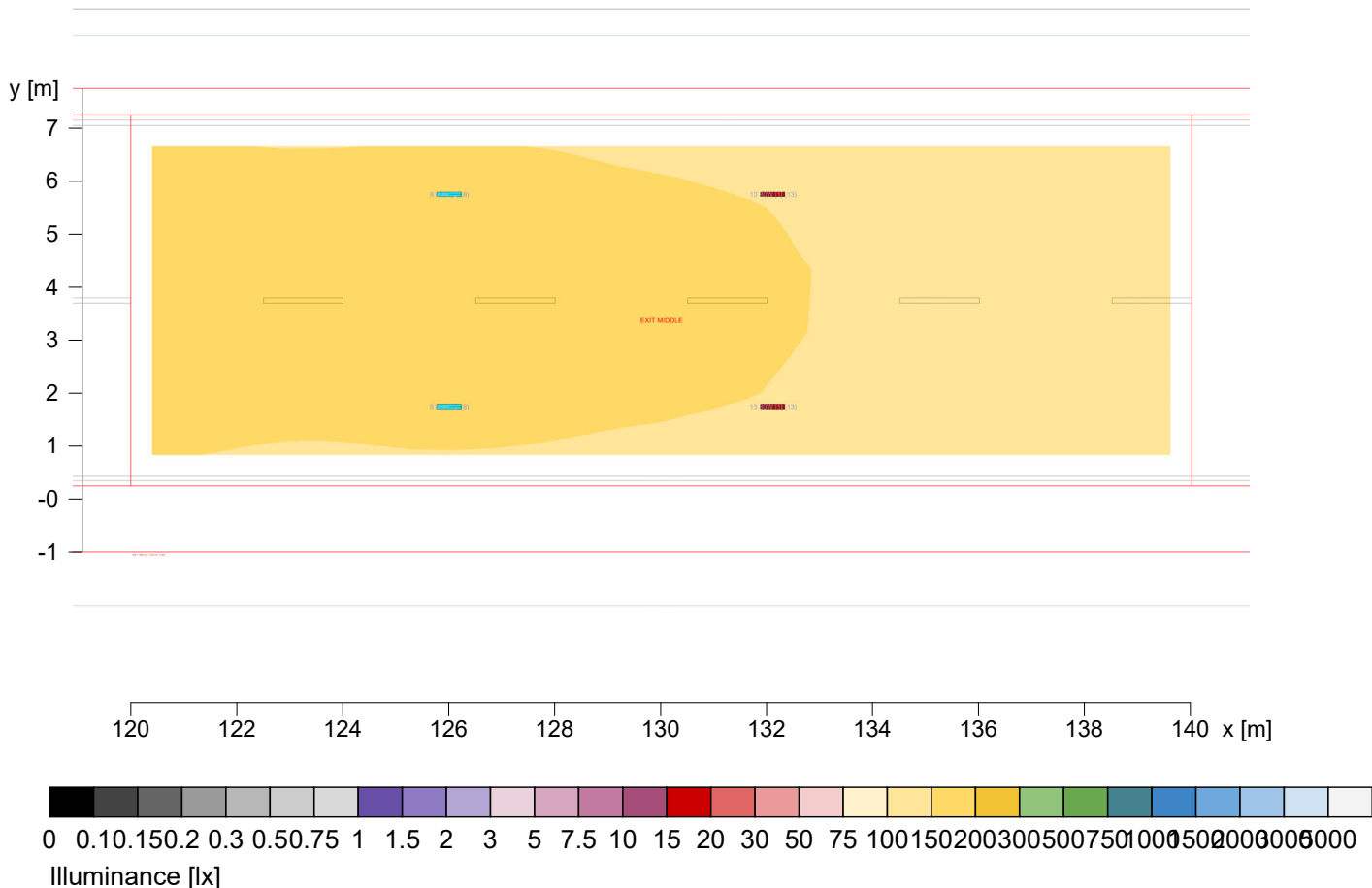
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 233M EXIT
 Project number : 81942
 Date : 23.09.2024



1.5 Calculation results, Tunnel

1.5.4 Pseudo colours, EXIT MIDDLE (E), S1: 100%



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 148 lx
Minimum illuminance	E_{min} : 117 lx
Maximum illuminance	E_{max} : 175 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.26 (0.79)
Diversity U_d	E_{min}/E_{max} : 1 : 1.49 (0.67)

[Handwritten signatures and initials]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.6 Calculation results, Tunnel

1.6.1 Table, EXIT START (L), S1: 100%, Obs. 1

[m]	4.74	4.91	5.06	5.13	5.12	5.2	5.3	5.31	5.29	5.2	5.11	5.02	4.94	4.83
6.42	5.18	5.37	5.5	5.59	5.63	5.67	5.75	5.82	5.77	5.66	5.54	5.47	5.43	5.31
5.25	5.48	5.69	5.89	5.86	5.74	5.77	5.87	5.88	5.87	5.84	5.77	5.73	5.68	5.57
4.08	5.49	5.71	5.91	5.92	5.8	5.81	5.9	5.91	5.9	5.86	5.8	5.76	5.7	5.57
2.92	5.19	5.41	5.56	5.62	5.64	5.67	5.73	5.81	5.76	5.65	5.55	5.5	5.45	5.33
1.75	4.77	4.91	5.05	5.12	5.11	5.15	5.25	5.27	5.26	5.18	5.11	5.05	4.99	4.88
0.58	210.40	211.20	212.00	212.80	213.60	214.40	215.20	216.00	216.80	217.60	218.40	219.20	220.00	220.80



Part1

Observer location 1 : x = 150, y = 1.75, z = 1.5 (dx = 60.40)
Average luminance $\bar{L}_m$: 5.25 cd/m²
Minimum luminance L_{min} : 4.55 cd/m²
Overall uniformity U_o : 0.87
Longitudinal uniformity U_l : 0.84

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-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



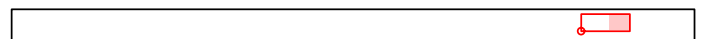
1 Tunnel

1.6 Calculation results, Tunnel

1.6.1 Table, EXIT START (L), S1: 100%, Obs. 1

4.67	(4.55)	4.59	4.62	4.66	4.64	4.59	(4.55)	4.57	4.65	4.78
5.13	4.96	4.91	4.9	4.91	4.91	4.89	4.89	4.95	5.09	5.21
5.36	5.22	5.21	5.19	5.23	5.21	5.22	5.22	5.23	5.33	5.53
5.39	5.22	5.22	5.21	5.24	5.21	5.22	5.24	5.25	5.35	5.56
5.14	4.96	4.92	4.91	4.92	4.92	4.91	4.9	4.96	5.08	5.26
4.72	4.58	4.61	4.61	4.63	4.62	4.57	(4.55)	4.58	4.65	4.77
221.60	222.40	223.20	224.00	224.80	225.60	226.40	227.20	228.00	228.80	229.60

[m]



Part2

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1.6 Calculation results, Tunnel

1.6.2 Table, EXIT START (E), S1: 100%

[m]	56	59.6	63.3	66.7	70.2	73.3	75.8	76.5	75.8	73.3	70.1	66.7	63.2	59.5
6.42	56	59.6	63.3	66.7	70.2	73.3	75.8	76.5	75.8	73.3	70.1	66.7	63.2	59.5
5.25	60.4	64.6	69.2	72.9	76.7	80.2	83.3	84.3	83.3	80.2	76.7	72.9	69.2	64.6
4.08	63	67.3	71.4	75.4	78.8	82.2	84.5	85.6	84.5	82.2	78.8	75.3	71.3	67.3
2.92	63.1	67.5	71.8	75.9	79.3	82.4	84.9	85.8	84.9	82.4	79.3	75.9	71.8	67.5
1.75	60.4	64.7	69.3	73.1	76.6	80	82.9	84	82.9	80	76.6	73.1	69.3	64.7
0.58	55.8	59.4	63.2	66.4	69.5	72.6	75	75.8	75	72.6	69.5	66.3	63.2	59.4
	210.40	211.20	212.00	212.80	213.60	214.40	215.20	216.00	216.80	217.60	218.40	219.20	220.00	220.80
	Illuminance [lx]													



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 65.6 lx
Minimum illuminance E_{min} : 49.7 lx
Maximum illuminance E_{max} : 85.8 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.32 (0.76)
Diversity U_d E_{min}/E_{max} : 1 : 1.73 (0.58)

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024



1.6 Calculation results, Tunnel

1.6.2 Table, EXIT START (E), S1: 100%

56	53.3	51.7	50.7	50.4	50.4	50.9	52.1	54.1	57	60.5
60.4	57.1	54.7	53.2	52.5	52.6	53.6	55.5	58.1	61.7	66
63	59.4	57.2	55.8	55.2	55.3	56.1	57.8	60.5	64.3	68.4
63.1	59.6	57.2	55.7	55.1	55.2	56.1	58	60.7	64.4	68.7
60.4	57	54.5	52.9	52.2	52.4	53.4	55.3	58.1	61.8	66.1
55.7	53	51.2	50.1	(49.7)	49.8	50.4	51.7	53.8	56.8	60.4
221.60	222.40	223.20	224.00	224.80	225.60	226.40	227.20	228.00	228.80	229.60

[m]



Part2

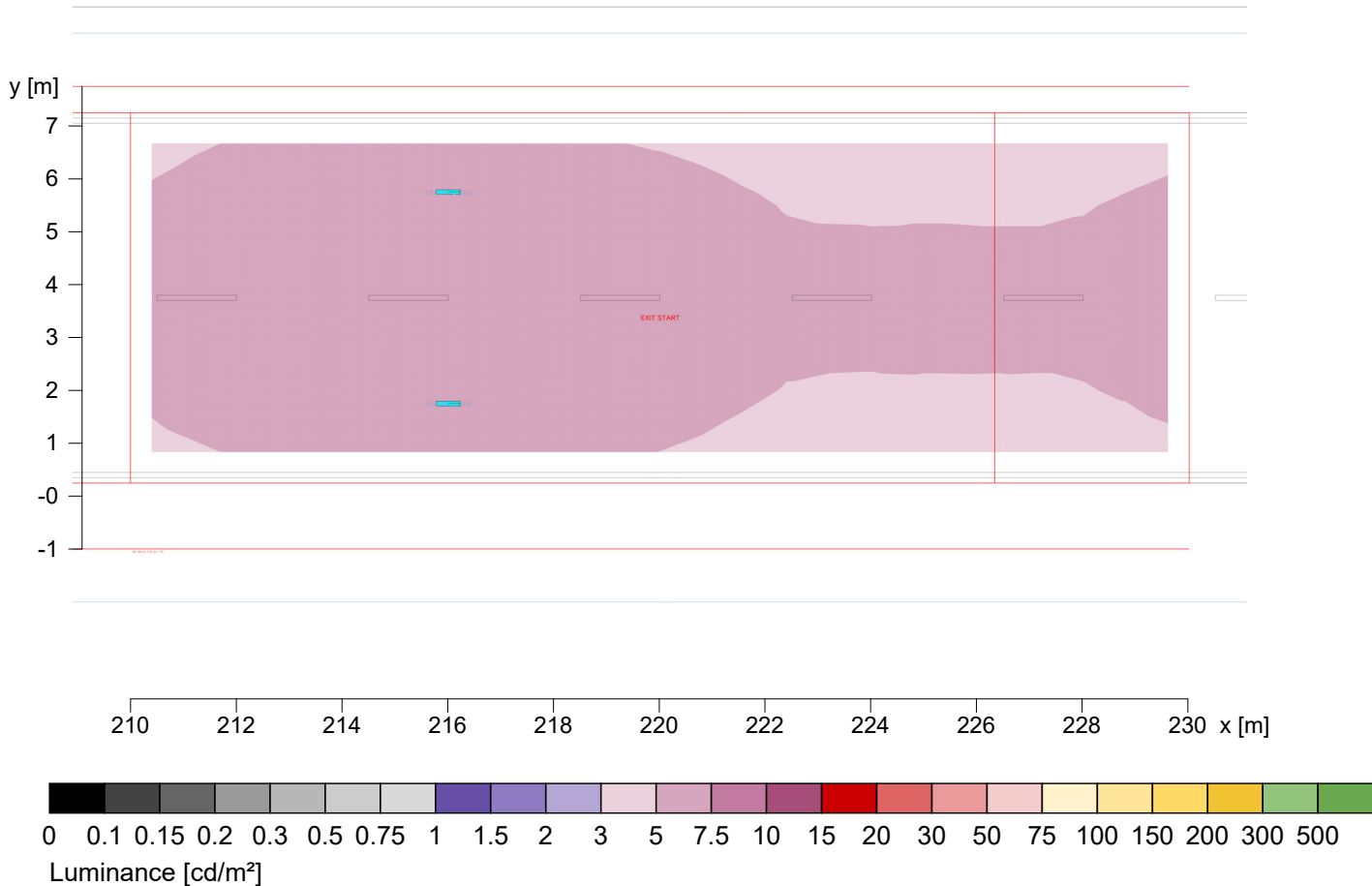
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 233M EXIT
 Project number : 81942
 Date : 23.09.2024



1.6 Calculation results, Tunnel

1.6.3 Pseudo colours, EXIT START (L), S1: 100%, Obs. 1



Observer location 1		: x = 150, y = 1.75, z = 1.5 (dx =
Average luminance	$\bar{L}_m$	: 5.25 cd/m²
Minimum luminance	L_{min}	: 4.55 cd/m²
Overall uniformity U_o	$L_{min}/\bar{L}_m$	: 0.87
Longitudinal uniformity U_l	$L_{l,min}/L_{l,max}$	: 0.84

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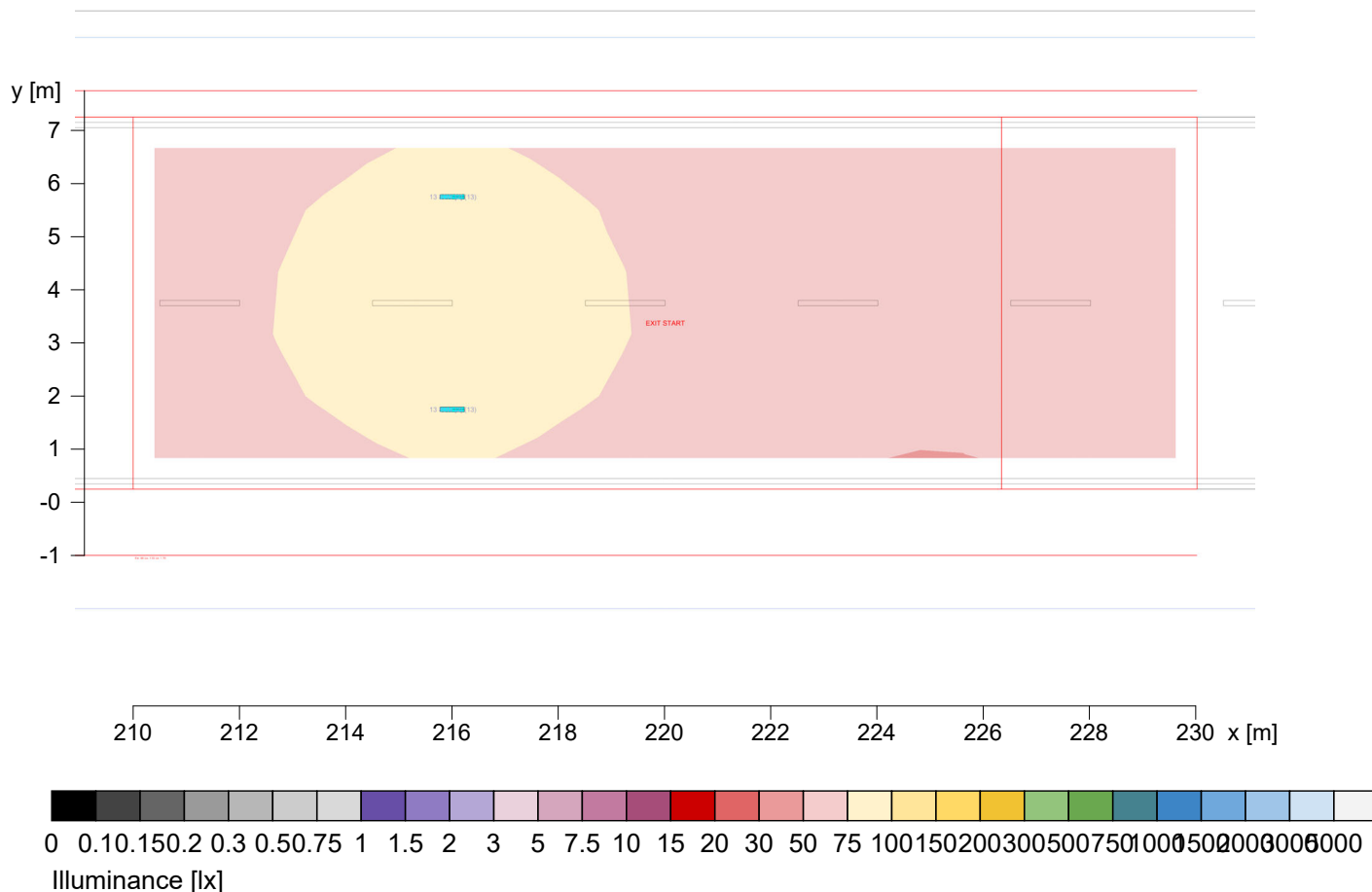
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 233M EXIT
Project number : 81942
Date : 23.09.2024

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1.6 Calculation results, Tunnel

1.6.4 Pseudo colours, EXIT START (E), S1: 100%



Height reference plane
Average illuminance
Minimum illuminance
Maximum illuminance
Uniformity U_0
Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 65.6 lx
 E_{max} : 49.7 lx
 $E_{min}/\bar{E}_m$: 85.8 lx
 E_{min}/E_{max} : 1 : 1.32 (0.76)
 E_{min}/E_{max} : 1 : 1.73 (0.58)

[Signatures]

-please put your own address here-

Amelia

Adri

Rob

Emma

James

APPENDIX - 4

Signature

Signature

Signature

Signature

Signature

Amelia

Adri

Rob

Emma

James

BBMP ROAD TUNNEL PROJECT

Installation : MAIN TUNNEL 1267M ENTRY

Project number : 81942

Customer :

Processed by : BAJAJ

Date : 23.09.2024

Project description:
Tunnel designed

1267m MAIN TUNNEL

Tunnel Main Road Width assumed - 7.0m Main Carriageway + 0.5m FOOTPATH + 1.25m FOOTPATH

BOTTOM OF LIGHT - 6.5m from road level

Total Length of the Tunnel - 1267m

SPEED - 80KMPH

ROAD - CONCRETE ROAD R1 - 0.10

THRESHOLD -288cd/m², TRANSITION - 115cd/m², INTERIOR 1 - 8 cd/m², INTERIOR 2 - 4 cd/m². EXIT - 20 cd/m²

NIGHT TIME - 4.0cd/m²

EMERGENCY - MIN 2 LUX AND AVG 10

The following values are based on precise calculations performed on calibrated lamps and luminaires, and their configurations, whereby gradual, unavoidable deviations can occur in practice. All guarantee claims are excluded for the specified data.

This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
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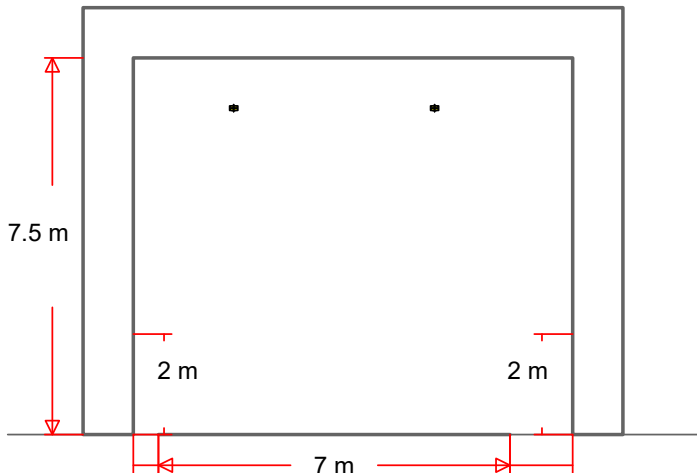
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1 Tunnel

1.1 Description, Tunnel

1.1.1 Project data



Geometry tunnel

Length of the tunnel : 1267 m
 Length of the tunnel (calculation model) : 1000 m
 Height of the tunnel : 7.5 m

Width of the carriageway : 7 m
 Number of lanes : 2
 Covering / material : R1, q0 = 0.09

Marginal strip left	:	0.5 m	Marginal strip right	:	1.25 m
Height of the wall (right)	:	2 m	Height of the wall (left)	:	2 m
Covering / material	:	diffus 30%	Covering / material	:	diffus 30%

Calculation specifications

Speed : 80 km/h
 Length of the threshold zone : 107 m
 Luminance threshold zone : 288 cd/m²
 Luminance interior zone : 4 cd/m²

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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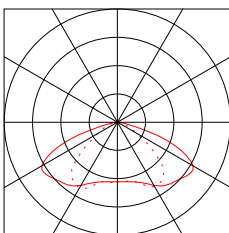
1 Tunnel

1.1 Description, Tunnel

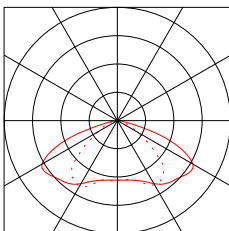
1.1.1 Project data

LDC in use

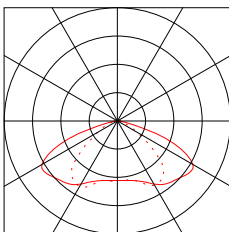
1 **Bajaj**
Order No. : s
Luminaire name : E230315 BJTU S 390L NW SYM PC
Equipment : 1 x Unknown 300.1 W / 37053 lm
Maintenance factor: 0.85



2
Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3
Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85



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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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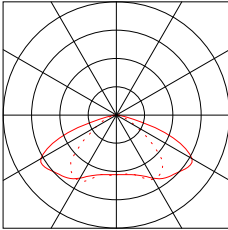
1 Tunnel

1.1 Description, Tunnel

1.1.1 Project data

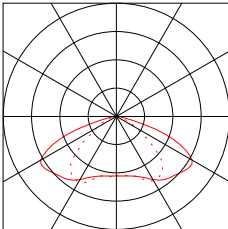
6

Order No. : s
Luminaire name : E230315 BJTU S 108L NW SYM PC
Equipment : 1 x Unknown 80 W / 9976 lm
Maintenance factor: 0.85



7

Order No. : s
Luminaire name : E230315 BJTU S 162L NW SYM PC
Equipment : 1 x Unknown 120 W / 14964 lm
Maintenance factor: 0.85



[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



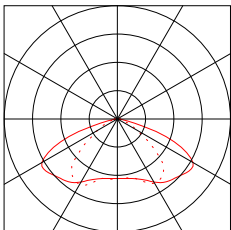
1.1 Description, Tunnel

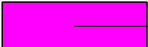
1.1.2 Luminaire list

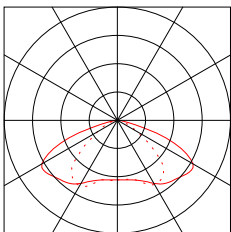
Adaptation LDC in use

Bajaj

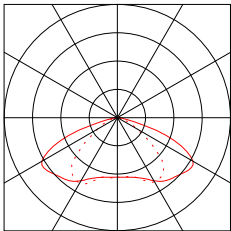
1 142 x  Order No. : s
Luminaire name : E230315 BJTU S 390L NW SYM PC
Equipment : 1 x Unknown 300.1 W / 37053 lm
Maintenance factor: 0.85



2 28 x  Order No. : s
Luminaire name : E230315 BJTU S 324L NW SYM PC
Equipment : 1 x Unknown 240 W / 31115 lm
Maintenance factor: 0.85



3 16 x  Order No. : s
Luminaire name : E230315 BJTU S 243L NW SYM PC
Equipment : 1 x Unknown 180.3 W / 22564 lm
Maintenance factor: 0.85









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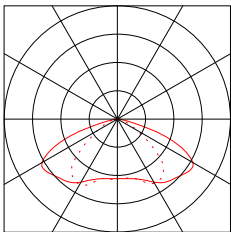
Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

7 66 x Order No. : s
 Luminaire name : E230315 BJTU S 162L NW SYM PC
 Equipment : 1 x Unknown 120 W / 14964 lm
 Maintenance factor: 0.85



Row of luminaires: Row 3.1

Number of luminaires: 126
 Basic position: x=1.60m y=5.50m, z=6.50m
 Rotation: z=180.0° C0=0.0° C90=0.0°

System power (total): 30.1kW
 -variable distances-

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.70	300.1W / 37.05kln1	100%	0%
2	1.60	300.1W / 37.05kln1	100%	0%
3	2.80	300.1W / 37.05kln1	100%	0%
4	4.00	300.1W / 37.05kln1	100%	0%
5	5.30	300.1W / 37.05kln1	100%	0%
6	6.50	300.1W / 37.05kln1	100%	0%
7	7.70	300.1W / 37.05kln1	100%	0%
8	8.90	300.1W / 37.05kln1	100%	0%
9	10.10	300.1W / 37.05kln1	100%	0%
10	11.40	300.1W / 37.05kln1	100%	0%
11	12.60	300.1W / 37.05kln1	100%	0%
12	13.80	300.1W / 37.05kln1	100%	0%
13	15.00	300.1W / 37.05kln1	100%	0%
14	16.20	300.1W / 37.05kln1	100%	0%
15	17.50	300.1W / 37.05kln1	100%	0%
16	18.70	300.1W / 37.05kln1	100%	0%
17	19.90	300.1W / 37.05kln1	100%	0%
18	21.10	300.1W / 37.05kln1	100%	0%
19	22.30	300.1W / 37.05kln1	100%	0%
20	23.60	300.1W / 37.05kln1	100%	0%
21	24.80	300.1W / 37.05kln1	100%	0%
22	26.00	300.1W / 37.05kln1	100%	0%
23	27.20	300.1W / 37.05kln1	100%	0%
24	28.40	300.1W / 37.05kln1	100%	0%
25	29.70	300.1W / 37.05kln1	100%	0%
26	30.90	300.1W / 37.05kln1	100%	0%
27	32.10	300.1W / 37.05kln1	100%	0%
28	33.30	300.1W / 37.05kln1	100%	0%
29	34.50	300.1W / 37.05kln1	100%	0%
30	35.80	300.1W / 37.05kln1	100%	0%
31	37.00	300.1W / 37.05kln1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

32	38.20	300.1W / 37.05klm1	100%	0%
33	39.40	300.1W / 37.05klm1	100%	0%
34	40.60	300.1W / 37.05klm1	100%	0%
35	41.90	300.1W / 37.05klm1	100%	0%
36	43.10	300.1W / 37.05klm1	100%	0%
37	44.30	300.1W / 37.05klm1	100%	0%
38	45.50	300.1W / 37.05klm1	100%	0%
39	46.70	300.1W / 37.05klm1	100%	0%
40	48.00	300.1W / 37.05klm1	100%	0%
41	49.20	300.1W / 37.05klm1	100%	0%
42	50.40	300.1W / 37.05klm1	100%	0%
43	51.60	300.1W / 37.05klm1	100%	0%
44	52.80	300.1W / 37.05klm1	100%	0%
45	54.10	300.1W / 37.05klm1	100%	0%
46	55.30	300.1W / 37.05klm1	100%	0%
47	56.50	300.1W / 37.05klm1	100%	0%
48	57.70	300.1W / 37.05klm1	100%	0%
49	58.90	300.1W / 37.05klm1	100%	0%
50	60.20	300.1W / 37.05klm1	100%	0%
51	61.40	300.1W / 37.05klm1	100%	0%
52	62.70	300.1W / 37.05klm1	100%	0%
53	64.00	300.1W / 37.05klm1	100%	0%
54	65.30	300.1W / 37.05klm1	100%	0%
55	66.70	300.1W / 37.05klm1	100%	0%
56	68.00	300.1W / 37.05klm1	100%	0%
57	69.40	300.1W / 37.05klm1	100%	0%
58	70.80	300.1W / 37.05klm1	100%	0%
59	72.30	300.1W / 37.05klm1	100%	0%
60	73.80	300.1W / 37.05klm1	100%	0%
61	75.30	300.1W / 37.05klm1	100%	0%
62	76.80	300.1W / 37.05klm1	100%	0%
63	78.40	300.1W / 37.05klm1	100%	0%
64	80.00	300.1W / 37.05klm1	100%	0%
65	81.60	300.1W / 37.05klm1	100%	0%
66	83.30	300.1W / 37.05klm1	100%	0%
67	85.00	300.1W / 37.05klm1	100%	0%
68	86.80	300.1W / 37.05klm1	100%	0%
69	88.70	300.1W / 37.05klm1	100%	0%
70	90.60	300.1W / 37.05klm1	100%	0%
71	92.50	300.1W / 37.05klm1	100%	0%
72	94.30	240W / 31.12klm 1	100%	0%
73	96.00	240W / 31.12klm 1	100%	0%
74	97.90	240W / 31.12klm 1	100%	0%
75	99.80	240W / 31.12klm 1	100%	0%
76	101.80	240W / 31.12klm 1	100%	0%
77	103.90	240W / 31.12klm 1	100%	0%
78	106.00	240W / 31.12klm 1	100%	0%
79	108.40	240W / 31.12klm 1	100%	0%
80	110.80	240W / 31.12klm 1	100%	0%
81	113.50	240W / 31.12klm 1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

82	116.30	240W / 31.12klm 1	100%	0%
83	119.50	240W / 31.12klm 1	100%	0%
84	122.90	240W / 31.12klm 1	100%	0%
85	126.70	240W / 31.12klm 1	100%	0%
86	129.80	180.3W / 22.56klm1	100%	0%
87	133.10	180.3W / 22.56klm1	100%	0%
88	136.60	180.3W / 22.56klm1	100%	0%
89	140.40	180.3W / 22.56klm1	100%	0%
90	144.60	180.3W / 22.56klm1	100%	0%
91	149.20	180.3W / 22.56klm1	100%	0%
92	154.20	180.3W / 22.56klm1	100%	0%
93	159.70	180.3W / 22.56klm1	100%	0%
94	163.70	120W / 14.96klm 1	100%	0%
95	168.00	120W / 14.96klm 1	100%	0%
96	172.50	120W / 14.96klm 1	100%	0%
97	177.40	120W / 14.96klm 1	100%	0%
98	182.70	120W / 14.96klm 1	100%	0%
99	188.40	120W / 14.96klm 1	100%	0%
100	194.60	120W / 14.96klm 1	100%	0%
101	201.40	120W / 14.96klm 1	100%	0%
102	208.80	120W / 14.96klm 1	100%	0%
103	216.90	120W / 14.96klm 1	100%	0%
104	225.90	120W / 14.96klm 1	100%	0%
105	235.90	120W / 14.96klm 1	100%	0%
106	247.10	120W / 14.96klm 1	100%	0%
107	259.80	120W / 14.96klm 1	100%	0%
108	274.40	120W / 14.96klm 1	100%	0%
109	289.40	120W / 14.96klm 1	100%	0%
110	304.40	120W / 14.96klm 1	100%	0%
111	319.40	120W / 14.96klm 1	100%	0%
112	334.40	120W / 14.96klm 1	100%	0%
113	349.40	120W / 14.96klm 1	100%	0%
114	364.40	120W / 14.96klm 1	100%	0%
115	379.40	120W / 14.96klm 1	100%	0%
116	394.40	120W / 14.96klm 1	100%	0%
117	409.40	120W / 14.96klm 1	100%	0%
118	424.40	120W / 14.96klm 1	100%	0%
119	439.40	120W / 14.96klm 1	100%	0%
120	454.40	120W / 14.96klm 1	100%	0%
121	469.40	120W / 14.96klm 1	100%	0%
122	484.40	120W / 14.96klm 1	100%	0%
123	499.40	120W / 14.96klm 1	100%	0%
124	514.40	120W / 14.96klm 1	100%	0%
125	529.40	120W / 14.96klm 1	100%	0%
126	544.40	120W / 14.96klm 1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

Row of luminaires: Row 4.1

Number of luminaires: 126

System power (total): 30.1kW

Basic position: x=1.60m y=1.50m, z=6.50m

-variable distances-

Rotation: z=180.0° C0=0.0° C90=0.0°

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.70	300.1W / 37.05klm1	100%	0%
2	1.60	300.1W / 37.05klm1	100%	0%
3	2.80	300.1W / 37.05klm1	100%	0%
4	4.00	300.1W / 37.05klm1	100%	0%
5	5.30	300.1W / 37.05klm1	100%	0%
6	6.50	300.1W / 37.05klm1	100%	0%
7	7.70	300.1W / 37.05klm1	100%	0%
8	8.90	300.1W / 37.05klm1	100%	0%
9	10.10	300.1W / 37.05klm1	100%	0%
10	11.40	300.1W / 37.05klm1	100%	0%
11	12.60	300.1W / 37.05klm1	100%	0%
12	13.80	300.1W / 37.05klm1	100%	0%
13	15.00	300.1W / 37.05klm1	100%	0%
14	16.20	300.1W / 37.05klm1	100%	0%
15	17.50	300.1W / 37.05klm1	100%	0%
16	18.70	300.1W / 37.05klm1	100%	0%
17	19.90	300.1W / 37.05klm1	100%	0%
18	21.10	300.1W / 37.05klm1	100%	0%
19	22.30	300.1W / 37.05klm1	100%	0%
20	23.60	300.1W / 37.05klm1	100%	0%
21	24.80	300.1W / 37.05klm1	100%	0%
22	26.00	300.1W / 37.05klm1	100%	0%
23	27.20	300.1W / 37.05klm1	100%	0%
24	28.40	300.1W / 37.05klm1	100%	0%
25	29.70	300.1W / 37.05klm1	100%	0%
26	30.90	300.1W / 37.05klm1	100%	0%
27	32.10	300.1W / 37.05klm1	100%	0%
28	33.30	300.1W / 37.05klm1	100%	0%
29	34.50	300.1W / 37.05klm1	100%	0%
30	35.80	300.1W / 37.05klm1	100%	0%
31	37.00	300.1W / 37.05klm1	100%	0%
32	38.20	300.1W / 37.05klm1	100%	0%
33	39.40	300.1W / 37.05klm1	100%	0%
34	40.60	300.1W / 37.05klm1	100%	0%
35	41.90	300.1W / 37.05klm1	100%	0%
36	43.10	300.1W / 37.05klm1	100%	0%
37	44.30	300.1W / 37.05klm1	100%	0%
38	45.50	300.1W / 37.05klm1	100%	0%
39	46.70	300.1W / 37.05klm1	100%	0%
40	48.00	300.1W / 37.05klm1	100%	0%
41	49.20	300.1W / 37.05klm1	100%	0%
42	50.40	300.1W / 37.05klm1	100%	0%
43	51.60	300.1W / 37.05klm1	100%	0%
44	52.80	300.1W / 37.05klm1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

45	54.10	300.1W / 37.05kln1	100%	0%
46	55.30	300.1W / 37.05kln1	100%	0%
47	56.50	300.1W / 37.05kln1	100%	0%
48	57.70	300.1W / 37.05kln1	100%	0%
49	58.90	300.1W / 37.05kln1	100%	0%
50	60.20	300.1W / 37.05kln1	100%	0%
51	61.40	300.1W / 37.05kln1	100%	0%
52	62.70	300.1W / 37.05kln1	100%	0%
53	64.00	300.1W / 37.05kln1	100%	0%
54	65.30	300.1W / 37.05kln1	100%	0%
55	66.70	300.1W / 37.05kln1	100%	0%
56	68.00	300.1W / 37.05kln1	100%	0%
57	69.40	300.1W / 37.05kln1	100%	0%
58	70.80	300.1W / 37.05kln1	100%	0%
59	72.30	300.1W / 37.05kln1	100%	0%
60	73.80	300.1W / 37.05kln1	100%	0%
61	75.30	300.1W / 37.05kln1	100%	0%
62	76.80	300.1W / 37.05kln1	100%	0%
63	78.40	300.1W / 37.05kln1	100%	0%
64	80.00	300.1W / 37.05kln1	100%	0%
65	81.60	300.1W / 37.05kln1	100%	0%
66	83.30	300.1W / 37.05kln1	100%	0%
67	85.00	300.1W / 37.05kln1	100%	0%
68	86.80	300.1W / 37.05kln1	100%	0%
69	88.70	300.1W / 37.05kln1	100%	0%
70	90.60	300.1W / 37.05kln1	100%	0%
71	92.50	300.1W / 37.05kln1	100%	0%
72	94.30	240W / 31.12klm 1	100%	0%
73	96.00	240W / 31.12klm 1	100%	0%
74	97.90	240W / 31.12klm 1	100%	0%
75	99.80	240W / 31.12klm 1	100%	0%
76	101.80	240W / 31.12klm 1	100%	0%
77	103.90	240W / 31.12klm 1	100%	0%
78	106.00	240W / 31.12klm 1	100%	0%
79	108.40	240W / 31.12klm 1	100%	0%
80	110.80	240W / 31.12klm 1	100%	0%
81	113.50	240W / 31.12klm 1	100%	0%
82	116.30	240W / 31.12klm 1	100%	0%
83	119.50	240W / 31.12klm 1	100%	0%
84	122.90	240W / 31.12klm 1	100%	0%
85	126.70	240W / 31.12klm 1	100%	0%
86	129.80	180.3W / 22.56kln1	100%	0%
87	133.10	180.3W / 22.56kln1	100%	0%
88	136.60	180.3W / 22.56kln1	100%	0%
89	140.40	180.3W / 22.56kln1	100%	0%
90	144.60	180.3W / 22.56kln1	100%	0%
91	149.20	180.3W / 22.56kln1	100%	0%
92	154.20	180.3W / 22.56kln1	100%	0%
93	159.70	180.3W / 22.56kln1	100%	0%
94	163.70	120W / 14.96klm 1	100%	0%

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

95	168.00	120W / 14.96klm	1	100%	0%
96	172.50	120W / 14.96klm	1	100%	0%
97	177.40	120W / 14.96klm	1	100%	0%
98	182.70	120W / 14.96klm	1	100%	0%
99	188.40	120W / 14.96klm	1	100%	0%
100	194.60	120W / 14.96klm	1	100%	0%
101	201.40	120W / 14.96klm	1	100%	0%
102	208.80	120W / 14.96klm	1	100%	0%
103	216.90	120W / 14.96klm	1	100%	0%
104	225.90	120W / 14.96klm	1	100%	0%
105	235.90	120W / 14.96klm	1	100%	0%
106	247.10	120W / 14.96klm	1	100%	0%
107	259.80	120W / 14.96klm	1	100%	0%
108	274.40	120W / 14.96klm	1	100%	0%
109	289.40	120W / 14.96klm	1	100%	0%
110	304.40	120W / 14.96klm	1	100%	0%
111	319.40	120W / 14.96klm	1	100%	0%
112	334.40	120W / 14.96klm	1	100%	0%
113	349.40	120W / 14.96klm	1	100%	0%
114	364.40	120W / 14.96klm	1	100%	0%
115	379.40	120W / 14.96klm	1	100%	0%
116	394.40	120W / 14.96klm	1	100%	0%
117	409.40	120W / 14.96klm	1	100%	0%
118	424.40	120W / 14.96klm	1	100%	0%
119	439.40	120W / 14.96klm	1	100%	0%
120	454.40	120W / 14.96klm	1	100%	0%
121	469.40	120W / 14.96klm	1	100%	0%
122	484.40	120W / 14.96klm	1	100%	0%
123	499.40	120W / 14.96klm	1	100%	0%
124	514.40	120W / 14.96klm	1	100%	0%
125	529.40	120W / 14.96klm	1	100%	0%
126	544.40	120W / 14.96klm	1	100%	0%

Interior LDC in use

6

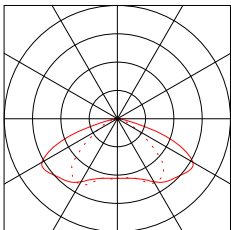
Bajaj

Order No. : s

Luminaire name : E230315 BJTU S 108L NW SYM PC

Equipment : 1 x Unknown 80 W / 9976 lm

Maintenance factor: 0.85



Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.1 Description, Tunnel

1.1.2 Luminaire list

Row of luminaires: Row 1.1

Number of luminaires: 71
 Basic position: x=0.00m y=5.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 5.7kW (1.27 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

Row of luminaires: Row 2.1

Number of luminaires: 71
 Basic position: x=0.00m y=1.50m, z=6.50m
 Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 5.7kW (1.27 km)
 Constant distance: 18.00m
 Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%





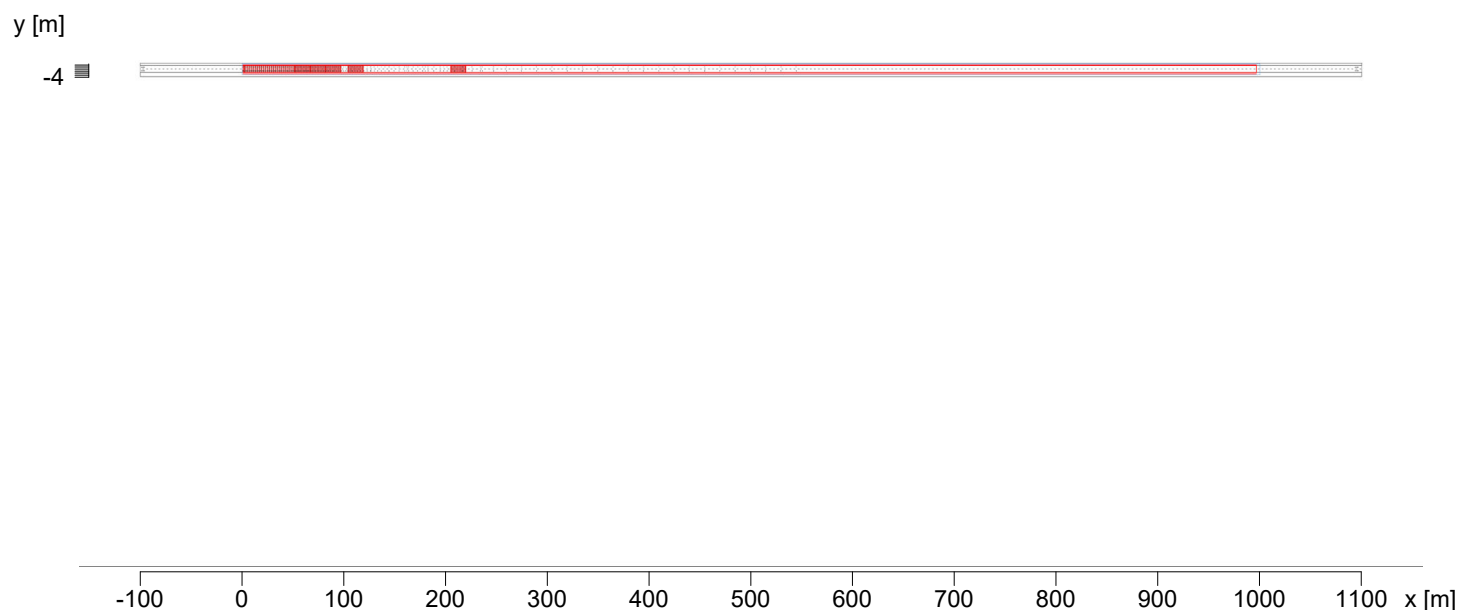


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1.1 Description, Tunnel

1.1.3 Floor plan



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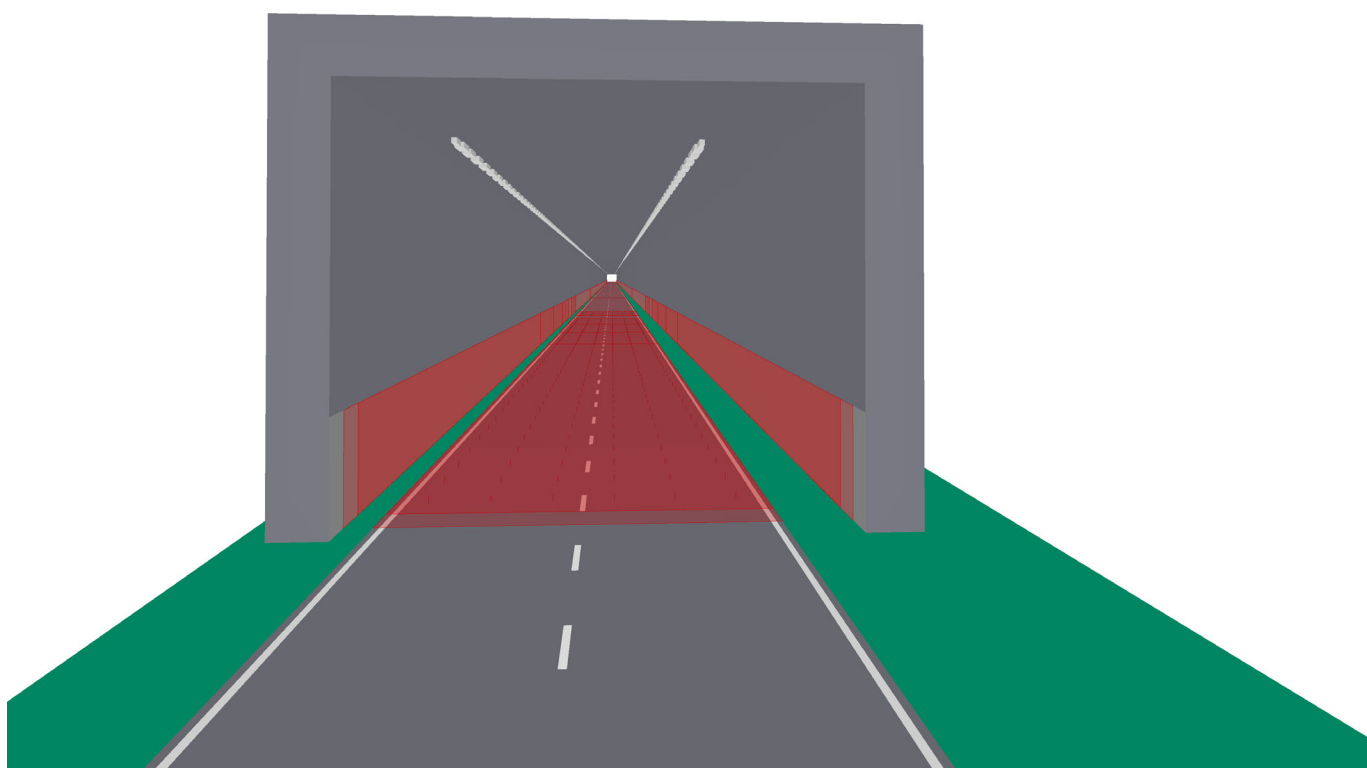
-please put your own address here-

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1.1 Description, Tunnel

1.1.4 3D view, View 1



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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.94 m - 996.61 m Points: nx = 481, ny = 6, nz = 3

Observer (starting point coordinate) : x = -83.96 m; z = 1.50 m dx = 85.93 m (moving)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

TH1

Measuring range: 2.00 m - 52.00 m Points: nx = 25, ny = 6, nz = 3

Observer (starting point coordinate) : x = -58.00 m; z = 1.50 m dx = 61.00 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{E}_m$	:	285.50 cd/m ²	285.44 cd/m ²	
U _o	L _{min} / $\bar{E}_m$	: 0.66	0.65	0.4
U _I	L _{I,min} /L _{I,max}	: 0.69	0.69	0.6
f _{TI,max}	Max.	: 2 %	2 %	

Wall left (diffus 30%)

$\bar{E}_m$	:	199.31 cd/m ²
U _o	L _{min} / $\bar{E}_m$	: 0.65
L _{wall} /L _{fsp}	:	0.70

Wall right (diffus 30%)

$\bar{E}_m$	:	193.04 cd/m ²
U _o	L _{min} / $\bar{E}_m$	: 0.64
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	3564.73 lx
U _o	E _{min} / $\bar{E}_m$	: 0.67

Wall left

$\bar{E}_m$	:	2087.30 lx
U _o	E _{min} / $\bar{E}_m$	: 0.65

Wall right

$\bar{E}_m$	:	2021.69 lx
U _o	E _{min} / $\bar{E}_m$	: 0.64

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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TH3

Measuring range: 67.00 m - 82.00 m Points: nx = 10, ny = 6, nz = 3

Observer (starting point coordinate) : x = 7.00 m; z = 1.50 m dx = 60.75 m (fix)

y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	239.55 cd/m ²	239.52 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.84	0.84	0.4
U _i	L _{i,min} /L _{i,max}	: 0.83	0.83	0.6
f _{TI,max}	Max.	: 2 %	2 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	166.15 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.81
L _{wall} /L _{fsp}	:	0.69

Wall right (diffus 30%)

$\bar{L}_m$	:	161.99 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.81
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	3007.80 lx
U _o	E _{min} / $\bar{E}_m$	: 0.84

Wall left

$\bar{E}_m$	:	1740.54 lx
U _o	E _{min} / $\bar{E}_m$	: 0.81

Wall right

$\bar{E}_m$	:	1697.08 lx
U _o	E _{min} / $\bar{E}_m$	: 0.81

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1 Tunnel

1.2 Calculation results, Tunnel

1.2.1 Result overview, S1: 100%

TR END

Measuring range: 205.00 m - 220.00 m Points: nx = 10, ny = 6, nz = 3

Observer (starting point coordinate) : x = 145.00 m; z = 1.50 m dx = 60.75 m (fix)

y = 1.75 m

y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	23.13 cd/m ²	23.13 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.87	0.86	0.4
U _i	L _{i,min} /L _{i,max}	: 0.89	0.88	0.6
f _{TI,max}	Max.	: 3 %	3 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	16.02 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.84
L _{wall} /L _{fsp}	:	0.69

Wall right (diffus 30%)

$\bar{L}_m$	:	15.62 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.85
L _{wall} /L _{fsp}	:	0.68

Illuminance

Roadway

$\bar{E}_m$	:	289.54 lx
U _o	E _{min} / $\bar{E}_m$	: 0.88

Wall left

$\bar{E}_m$	:	167.83 lx
U _o	E _{min} / $\bar{E}_m$	: 0.84

Wall right

$\bar{E}_m$	:	163.65 lx
U _o	E _{min} / $\bar{E}_m$	: 0.85

qc: The backward reflection of the road was calculated.

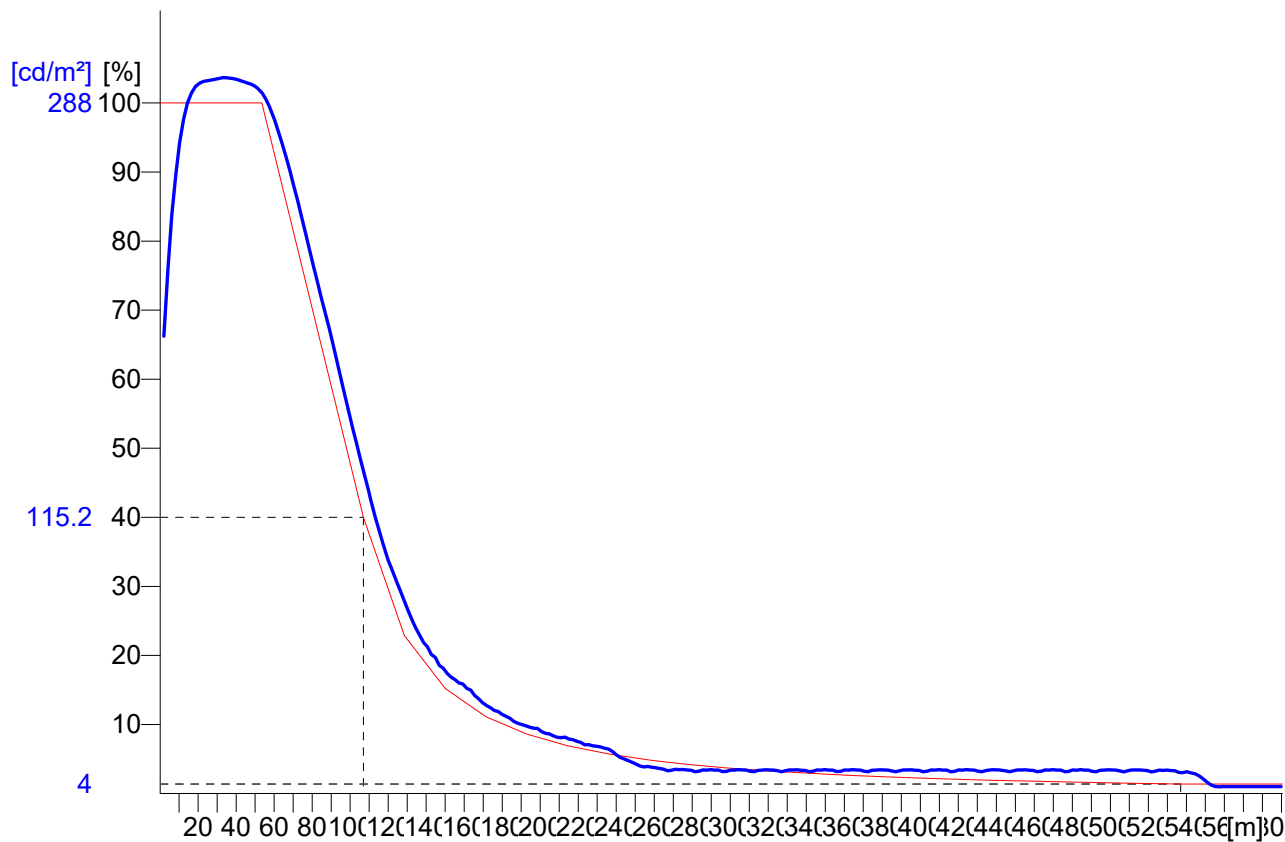
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1.2 Calculation results, Tunnel

1.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -84, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

[Handwritten signatures]

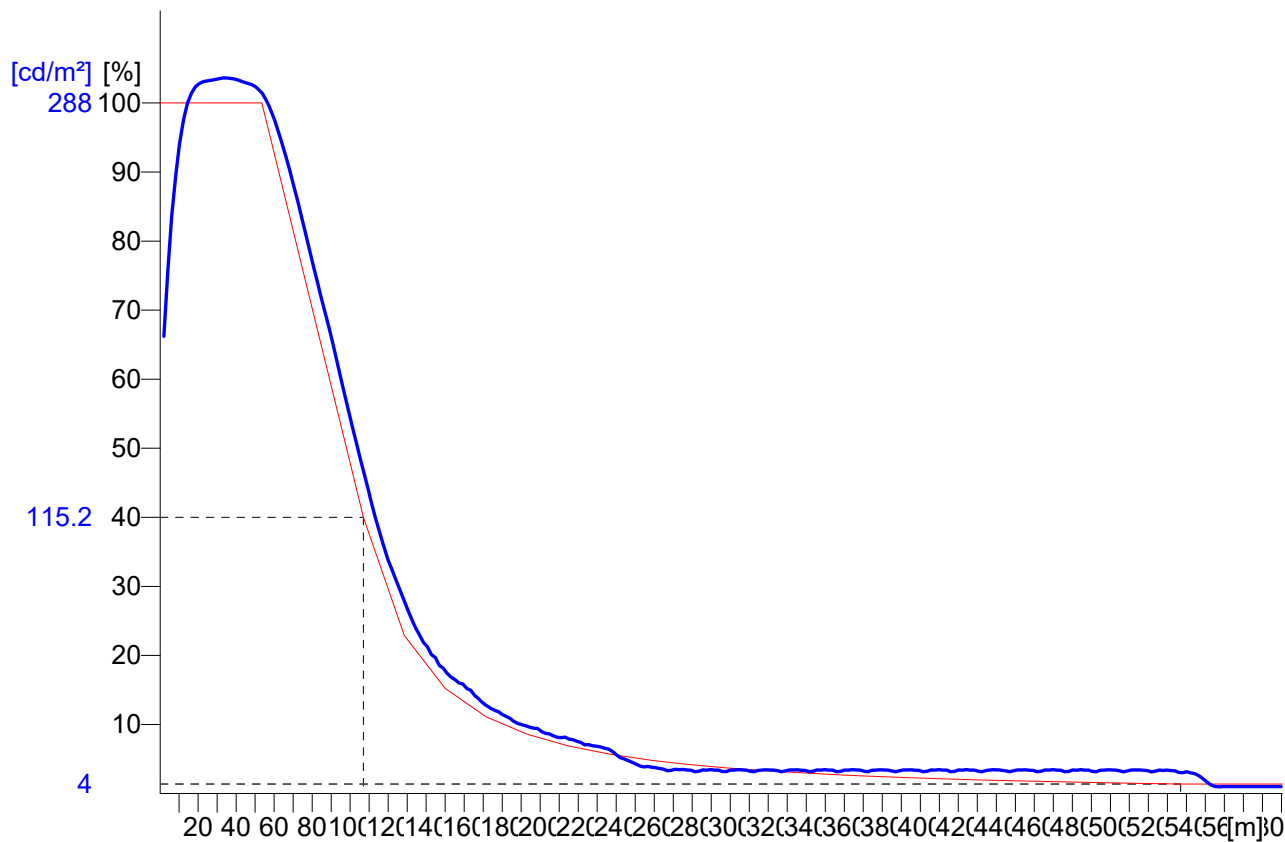
-please put your own address here-

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1.2 Calculation results, Tunnel

1.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



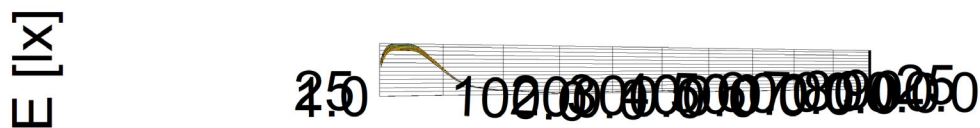
Observer location 2 : x = -84, y = 5.25, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

[Handwritten signatures]

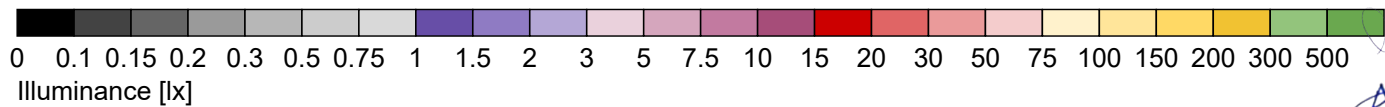
-please put your own address here-

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1.3.1 3D mountain plot, Adaptation (L), S1: 100%, Obs. 1



x [m]



Amelia
Adair
Rob
Proton
David

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1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

[m]	(189)	212	229	244	256	264	270	274	276	277	278	278	279	279	280	280
6.42	208	232	251	266	278	287	292	296	298	300	300	301	301	301	302	302
5.25	220	245	264	280	292	301	307	310	313	314	315	315	315	[316]	[316]	[316]
4.08	219	244	264	279	292	300	306	310	312	313	314	314	314	315	315	315
2.92	209	233	252	266	278	287	292	296	298	299	300	300	301	301	301	302
1.75	190	211	228	242	254	261	267	271	273	274	275	275	276	276	276	277
0.58	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00	29.00	31.00	33.00



Part1

Observer location 1 : x = -58, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 286 cd/m²
Minimum luminance L_{min} : 189 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.66
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.69

[Signatures]

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1 Tunnel

1.4 Calculation results, Tunnel

1.4.1 Table, TH1 (L), S1: 100%, Obs. 1

	280	280	280	279	279	279	278	277	276
	302	302	302	301	301	300	300	299	298
	[316]	[316]	[316]	315	315	314	314	313	311
	315	315	315	314	313	313	312	311	310
	302	301	301	301	300	300	299	298	297
	277	277	276	276	275	275	274	274	273
00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00

[m]



Part2

-please put your own address here-

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1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

[m]	2460	2780	3010	3190	3310	3390	3440	3480	3490	3500	3490	3490	3490
6.42	2650	3000	3250	3430	3560	3650	3700	3740	3750	3750	3750	3740	3740
5.25	2740	3100	3360	3550	3680	3770	3830	3860	3880	3880	3880	3870	3870
4.08	2720	3080	3340	3530	3660	3750	3810	3840	3860	3860	3860	3850	3850
2.92	2630	2970	3220	3400	3530	3610	3670	3700	3720	3720	3720	3710	3710
1.75	(2390)	2700	2930	3100	3220	3300	3350	3390	3400	3410	3400	3400	3400
0.58													
	3.00	5.00	7.00	9.00	11.00	13.00	15.00	17.00	19.00	21.00	23.00	25.00	27.00
	Illuminance [lx]												



Part1

Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3560 lx
Minimum illuminance	E_{min} : 2390 lx
Maximum illuminance	E_{max} : 3900 lx
Uniformity U_o	$E_{min}/\bar{E}_m$: 1 : 1.49 (0.67)
Diversity U_d	E_{min}/E_{max} : 1 : 1.63 (0.61)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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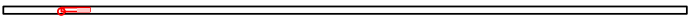
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1.4 Calculation results, Tunnel

1.4.2 Table, TH1 (E), S1: 100%

3490	3500	3510	3520	3520	3510	3500	3490	3490	3490	3490	3490
3750	3750	3770	3780	3770	3770	3760	3750	3740	3740	3740	3740
3870	3890	[3900]	[3900]	[3900]	3890	3880	3880	3870	3870	3870	3870
3850	3860	3870	3880	3880	3870	3860	3850	3850	3850	3850	3850
3710	3720	3730	3740	3740	3730	3720	3710	3710	3710	3710	3710
3400	3410	3420	3430	3430	3420	3410	3400	3400	3400	3400	3400
29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00	49.00	51.00 [m]



Part2

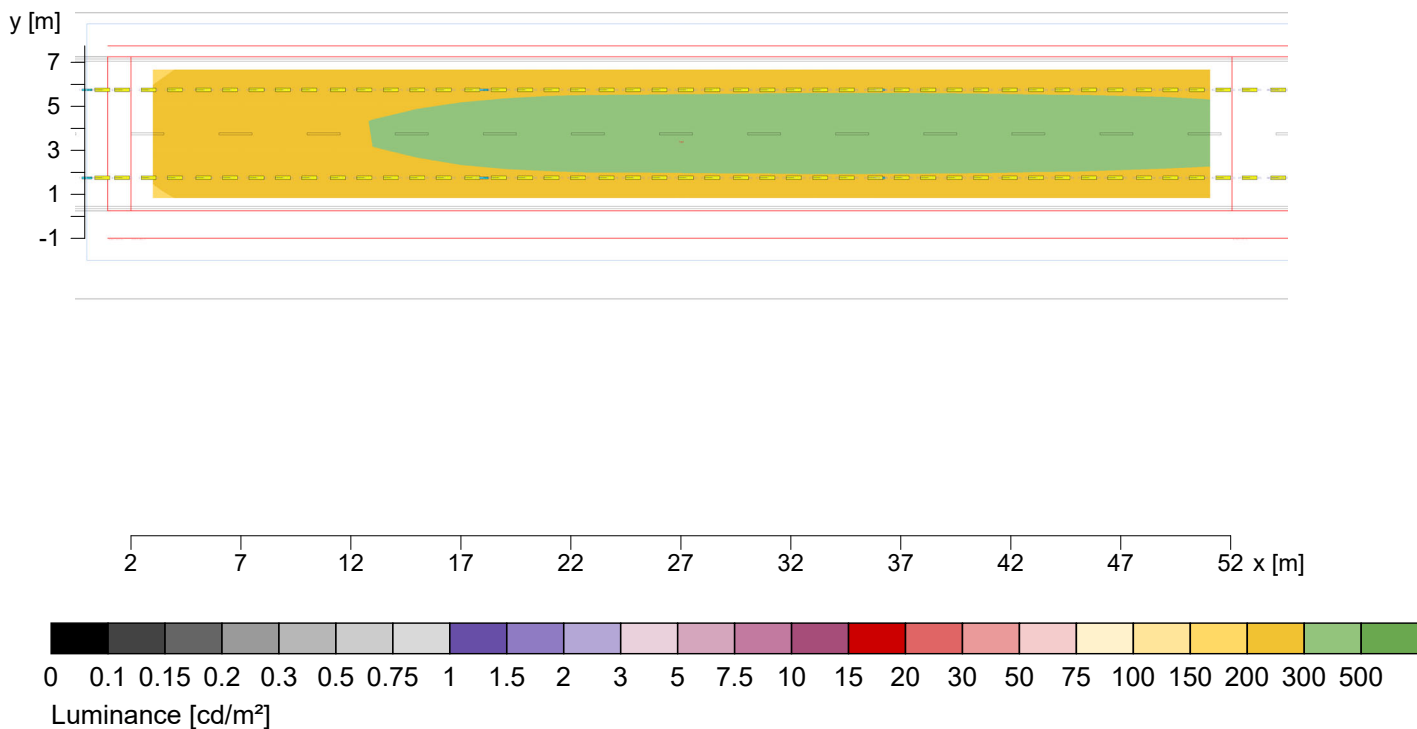
[Handwritten signatures]

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1.4 Calculation results, Tunnel

1.4.3 Pseudo colours, TH1 (L), S1: 100%, Obs. 1



Observer location 1		: x = -58, y = 1.75, z = 1.5 (dx = 6
Average luminance	$\bar{L}_m$	: 286 cd/m ²
Minimum luminance	L_{min}	: 189 cd/m ²
Overall uniformity U_o	$L_{min}/\bar{L}_m$	: 0.66
Longitudinal uniformity U_l	$L_{l,min}/L_{l,max}$	: 0.69

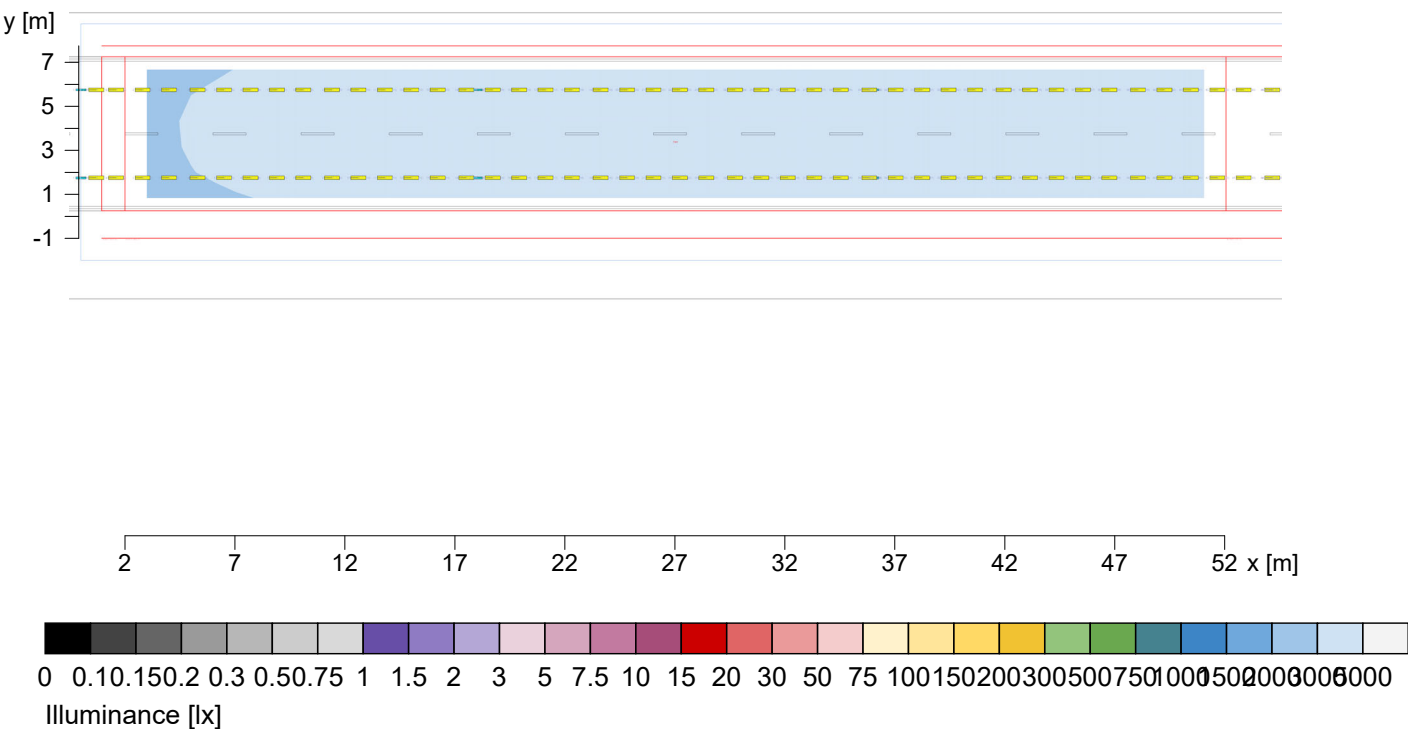
[Handwritten signatures]

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1.4 Calculation results, Tunnel

1.4.4 Pseudo colours, TH1 (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 3560 lx
 E_{max} : 2390 lx
 $E_{min}/\bar{E}_m$: 3900 lx
 E_{min}/E_{max} : 1 : 1.49 (0.67)
 E_{min}/E_{max} : 1 : 1.63 (0.61)

[Handwritten signatures]

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1 Tunnel

1.5 Calculation results, Tunnel

1.5.1 Table, TH2 (L), S1: 100%, Obs. 1

[m]	273	272	270	268	265	262	259	256	252	248
6.42	295	294	292	290	287	284	280	276	272	268
5.25	[309]	308	306	303	300	297	293	289	285	280
4.08	308	307	305	303	299	296	292	288	284	279
2.92	295	294	292	290	287	283	280	276	272	267
1.75	271	269	268	266	263	260	256	253	250	(246)
0.58	52.75	54.25	55.75	57.25	58.75	60.25	61.75	63.25	64.75	66.25



Observer location 1 : x = -8, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 281 cd/m²
Minimum luminance L_{min} : 246 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.88
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.91

[Handwritten signatures]

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1.5 Calculation results, Tunnel

1.5.2 Table, TH2 (E), S1: 100%

[m]	3470	3460	3440	3410	3370	3330	3290	3240	3190	3140
6.42	3740	3730	3700	3670	3630	3590	3540	3490	3440	3380
5.25	3870	3850	3830	3800	3760	3710	3660	3610	3560	3500
4.08	3840	3830	3810	3780	3740	3690	3640	3590	3540	3480
2.92	3700	3690	3670	3640	3600	3560	3510	3460	3410	3360
1.75	3390	3380	3360	3330	3290	3250	3210	3170	3120	3070
0.58	52.75	54.25	55.75	57.25	58.75	60.25	61.75	63.25	64.75	66.25
	Illuminance [lx]									



Height reference plane : 0.00 m
 Average illuminance $\bar{E}_m$: 3530 lx
 Minimum illuminance E_{min} : 3070 lx
 Maximum illuminance E_{max} : 3870 lx
 Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.15 (0.87)
 Diversity U_d E_{min}/E_{max} : 1 : 1.26 (0.79)

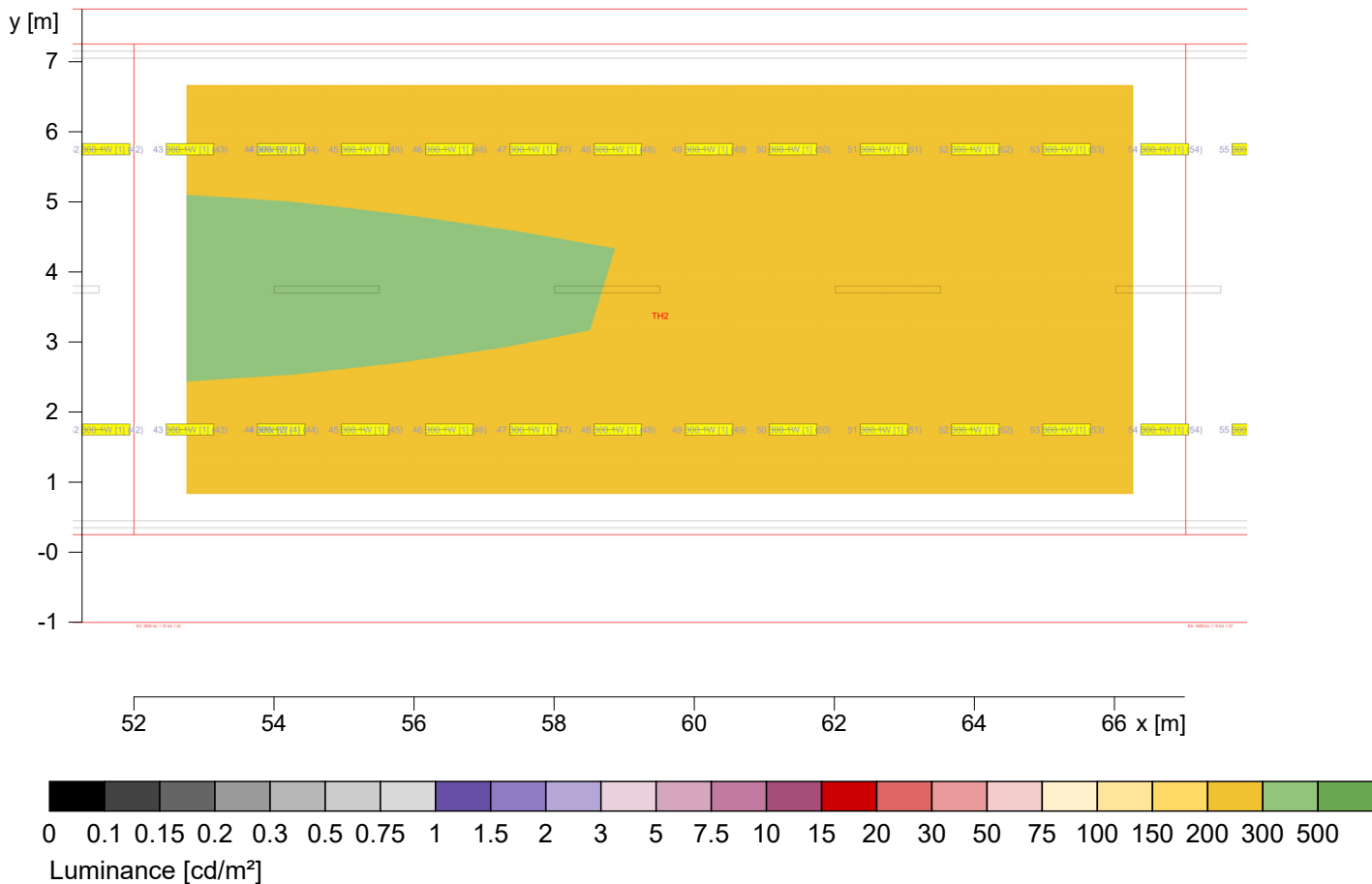
[Handwritten signatures]

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1.5 Calculation results, Tunnel

1.5.3 Pseudo colours, TH2 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = -8, y = 1.75, z = 1.5$ (dx = 60) : 281 cd/m²
 L_{min} : 246 cd/m²
 $L_{min}/\bar{L}_m$: 0.88
 $L_{l,min}/L_{l,max}$: 0.91

[Handwritten signatures and initials]

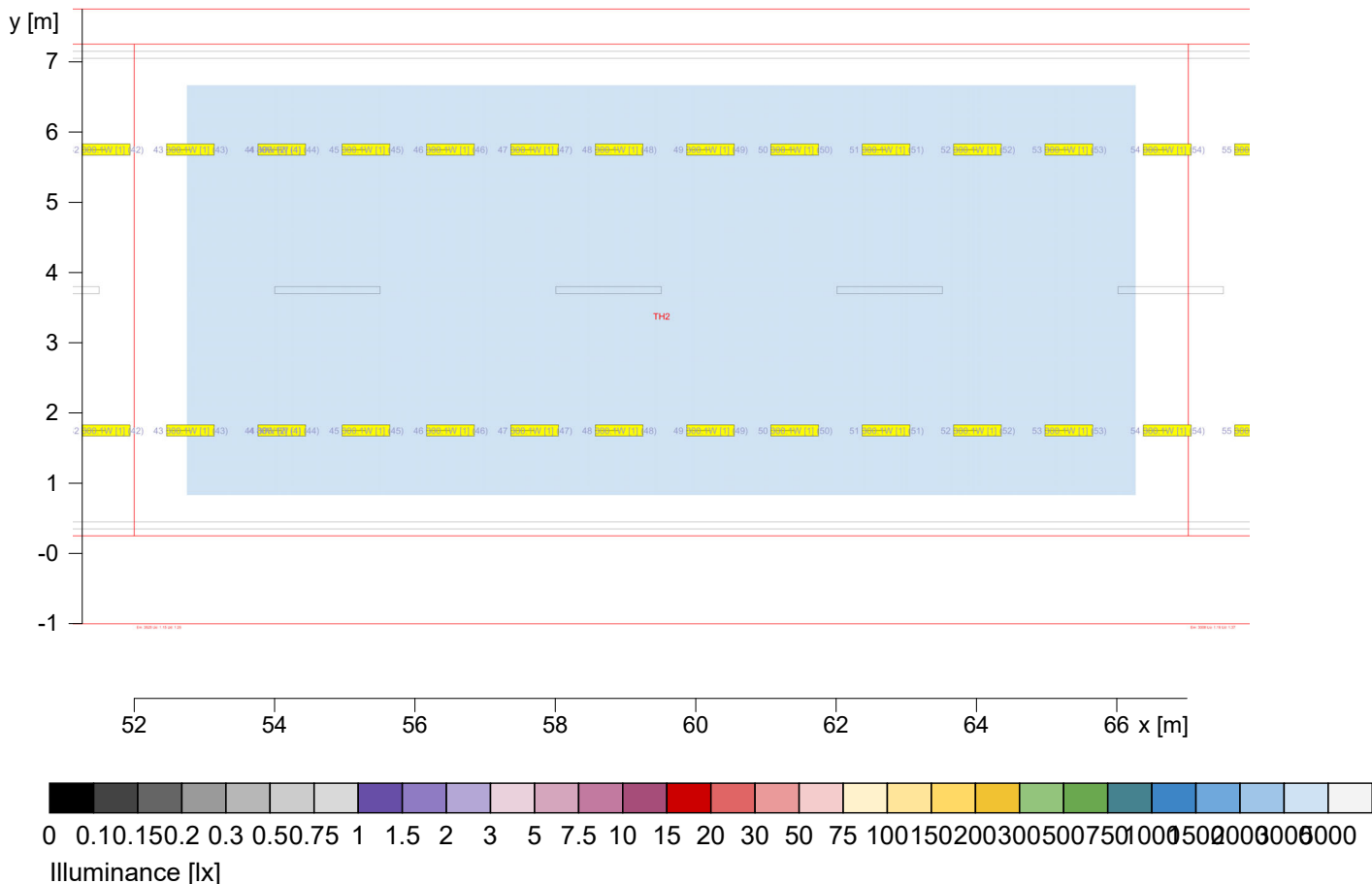
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1.5 Calculation results, Tunnel

1.5.4 Pseudo colours, TH2 (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 3530 lx
 E_{min} : 3070 lx
 E_{max} : 3870 lx
 $E_{min}/\bar{E}_m$: 1 : 1.15 (0.87)
 E_{min}/E_{max} : 1 : 1.26 (0.79)

[Handwritten signatures]

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1 Tunnel

1.6 Calculation results, Tunnel

1.6.1 Table, TH3 (L), S1: 100%, Obs. 1

[m]	244	240	236	232	227	222	218	213	209	204
6.42	263	259	255	250	245	240	235	230	225	220
5.25	[275]	271	266	261	256	251	246	241	236	230
4.08	[275]	270	266	261	256	251	245	240	235	230
2.92	263	259	255	250	245	240	235	230	225	220
1.75	242	238	234	229	225	220	216	211	207	(202)
0.58	67.75	69.25	70.75	72.25	73.75	75.25	76.75	78.25	79.75	81.25



Observer location 1 : x = 7, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 240 cd/m²
Minimum luminance L_{min} : 202 cd/m²
Overall uniformity U_o : 0.84
Longitudinal uniformity U_l : 0.83

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

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1.6 Calculation results, Tunnel

1.6.2 Table, TH3 (E), S1: 100%

[m]	3100	3050	3000	2940	2880	2820	2760	2700	2640	2580
6.42	3330	3280	3230	3170	3100	3040	2970	2900	2840	2780
5.25	3330	3280	3230	3170	3100	3040	2970	2900	2840	2780
4.08	3450	3390	3340	3280	3210	3140	3070	3000	2940	2870
2.92	3430	3380	3320	3260	3190	3130	3060	2990	2920	2860
1.75	3300	3250	3200	3140	3080	3010	2940	2880	2810	2750
0.58	3020	2980	2930	2870	2820	2760	2700	2630	2580	(2520)
	67.75	69.25	70.75	72.25	73.75	75.25	76.75	78.25	79.75	81.25
	Illuminance [lx]									



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3010 lx
Minimum illuminance	E_{min} : 2520 lx
Maximum illuminance	E_{max} : 3450 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.19 (0.84)
Diversity U_d	E_{min}/E_{max} : 1 : 1.37 (0.73)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

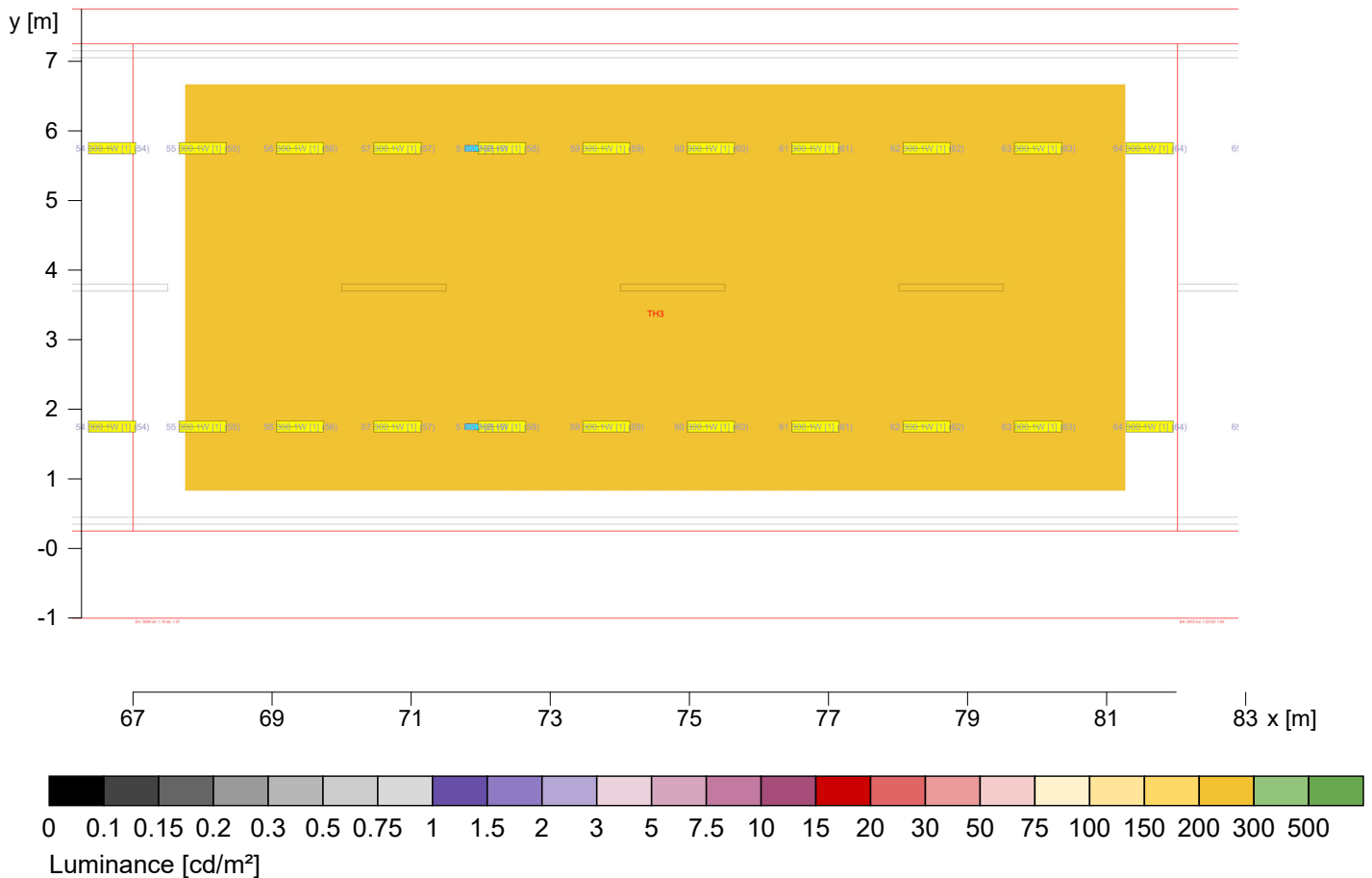
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1.6 Calculation results, Tunnel

1.6.3 Pseudo colours, TH3 (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$
 L_{min}
 $L_{min}/\bar{L}_m$
 $L_{l,min}/L_{l,max}$

: $x = 7, y = 1.75, z = 1.5$ ($dx = 60$)
: 240 cd/m^2
: 202 cd/m^2
: 0.84
: 0.83

[Signatures]

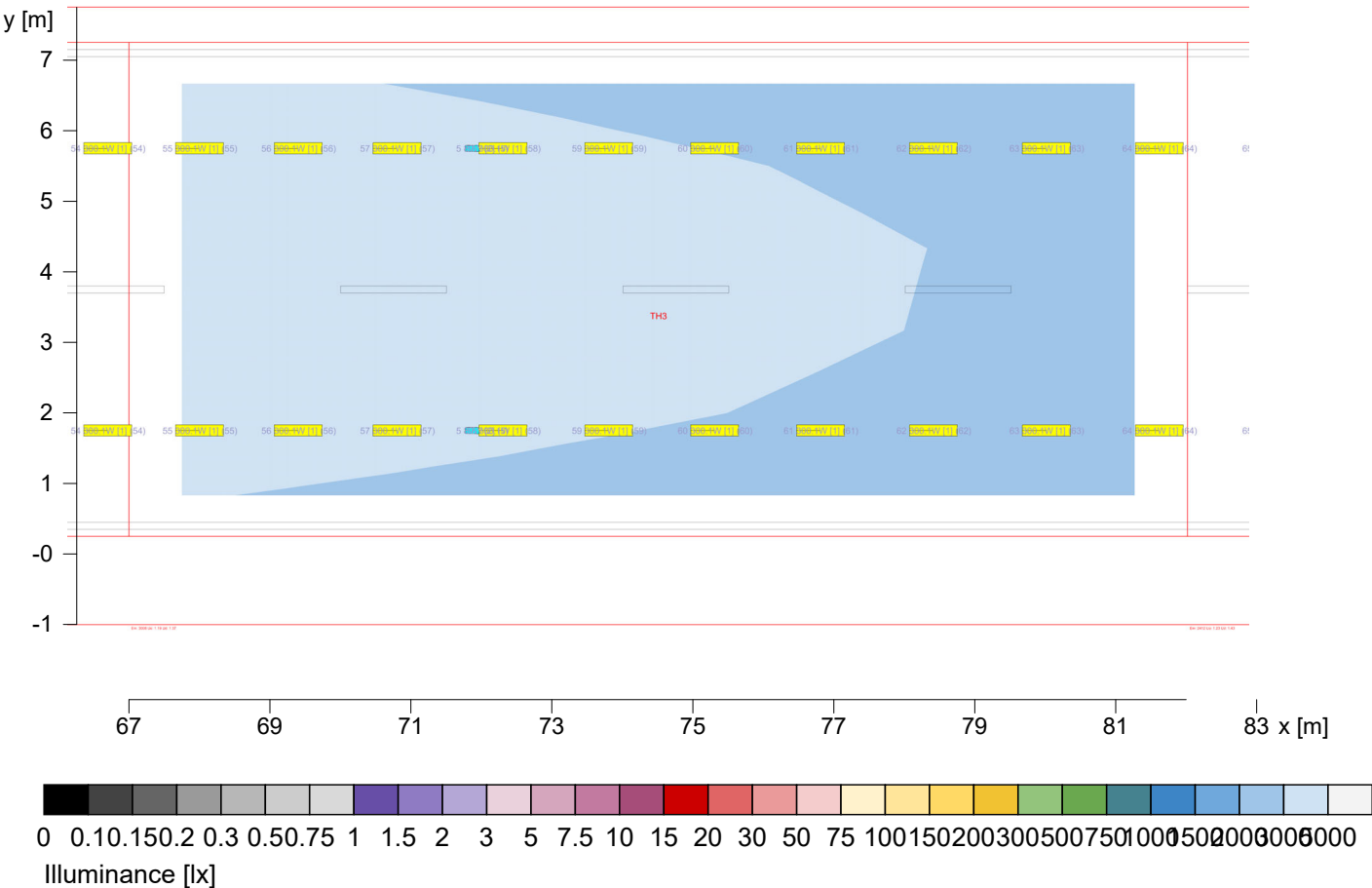
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.6 Calculation results, Tunnel

1.6.4 Pseudo colours, TH3 (E), S1: 100%



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 3010 lx
Minimum illuminance	E_{min} : 2520 lx
Maximum illuminance	E_{max} : 3450 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.19 (0.84)
Diversity U_d	E_{min}/E_{max} : 1 : 1.37 (0.73)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.7 Calculation results, Tunnel

1.7.1 Table, TH4 (L), S1: 100%, Obs. 1

[m]	199	195	191	187	182	178	173	168	164	158
6.42	└	└	└	└	└	└	└	└	└	└
5.25	215	211	206	202	197	192	187	182	176	171
	└	└	└	└	└	└	└	└	└	└
4.08	[225]	220	216	211	206	200	195	189	184	178
	└	└	└	└	└	└	└	└	└	└
2.92	224	219	215	210	205	200	194	189	184	178
	└	└	└	└	└	└	└	└	└	└
1.75	215	210	206	201	196	192	186	181	176	170
	└	└	└	└	└	└	└	└	└	└
0.58	197	193	189	185	180	176	171	167	162	(157)
	└	└	└	└	└	└	└	└	└	└
	82.75	84.25	85.75	87.25	88.75	90.25	91.75	93.25	94.75	96.25



Observer location 1 : x = 22, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 191 cd/m²
Minimum luminance L_{min} : 157 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.82
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.79

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.7 Calculation results, Tunnel

1.7.2 Table, TH4 (E), S1: 100%

[m]	2520	2470	2420	2370	2320	2270	2210	2140	2080	2010
6.42	2720	2660	2610	2550	2500	2440	2380	2310	2240	2160
5.25	[2810]	2750	2700	2640	2590	2530	2460	2390	2310	2240
4.08	2790	2730	2680	2630	2570	2510	2440	2370	2300	2230
2.92	2690	2640	2590	2530	2480	2420	2360	2290	2220	2140
1.75	2470	2420	2370	2320	2270	2220	2160	2100	2030	(1960)
0.58	82.75	84.25	85.75	87.25	88.75	90.25	91.75	93.25	94.75	96.25
Illuminance [lx]										



Height reference plane : 0.00 m
 Average illuminance $\bar{E}_m$: 2410 lx
 Minimum illuminance E_{min} : 1960 lx
 Maximum illuminance E_{max} : 2810 lx
 Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.23 (0.81)
 Diversity U_d E_{min}/E_{max} : 1 : 1.43 (0.7)

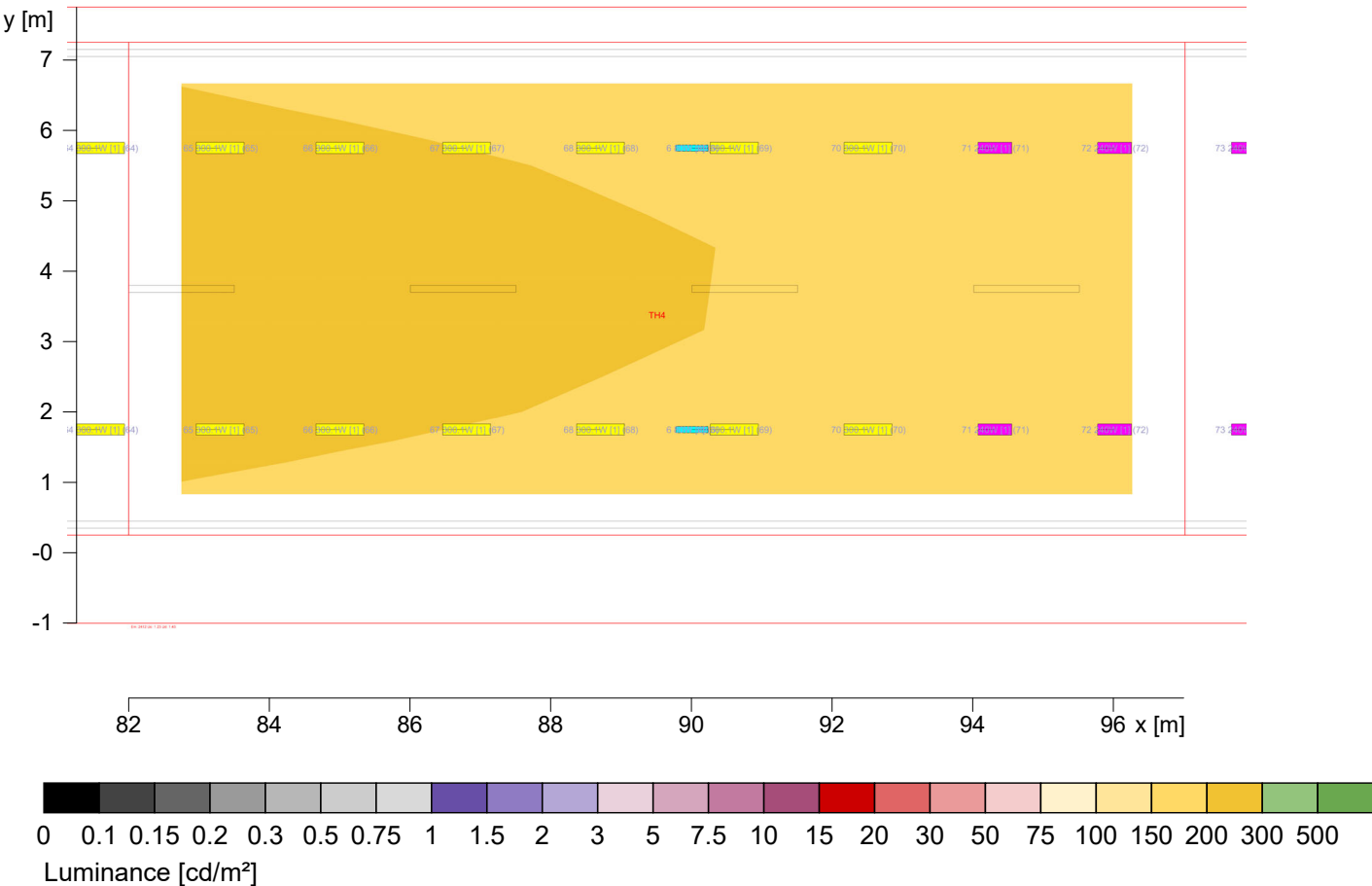
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
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1.7 Calculation results, Tunnel

1.7.3 Pseudo colours, TH4 (L), S1: 100%, Obs. 1



Observer location 1
 Average luminance
 Minimum luminance
 Overall uniformity U_o
 Longitudinal uniformity U_l

$\bar{L}_m$: $x = 22, y = 1.75, z = 1.5$ (dx = 6
 L_{min} : 191 cd/m²
 $L_{min}/\bar{L}_m$: 157 cd/m²
 $L_{l,min}/L_{l,max}$: 0.82
 $L_{l,min}/L_{l,max}$: 0.79

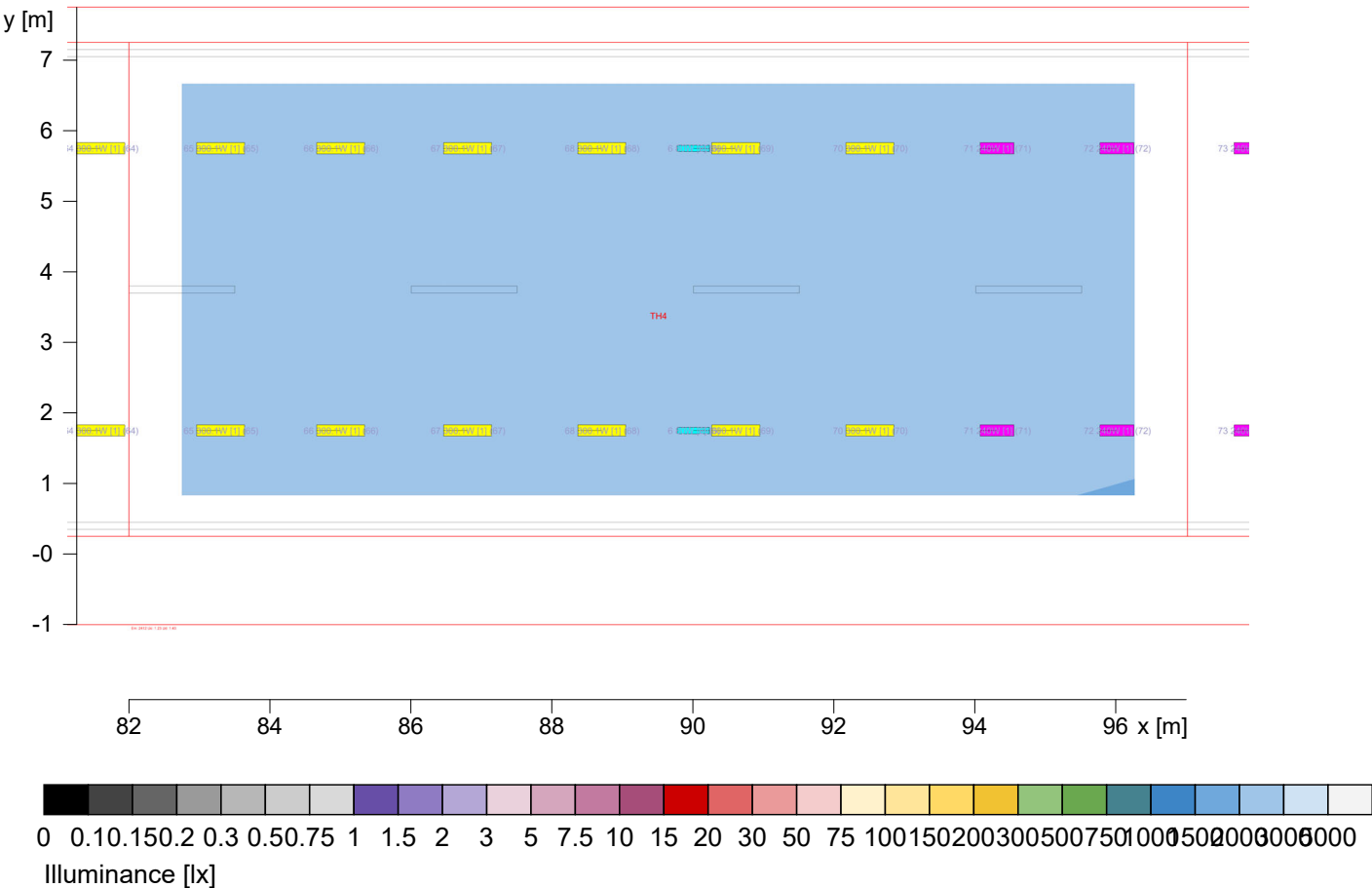
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
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 Date : 23.09.2024



1.7 Calculation results, Tunnel

1.7.4 Pseudo colours, TH4 (E), S1: 100%



Height reference plane	:	0.00 m
Average illuminance	$\bar{E}_m$	: 2410 lx
Minimum illuminance	E_{min}	: 1960 lx
Maximum illuminance	E_{max}	: 2810 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	: 1 : 1.23 (0.81)
Diversity U_d	E_{min}/E_{max}	: 1 : 1.43 (0.7)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



1 Tunnel

1.8 Calculation results, Tunnel

1.8.1 Table, TR START (L), S1: 100%, Obs. 1

[m]	133	128	124	120	115	111	106	103	99	96
6.42	143	138	134	129	124	119	115	110	106	103
5.25	[149]	144	139	134	129	125	119	116	111	107
4.08	[149]	144	139	134	129	125	119	115	111	107
2.92	142	138	133	129	124	119	115	110	106	103
1.75	131	127	123	118	114	110	106	102	98	(94)
0.58	104.75	106.25	107.75	109.25	110.75	112.25	113.75	115.25	116.75	118.25



Observer location 1 : x = 44, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 121 cd/m²
Minimum luminance L_{min} : 94.5 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.78
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.72

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
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1.8 Calculation results, Tunnel

1.8.2 Table, TR START (E), S1: 100%

[m]	1690	1630	1580	1520	1460	1400	1340	1290	1240	1200
6.42	1820	1760	1700	1640	1580	1510	1450	1390	1330	1280
5.25	1820	1760	1700	1640	1580	1510	1450	1390	1330	1280
4.08	1870	1810	1750	1690	1620	1560	1490	1430	1370	1320
2.92	1870	1810	1750	1690	1620	1560	1490	1430	1370	1320
1.75	1800	1750	1690	1630	1560	1500	1430	1380	1320	1270
0.58	1650	1600	1550	1490	1430	1370	1310	1260	1210	(1170)
	104.75	106.25	107.75	109.25	110.75	112.25	113.75	115.25	116.75	118.25
	Illuminance [lx]									



Height reference plane	: 0.00 m
Average illuminance	$\bar{E}_m$: 1520 lx
Minimum illuminance	E_{min} : 1170 lx
Maximum illuminance	E_{max} : 1880 lx
Uniformity U_0	$E_{min}/\bar{E}_m$: 1 : 1.3 (0.77)
Diversity U_d	E_{min}/E_{max} : 1 : 1.61 (0.62)

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

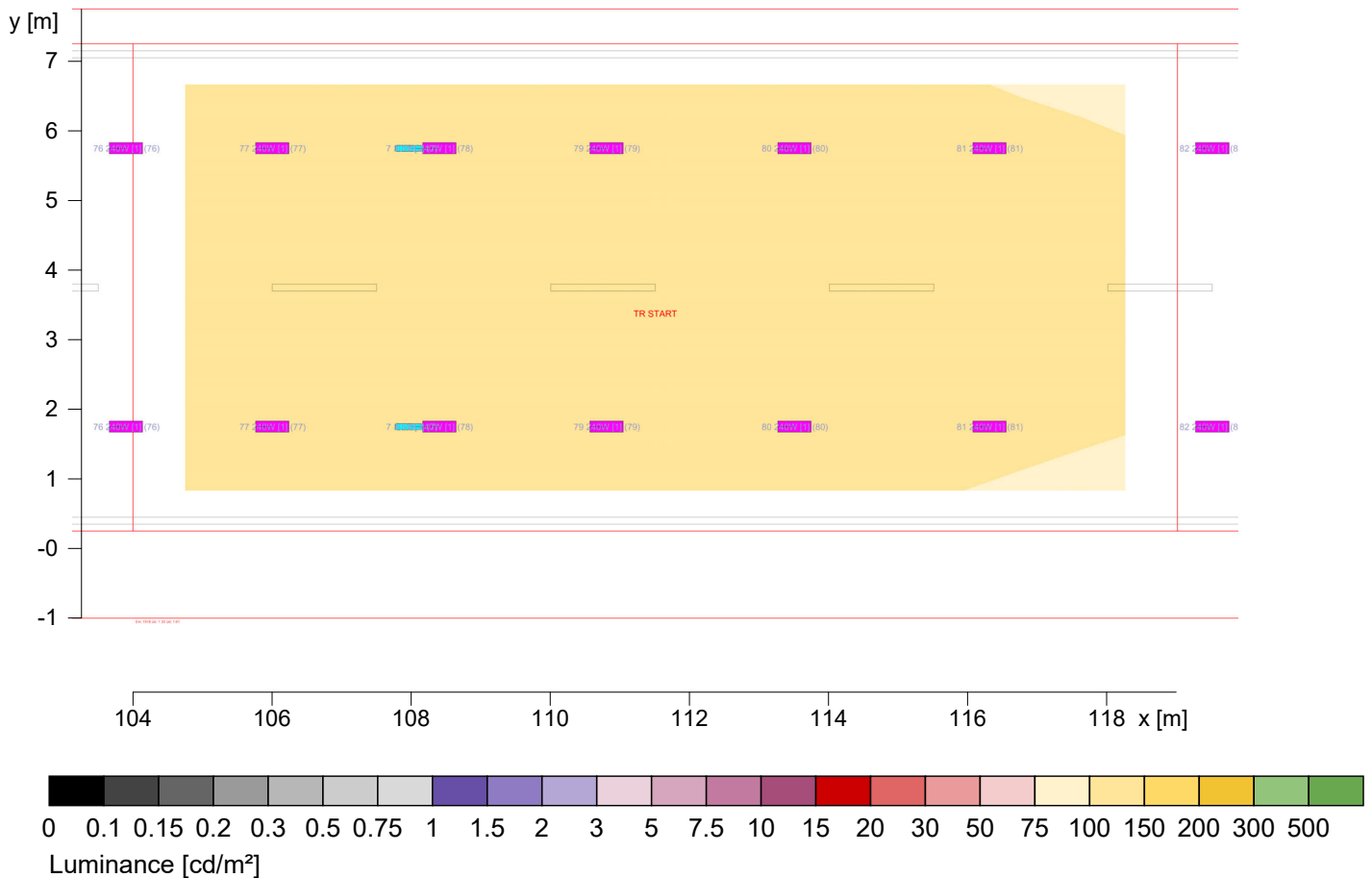
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
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1.8 Calculation results, Tunnel

1.8.3 Pseudo colours, TR START (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: x = 44, y = 1.75, z = 1.5 (dx = 6
: 121 cd/m²
 L_{min} : 94.5 cd/m²
 $L_{min}/\bar{L}_m$: 0.78
 $L_{l,min}/L_{l,max}$: 0.72

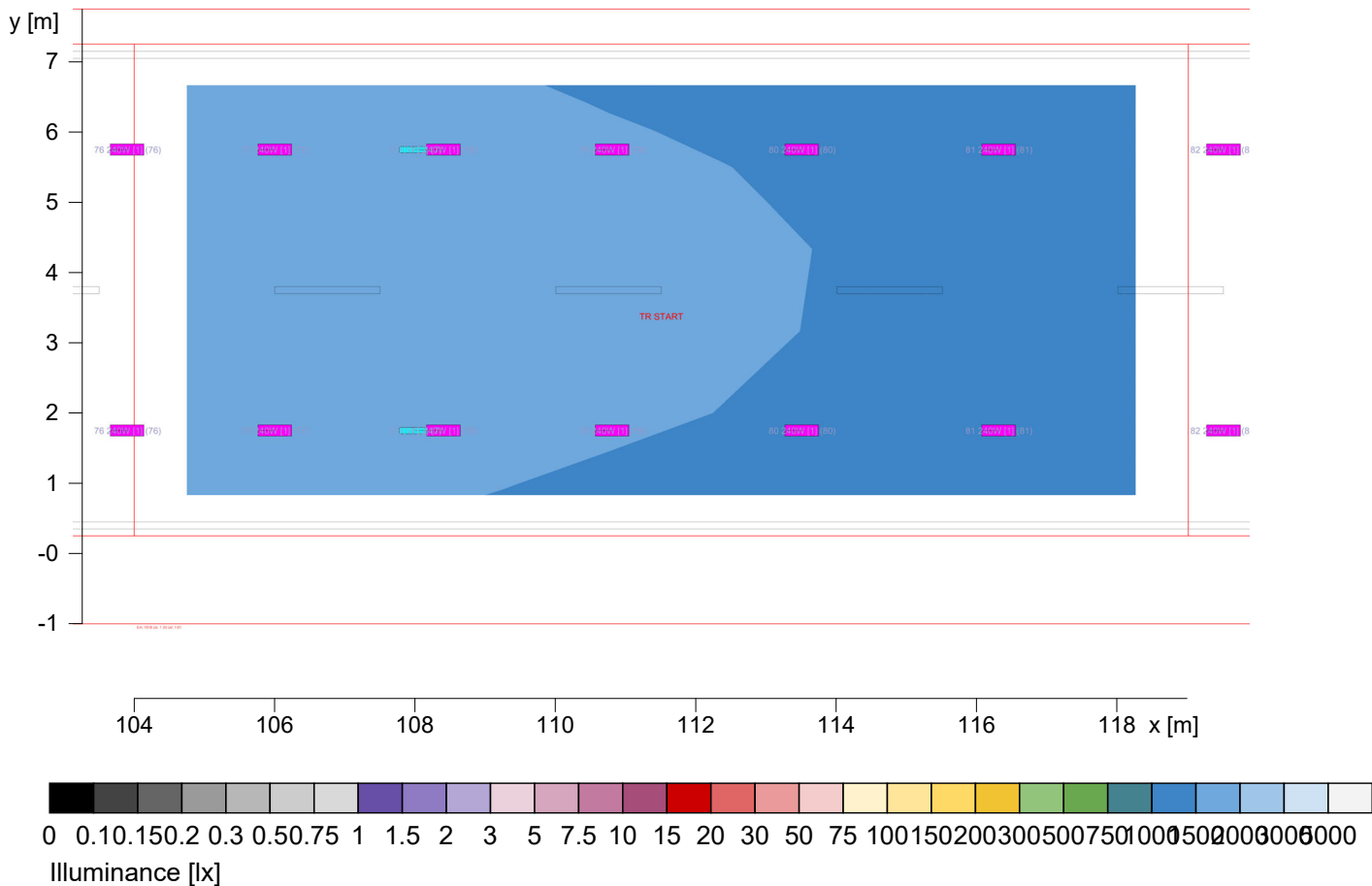
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
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1.8 Calculation results, Tunnel

1.8.4 Pseudo colours, TR START (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

: 0.00 m
 $\bar{E}_m$: 1520 lx
 E_{min} : 1170 lx
 E_{max} : 1880 lx
 $E_{min}/\bar{E}_m$: 1 : 1.3 (0.77)
 E_{min}/E_{max} : 1 : 1.61 (0.62)

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
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1 Tunnel

1.9 Calculation results, Tunnel

1.9.1 Table, TR END (L), S1: 100%, Obs. 1

[m]										
6.42	22.9	22.4	22	21.7	21.8	21.8	21.3	21.3	20.9	(20.2)
5.25	24.8	24.1	23.6	23.4	23.7	23.7	23.2	22.9	22.4	21.9
4.08	[26]	25.1	24.7	24.6	24.9	24.9	24	23.7	23.4	23
2.92	[26]	25.2	24.8	24.6	24.9	24.8	23.9	23.8	23.4	23
1.75	24.8	24.1	23.7	23.4	23.7	23.7	23.2	22.9	22.5	21.9
0.58	22.8	22.2	21.9	21.6	21.7	21.6	21.2	21.1	20.7	(20.2)
	205.75	207.25	208.75	210.25	211.75	213.25	214.75	216.25	217.75	219.25
	[m]									



Observer location 1 : x = 145, y = 1.75, z = 1.5 (dx = 60.75)
Average luminance $\bar{L}_m$: 23.1 cd/m²
Minimum luminance L_{min} : 20.2 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.87
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.89

[Handwritten signatures]

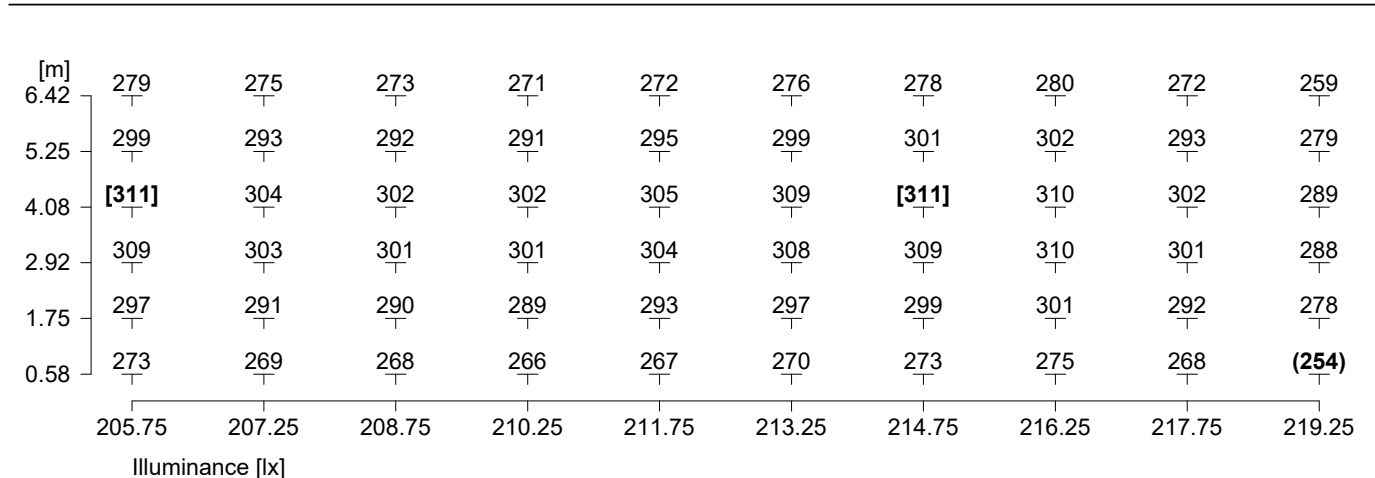
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
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1.9 Calculation results, Tunnel

1.9.2 Table, TR END (E), S1: 100%



Height reference plane		: 0.00 m
Average illuminance	$\bar{E}_m$	: 290 lx
Minimum illuminance	E_{min}	: 254 lx
Maximum illuminance	E_{max}	: 311 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	: 1 : 1.14 (0.88)
Diversity U_d	E_{min}/E_{max}	: 1 : 1.22 (0.82)

[Handwritten signatures]

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1.9.3 Pseudo colours, TR END (L), S1: 100%, Obs. 1

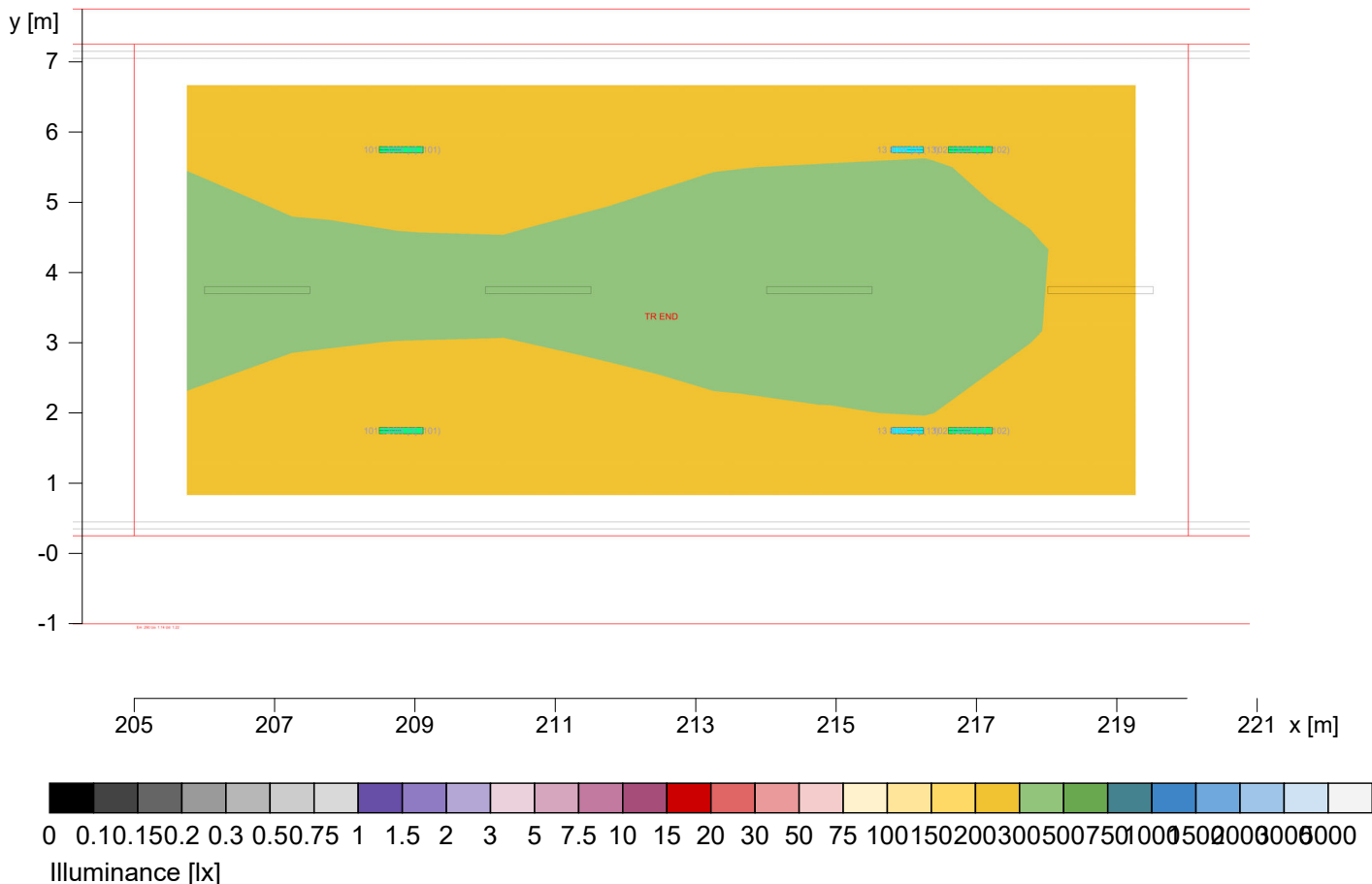
[illegible]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



1.9 Calculation results, Tunnel

1.9.4 Pseudo colours, TR END (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 290 lx
 E_{max} : 254 lx
 $E_{min}/\bar{E}_m$: 311 lx
 E_{min}/E_{max} : 1 : 1.14 (0.88)
 E_{min}/E_{max} : 1 : 1.22 (0.82)

[Signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
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Date : 23.09.2024

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2 NIGHT TIME

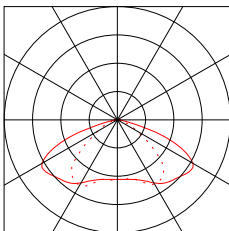
2.1 Description, NIGHT TIME

2.1.1 Luminaire list

Adaptation
LDC in use

Interior
LDC in use

Bajaj
6 Order No. : s
Luminaire name : E230315 BJTU S 108L NW SYM PC
Equipment : 1 x Unknown 80 W / 9976 lm
Maintenance factor: 0.85



Row of luminaires: Row 1.1

Number of luminaires: 71

Basic position: x=0.00m y=5.50m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 5.7kW (1.27 km)

Constant distance: 18.00m

Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2 NIGHT TIME

2.1 Description, NIGHT TIME

2.1.1 Luminaire list

Row of luminaires: Row 2.1

Number of luminaires: 71

Basic position: x=0.00m y=1.50m, z=6.50m

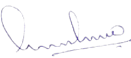
Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 5.7kW (1.27 km)

Constant distance: 18.00m

Flicker frequency (v=80 km/h): 1.2 Hz

Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%







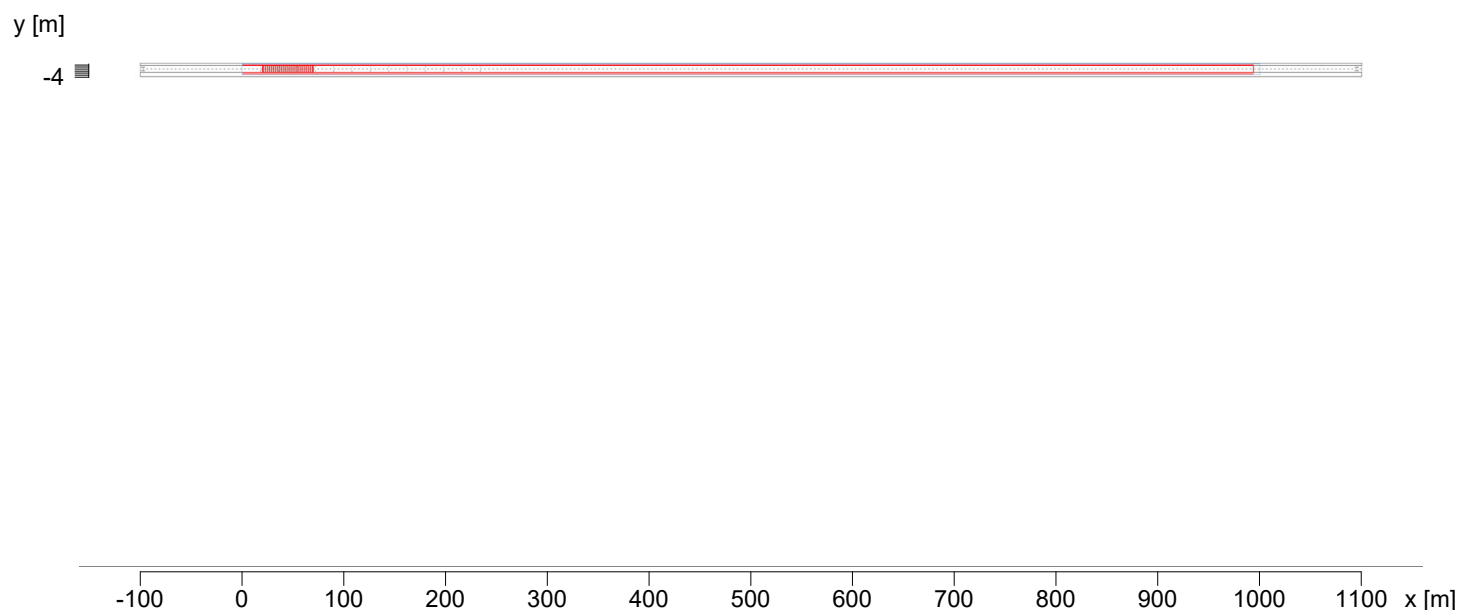
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2.1 Description, NIGHT TIME

2.1.2 Floor plan



[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2.1 Description, NIGHT TIME

2.1.3 3D view, View 1



Handwritten signatures:
1. *Shubh*
2. *Adar*
3. *Rob*
4. *CSA Son*
5. *Sanjay Kumar*

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2 NIGHT TIME

2.2 Calculation results, NIGHT TIME

2.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

1: 100%
Interior
2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.00 m - 993.60 m Points: nx = 276, ny = 6, nz = 3

Observer (starting point coordinate) : x = -84.13 m; z = 1.50 m dx = 85.93 m (moving)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

NIGHT TIME

Measuring range: 20.00 m - 70.00 m Points: nx = 25, ny = 6, nz = 3

Observer (starting point coordinate) : x = -40.00 m; z = 1.50 m dx = 61.00 m (fix)
y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	5.33 cd/m ²	5.33 cd/m ²	
U _o	L _{min} / $\bar{L}_m$	: 0.87	0.86	0.4
U _I	L _{I,min} /L _{I,max}	: 0.87	0.87	0.6
f _{TI,max}	Max.	: 6 %	6 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	3.62 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.78
L _{wall} /L _{fsp}	:	0.68

Wall right (diffus 30%)

$\bar{L}_m$	:	3.51 cd/m ²
U _o	L _{min} / $\bar{L}_m$	: 0.76
L _{wall} /L _{fsp}	:	0.66

Illuminance

Roadway

$\bar{E}_m$	:	65.04 lx
U _o	E _{min} / $\bar{E}_m$	: 0.77

Wall left

$\bar{E}_m$	:	37.92 lx
U _o	E _{min} / $\bar{E}_m$	: 0.78

Wall right

$\bar{E}_m$	:	36.74 lx
U _o	E _{min} / $\bar{E}_m$	: 0.76

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

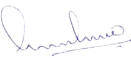
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2 NIGHT TIME

2.2 Calculation results, NIGHT TIME

2.2.1 Result overview, S1: 100%

qc: The backward reflecion of the road was calculated.







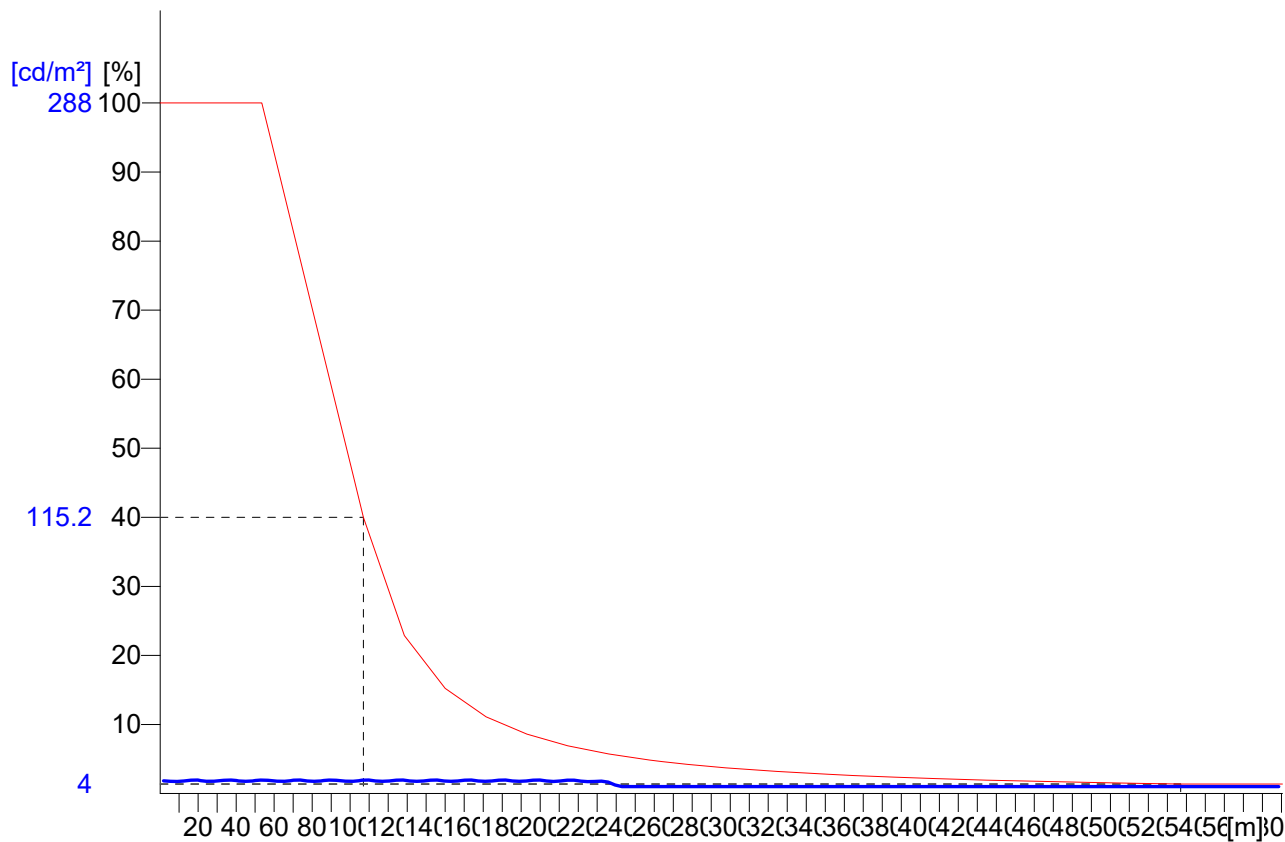
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



2.2 Calculation results, NIGHT TIME

2.2.2 Evolution, Adaptation (L), S1: 100%, Obs. 1



Observer location 1 : x = -84.1, y = 1.75, z = 1.5 (dx = 85.93)
 Evaluation of L on whole width of road

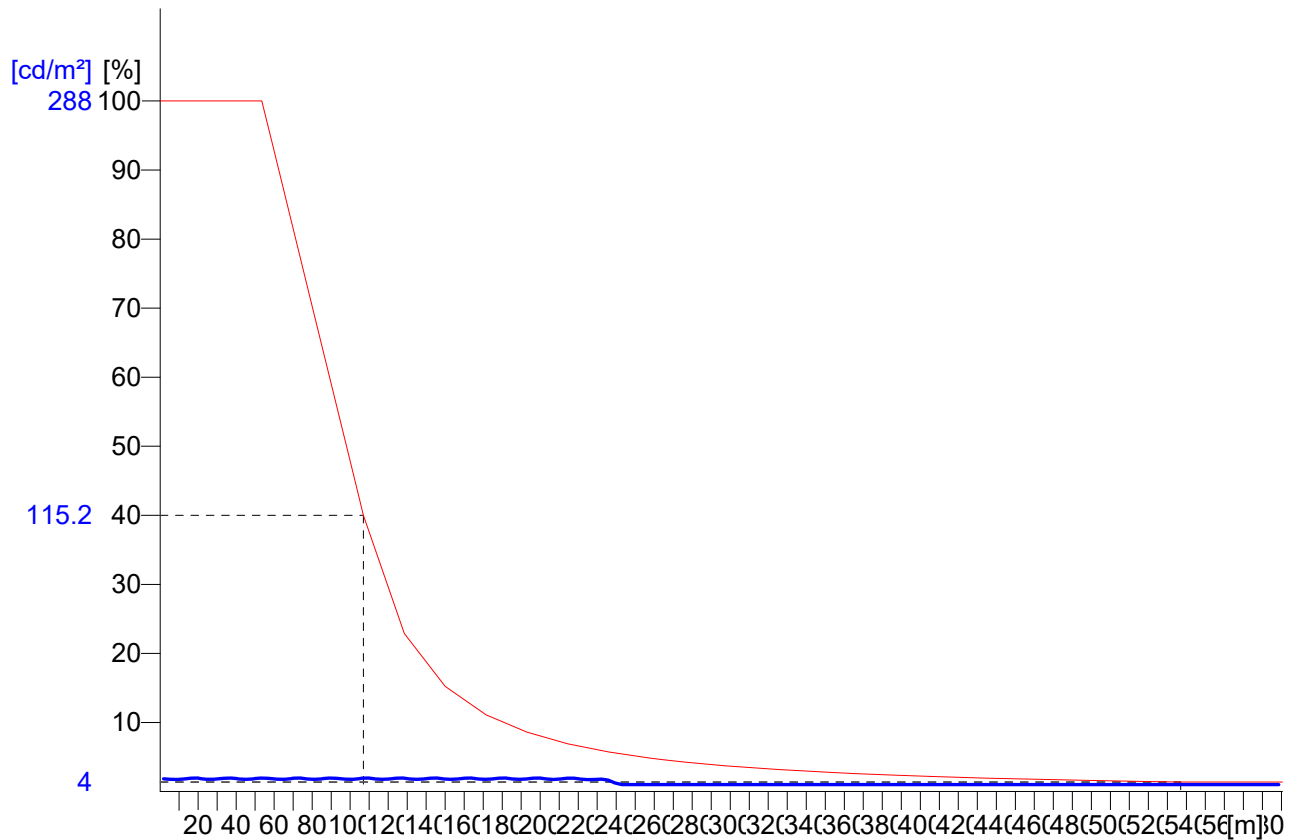
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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2.2 Calculation results, NIGHT TIME

2.2.3 Evolution, Adaptation (L), S1: 100%, Obs. 2



Observer location 2 : x = -84.1, y = 5.25, z = 1.5 (dx = 85.93)
Evaluation of L on whole width of road

Signature 1
Signature 2
Signature 3
Signature 4
Signature 5

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2 NIGHT TIME

2.3 Calculation results, NIGHT TIME

2.3.1 Table, NIGHT TIME (L), S1: 100%, Obs. 1

[m]	5.07	4.84	(4.65)	4.77	4.7	4.91	5.17	5.33	5.33	5.1	4.87	4.68	4.78	4.72
6.42	5.52	5.33	5	5.03	5.04	5.38	5.64	5.77	5.79	5.54	5.35	5.02	5.04	5.06
5.25	5.8	5.59	5.33	5.37	5.41	5.67	5.84	5.88	5.91	5.81	5.6	5.33	5.38	5.42
4.08	5.83	5.62	5.33	5.39	5.44	5.69	5.93	5.91	[5.95]	5.83	5.62	5.33	5.39	5.44
2.92	5.57	5.37	5.04	5.06	5.09	5.4	5.67	5.75	5.77	5.58	5.38	5.04	5.06	5.09
1.75	5.11	4.9	4.69	4.75	4.72	4.91	5.16	5.27	5.29	5.12	4.91	4.7	4.76	4.72
0.58	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00



Part1

Observer location 1 : x = -40, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 5.33 cd/m²
Minimum luminance L_{min} : 4.65 cd/m²
Overall uniformity U_o : $L_{min}/\bar{L}_m$: 0.87
Longitudinal uniformity U_l : $L_{l,min}/L_{l,max}$: 0.87

Handwritten signatures:
1. *[Signature]*
2. *[Signature]*
3. *[Signature]*
4. *[Signature]*
5. *[Signature]*

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2 NIGHT TIME

2.3 Calculation results, NIGHT TIME

2.3.1 Table, NIGHT TIME (L), S1: 100%, Obs. 1

4.92	5.2	5.34	5.35	5.12	4.89	4.69	4.79	4.73	4.92	5.19
5.39	5.65	5.77	5.8	5.55	5.36	5.02	5.05	5.06	5.39	5.64
5.67	5.85	5.89	5.92	5.81	5.6	5.33	5.38	5.42	5.67	5.84
5.69	5.93	5.91	[5.95]	5.83	5.6	5.33	5.38	5.44	5.68	5.92
5.4	5.67	5.75	5.77	5.58	5.38	5.04	5.06	5.09	5.4	5.66
4.92	5.17	5.27	5.3	5.12	4.92	4.71	4.76	4.73	4.92	5.16
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00

[m]



Part2

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.2 Table, NIGHT TIME (E), S1: 100%

[m]	67.9	59	52.5	50.9	52.5	59	67.9	75.8	75.8	67.9	59	52.5	51	52.5
6.42														
5.25	73.8	63.6	55.4	52.8	55.4	63.6	73.9	82.7	82.7	73.9	63.6	55.5	52.8	55.5
4.08	76.3	66.3	57.9	55.5	57.9	66.3	76.3	84	84	76.3	66.3	57.9	55.5	57.9
2.92	76.8	66.4	58	55.4	58	66.5	76.8	84.4	84.4	76.8	66.5	58	55.4	58
1.75	74	63.7	55.3	52.5	55.3	63.7	74	82.3	82.3	74	63.7	55.3	52.5	55.3
0.58	67.1	58.5	51.8	50	51.8	58.6	67.1	74.7	74.7	67.1	58.6	51.9	50	51.9
	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00
Illuminance [lx]														



Part1

Height reference plane : 0.00 m
Average illuminance $\bar{E}_m$: 65 lx
Minimum illuminance E_{min} : 50 lx
Maximum illuminance E_{max} : 84.4 lx
Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.3 (0.77)
Diversity U_d E_{min}/E_{max} : 1 : 1.69 (0.59)

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.2 Table, NIGHT TIME (E), S1: 100%

59	67.9	75.8	75.8	67.9	59	52.5	50.9	52.5	59	67.9
63.6	73.9	82.7	82.7	73.9	63.6	55.5	52.8	55.5	63.6	73.9
66.3	76.3	84	84	76.3	66.3	57.9	55.5	57.9	66.3	76.3
66.5	76.8	[84.4]	[84.4]	76.8	66.5	58	55.4	58	66.5	76.8
63.7	74	82.4	82.4	74	63.7	55.3	52.5	55.3	63.7	74
58.6	67.1	74.7	74.7	67.1	58.6	51.9	(50)	51.8	58.6	67.1
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00 [m]



Part2

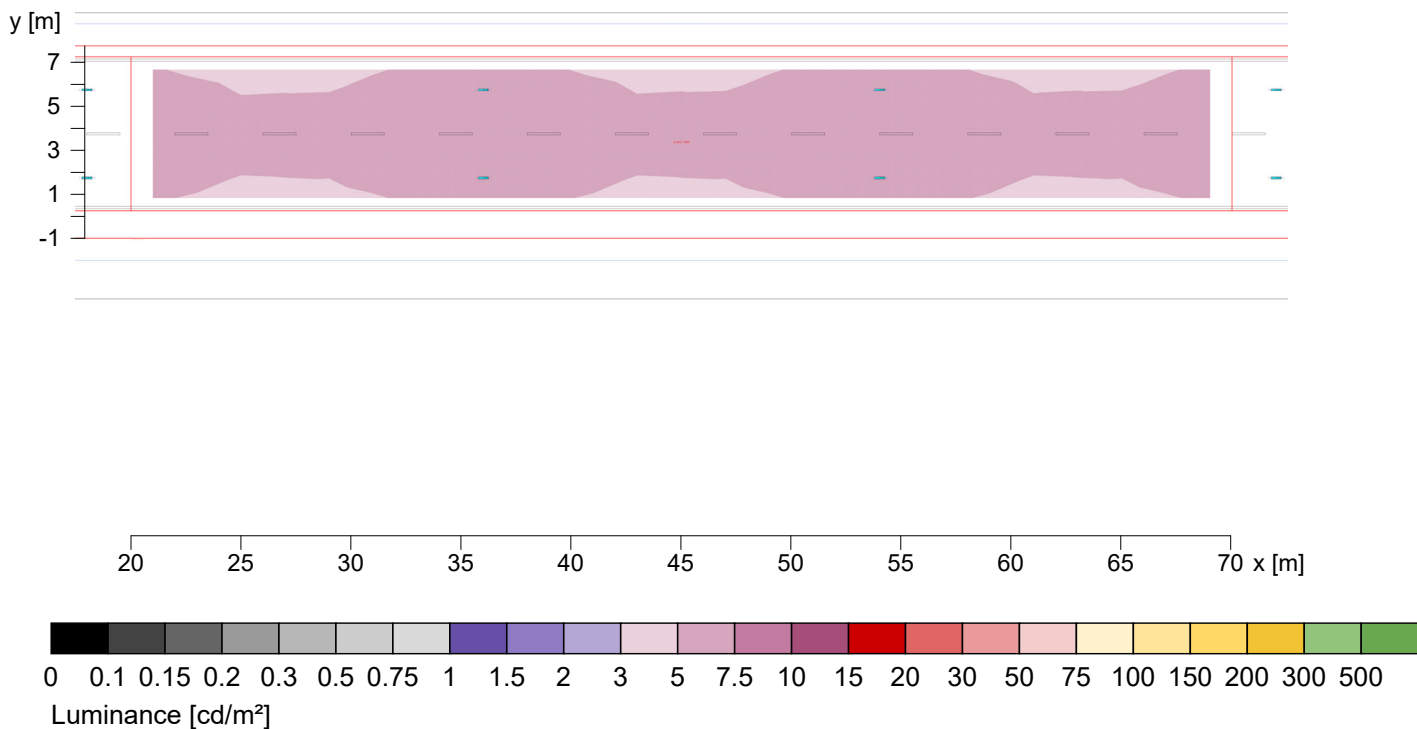
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.3 Pseudo colours, NIGHT TIME (L), S1: 100%, Obs. 1



Observer location 1		: x = -40, y = 1.75, z = 1.5 (dx = 6
Average luminance	$\bar{L}_m$	: 5.33 cd/m ²
Minimum luminance	L_{min}	: 4.65 cd/m ²
Overall uniformity U_o	$L_{min}/\bar{L}_m$	: 0.87
Longitudinal uniformity U_l	$L_{l,min}/L_{l,max}$	: 0.87

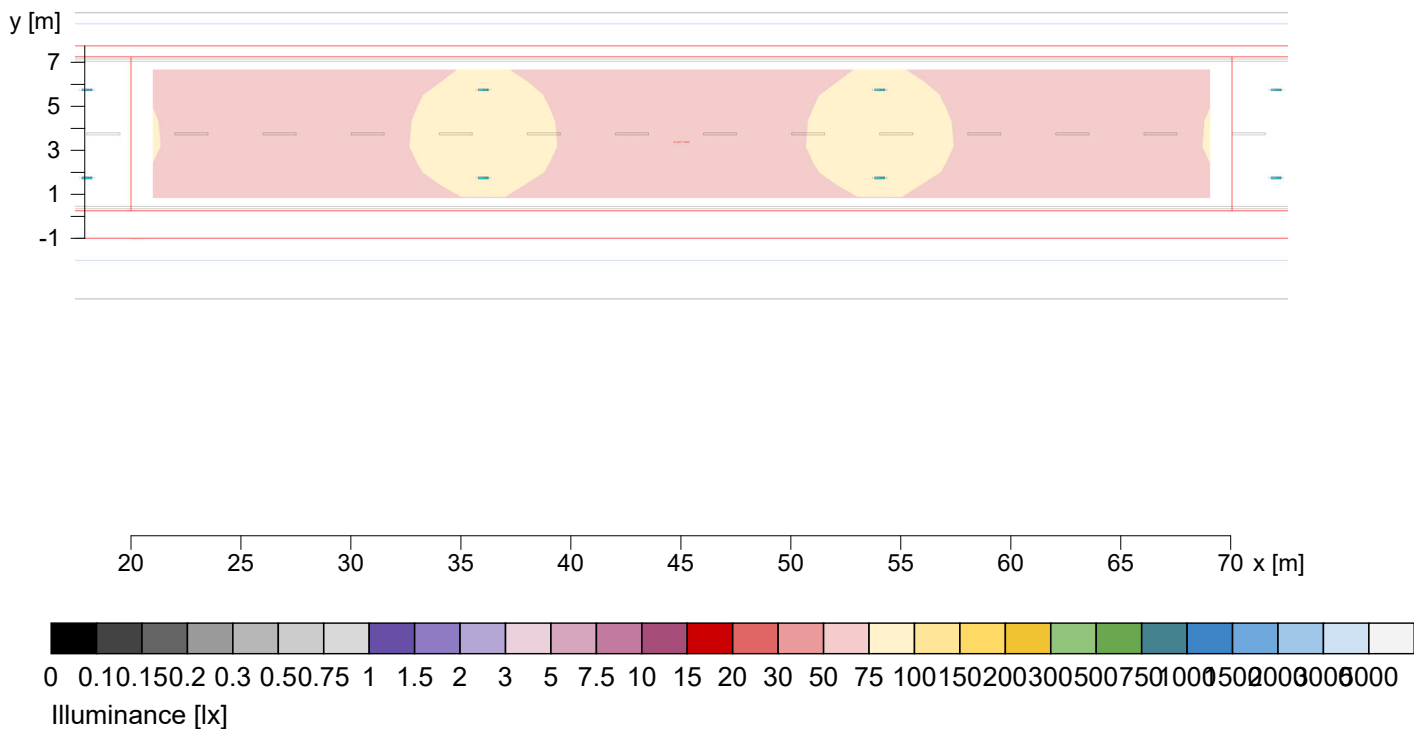
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



2.3 Calculation results, NIGHT TIME

2.3.4 Pseudo colours, NIGHT TIME (E), S1: 100%



Height reference plane
 Average illuminance
 Minimum illuminance
 Maximum illuminance
 Uniformity U_0
 Diversity U_d

$\bar{E}_m$: 0.00 m
 E_{min} : 65 lx
 E_{max} : 50 lx
 $E_{min}/\bar{E}_m$: 84.4 lx
 E_{min}/E_{max} : 1 : 1.3 (0.77)
 E_{min}/E_{max} : 1 : 1.69 (0.59)

[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



3 EMERGENCY

3.1 Description, EMERGENCY

3.1.1 Luminaire list

Adaptation
 LDC in use

Interior
 LDC in use

6

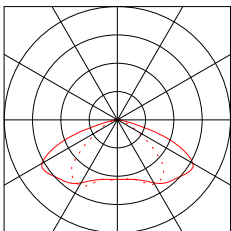
Bajaj

Order No. : s

Luminaire name : E230315 BJTU S 108L NW SYM PC

Equipment : 1 x Unknown 80 W / 9976 lm

Maintenance factor: 0.85



Row of luminaires: Row 2.1

Number of luminaires: 71

Basic position: x=0.00m y=1.50m, z=6.50m

Rotation: z=0.0° C0=0.0° C90=0.0°

System power (total): 5.7kW (1.27 km)

Constant distance: 18.00m

Flicker frequency (v=80 km/h): 1.2 Hz

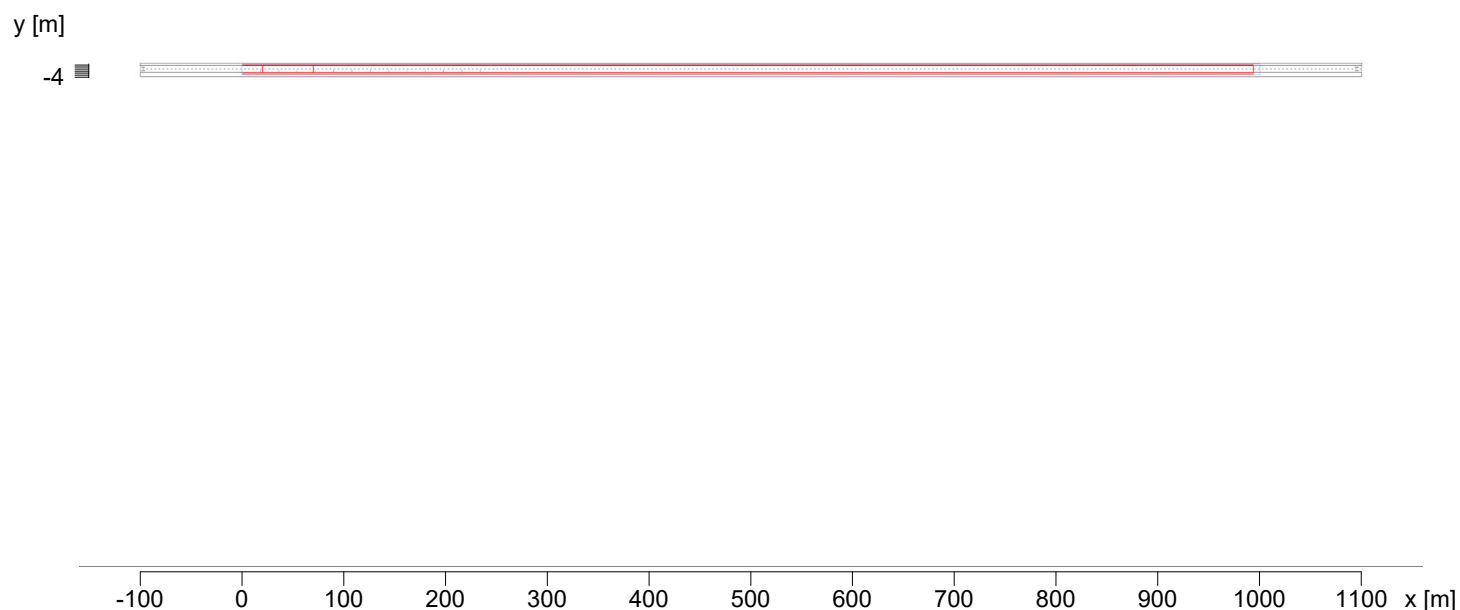
Nr.	Pos. X [m]	Power level	Control gr.S1	Int.1
1	0.00	80W / 9.98klm	2	100% 100%
2	18.00	80W / 9.98klm	2	100% 100%
3	36.00	80W / 9.98klm	2	100% 100%
4	54.00	80W / 9.98klm	2	100% 100%
5	72.00	80W / 9.98klm	2	100% 100%
6	90.00	80W / 9.98klm	2	100% 100%
7	108.00	80W / 9.98klm	2	100% 100%
8	126.00	80W / 9.98klm	2	100% 100%
9	144.00	80W / 9.98klm	2	100% 100%
10	162.00	80W / 9.98klm	2	100% 100%
11	180.00	80W / 9.98klm	2	100% 100%
12	198.00	80W / 9.98klm	2	100% 100%
13	216.00	80W / 9.98klm	2	100% 100%
14	234.00	80W / 9.98klm	2	100% 100%

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
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Date : 23.09.2024

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3.1 Description, EMERGENCY

3.1.2 Floor plan



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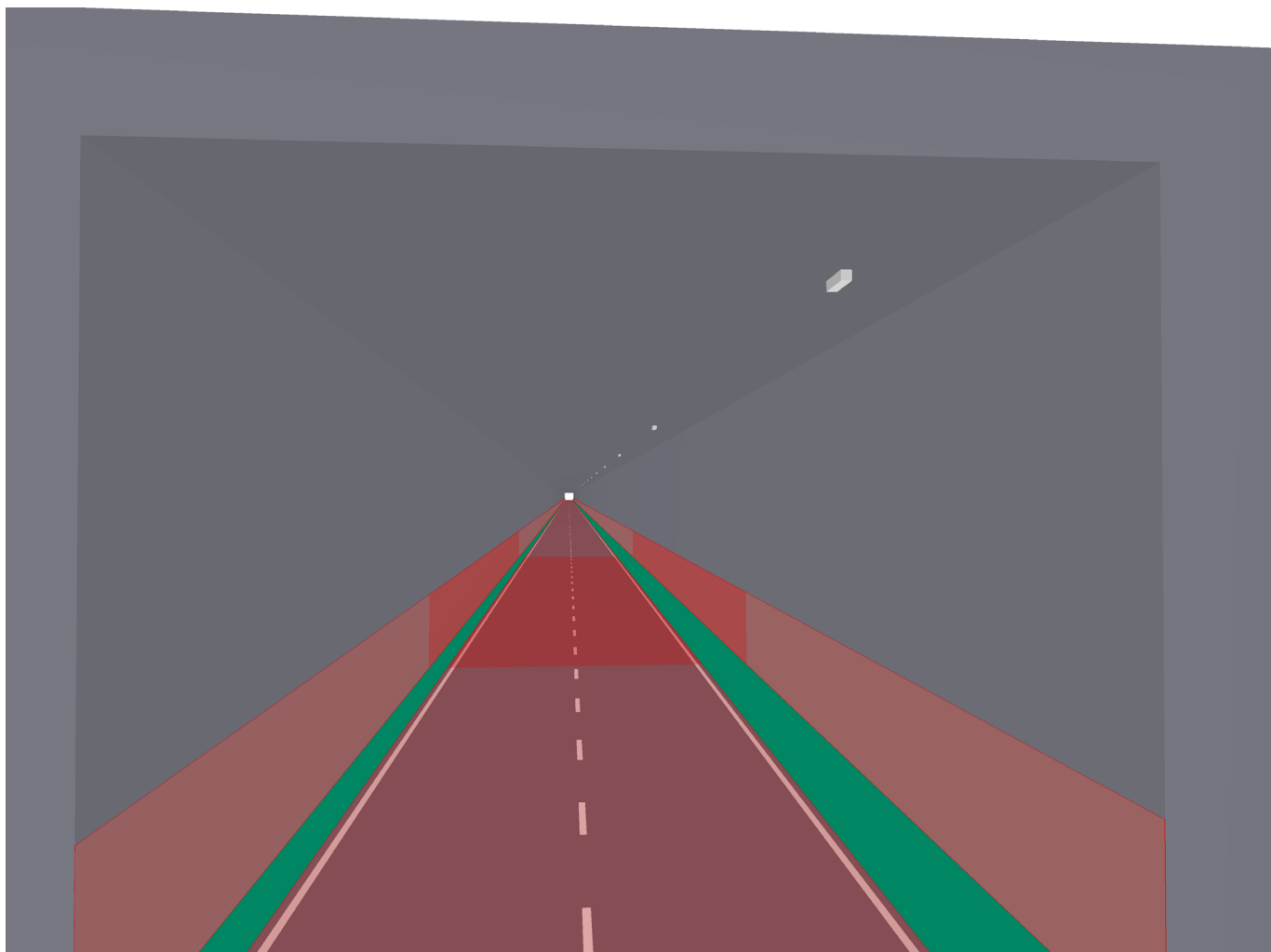
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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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3.1 Description, EMERGENCY

3.1.3 3D view, View 1



Handwritten signatures:
1. *Shubh*
2. *Adar*
3. *Rob*
4. *CSA Son*
5. *Sanjay Kumar*

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
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3 EMERGENCY

3.2 Calculation results, EMERGENCY

3.2.1 Result overview, S1: 100%

Regulating step: S1: 100%

Adaptation

Interior 1: 100%
 2: 100%

Adaptation, Threshold and transition zone

Measuring range: 0.00 m - 993.60 m Points: nx = 276, ny = 6, nz = 3

Observer (starting point coordinate) : x = -84.13 m; z = 1.50 m dx = 85.93 m (moving)
 y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

Wall left (diffus 30%)

Wall right (diffus 30%)

EMERGENCY

Measuring range: 20.00 m - 70.00 m Points: nx = 25, ny = 6, nz = 3

Observer (starting point coordinate) : x = -40.00 m; z = 1.50 m dx = 61.00 m (fix)
 y = 1.75 m y = 5.25 m

Roadway (R1, q0 = 0.09)

$\bar{L}_m$	:	2.66 cd/m ²	2.67 cd/m ²	
U_o	$L_{min}/\bar{L}_m$	: 0.73	0.74	0.4
U_l	$L_{l,min}/L_{l,max}$	: 0.87	0.87	0.6
$f_{TI,max}$	Max.	: 7 %	5 %	

Wall left (diffus 30%)

$\bar{L}_m$	:	1.89 cd/m ²
U_o	$L_{min}/\bar{L}_m$	: 0.83
L_{wall}/L_{fsp}	:	0.79

Wall right (diffus 30%)

$\bar{L}_m$	:	2.08 cd/m ²
U_o	$L_{min}/\bar{L}_m$	: 0.63
L_{wall}/L_{fsp}	:	0.71

Illuminance

Roadway

$\bar{E}_m$	:	32.48 lx
U_o	$E_{min}/\bar{E}_m$	: 0.72

Wall left

$\bar{E}_m$	:	19.77 lx
U_o	$E_{min}/\bar{E}_m$	: 0.83

Wall right

$\bar{E}_m$	:	21.80 lx
U_o	$E_{min}/\bar{E}_m$	: 0.63

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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3 EMERGENCY

3.2 Calculation results, EMERGENCY

3.2.1 Result overview, S1: 100%

qc: The backward reflecion of the road was calculated.







-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMERGENCY (L), S1: 100%, Obs. 1

[m]	2.08	1.96	(1.95)	2.01	(1.95)	1.98	2.12	2.23	2.22	2.08	1.96	1.96	2.01	(1.95)
6.42	2.47	2.36	2.3	2.33	2.3	2.43	2.56	2.65	2.66	2.48	2.37	2.31	2.34	2.31
5.25	2.77	2.64	2.54	2.58	2.62	2.73	2.85	2.87	2.89	2.78	2.65	2.55	2.59	2.63
4.08	2.93	2.84	2.69	2.73	2.71	2.85	2.9	2.97	2.98	2.94	2.85	2.69	2.74	2.71
2.92	3.05	2.98	2.71	2.72	2.75	2.95	3.08	3.09	3.1	3.06	2.98	2.71	2.72	2.75
1.75	3.09	2.99	2.78	2.8	2.82	2.98	3.12	3.14	3.15	3.1	2.99	2.79	2.81	2.82
0.58	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00



Part1

Observer location 1 : x = -40, y = 1.75, z = 1.5 (dx = 61.00)
Average luminance $\bar{L}_m$: 2.66 cd/m²
Minimum luminance L_{min} : 1.95 cd/m²
Overall uniformity U_o $L_{min}/\bar{L}_m$: 0.73
Longitudinal uniformity U_l $L_{l,min}/L_{l,max}$: 0.87

[Handwritten signatures]

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Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



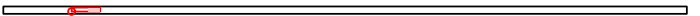
3 EMERGENCY

3.3 Calculation results, EMERGENCY

3.3.1 Table, EMERGENCY (L), S1: 100%, Obs. 1

1.98	2.12	2.23	2.23	2.09	1.96	1.96	2.01	(1.95)	1.98	2.12
2.44	2.57	2.66	2.67	2.49	2.37	2.31	2.34	2.31	2.44	2.57
2.74	2.86	2.88	2.89	2.78	2.66	2.55	2.59	2.63	2.74	2.87
2.85	2.9	2.97	2.98	2.94	2.83	2.7	2.74	2.71	2.85	2.9
2.95	3.08	3.09	3.1	3.06	2.98	2.71	2.72	2.75	2.95	3.07
2.98	3.12	3.14	[3.16]	3.1	3	2.79	2.81	2.82	2.98	3.12
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00

[m]



Part2

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMERGENCY (E), S1: 100%

[m]	27.7	24.8	23.5	(23.3)	23.5	24.8	27.7	30.6	30.6	27.7	24.8	23.5	(23.3)	23.5
6.42	33.5	29.4	27.2	26.3	27.2	29.4	33.5	37.4	37.4	33.5	29.4	27.2	26.3	27.2
5.25	37.1	32.4	28.9	27.8	28.9	32.4	37.1	41	41	37.1	32.4	28.9	27.8	28.9
4.08	38.4	33	28.6	27.4	28.6	33.1	38.4	42.6	42.6	38.4	33.1	28.6	27.5	28.6
2.92	40.1	34	28.1	26.4	28.1	34	40.1	45	45	40.2	34.1	28.2	26.4	28.2
1.75	40.5	34.4	29.1	27.7	29.1	34.4	40.5	[45.4]	[45.4]	40.5	34.4	29.2	27.7	29.2
0.58	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00	45.00	47.00
	Illuminance [lx]													



Part1

Height reference plane : 0.00 m
 Average illuminance $\bar{E}_m$: 32.5 lx
 Minimum illuminance E_{min} : 23.3 lx
 Maximum illuminance E_{max} : 45.4 lx
 Uniformity U_o $E_{min}/\bar{E}_m$: 1 : 1.39 (0.72)
 Diversity U_d E_{min}/E_{max} : 1 : 1.94 (0.51)

[Handwritten signatures]

-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.2 Table, EMERGENCY (E), S1: 100%

24.8	27.7	30.6	30.6	27.7	24.8	23.5	(23.3)	23.5	24.8	27.7
29.4	33.5	37.4	37.4	33.5	29.4	27.2	26.3	27.2	29.4	33.5
32.4	37.1	41	41	37.1	32.4	28.9	27.8	28.9	32.4	37.1
33.1	38.4	42.6	42.6	38.4	33.1	28.6	27.4	28.6	33.1	38.4
34.1	40.2	45	45	40.2	34.1	28.2	26.4	28.2	34	40.1
34.4	40.5	[45.4]	[45.4]	40.5	34.4	29.1	27.7	29.1	34.4	40.5
49.00	51.00	53.00	55.00	57.00	59.00	61.00	63.00	65.00	67.00	69.00 [m]



Part2

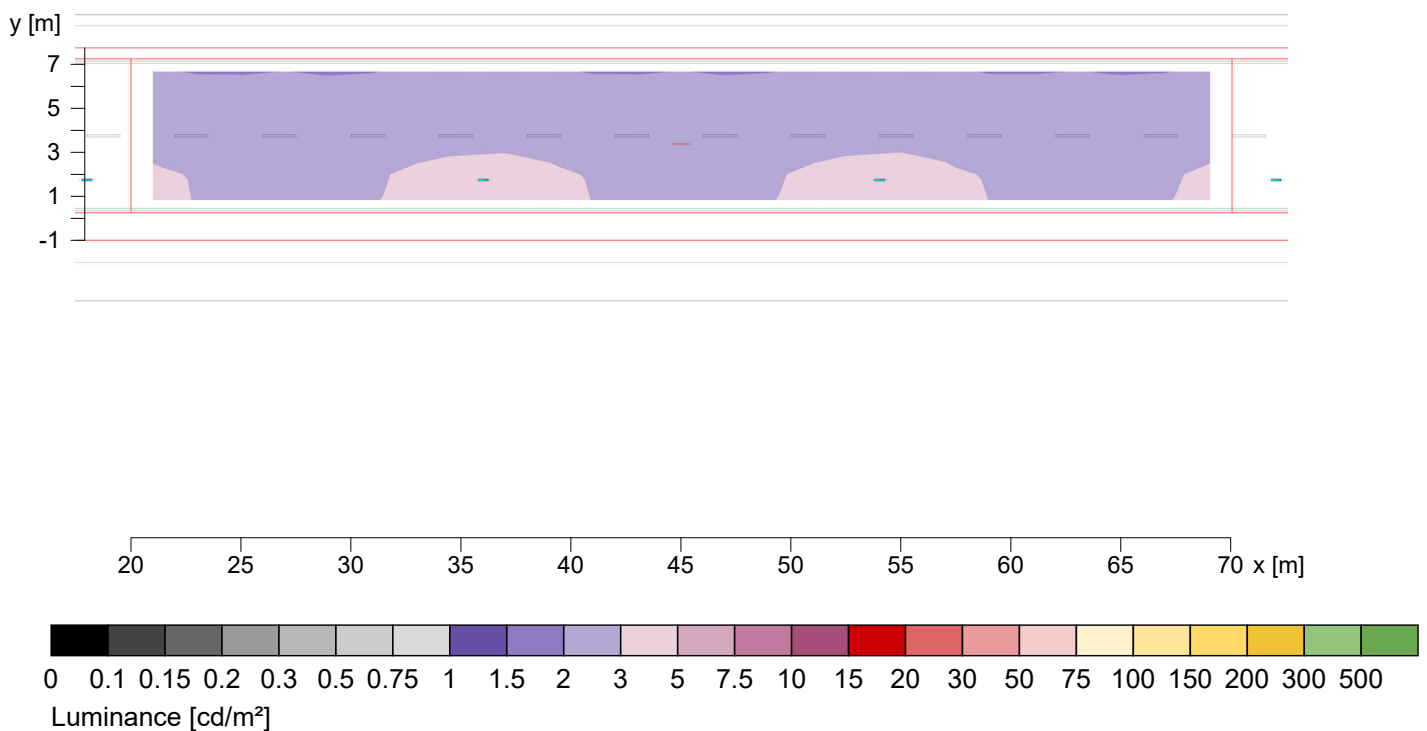
[Handwritten signatures]

Object : BBMP ROAD TUNNEL PROJECT
Installation : MAIN TUNNEL 220M ENTRY
Project number : 81942
Date : 23.09.2024

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3.3 Calculation results, EMERGENCY

3.3.3 Pseudo colours, EMERGENCY (L), S1: 100%, Obs. 1



Observer location 1
Average luminance
Minimum luminance
Overall uniformity U_o
Longitudinal uniformity U_l

$\bar{L}_m$: x = -40, y = 1.75, z = 1.5 (dx = 6) : 2.66 cd/m²
 L_{min} : 1.95 cd/m²
 $L_{min}/\bar{L}_m$: 0.73
 $L_{l,min}/L_{l,max}$: 0.87

[Handwritten signatures]

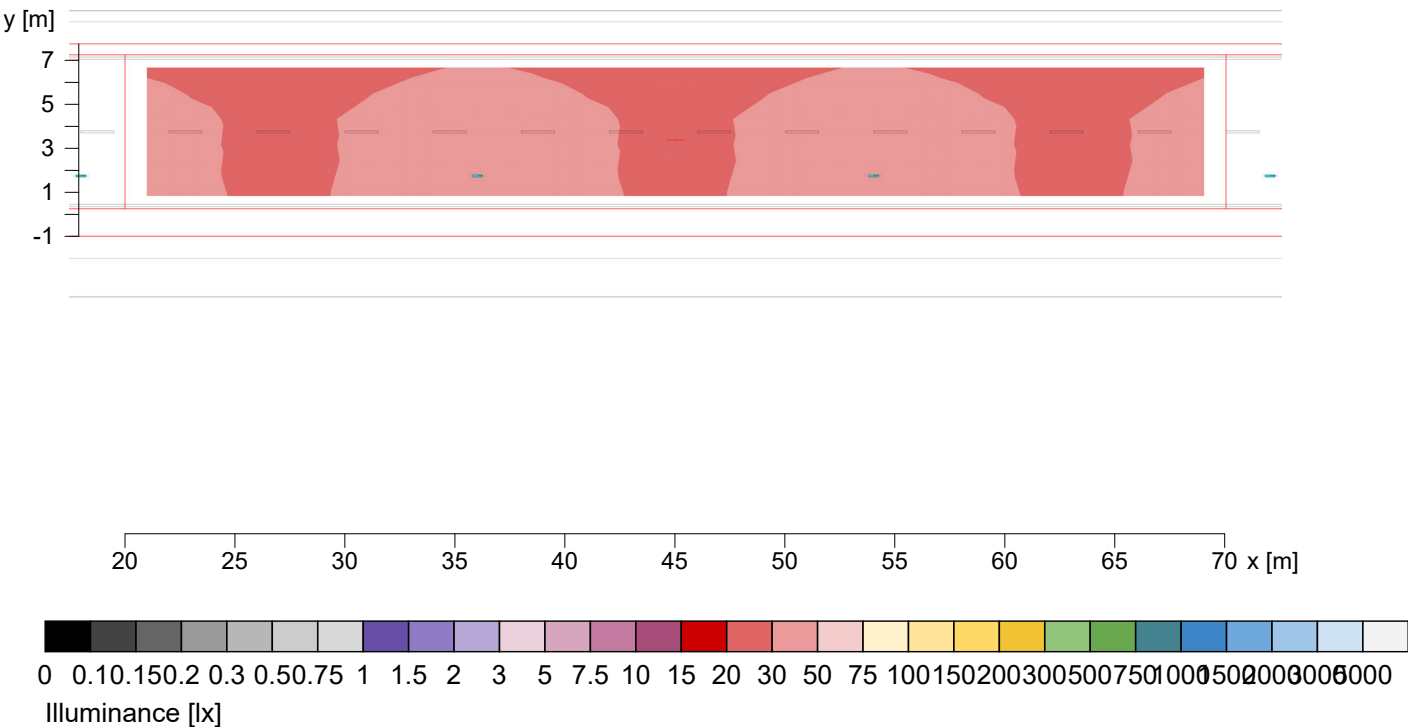
-please put your own address here-

Object : BBMP ROAD TUNNEL PROJECT
 Installation : MAIN TUNNEL 220M ENTRY
 Project number : 81942
 Date : 23.09.2024



3.3 Calculation results, EMERGENCY

3.3.4 Pseudo colours, EMERGENCY (E), S1: 100%



Height reference plane		: 0.00 m
Average illuminance	$\bar{E}_m$	: 32.5 lx
Minimum illuminance	E_{min}	: 23.3 lx
Maximum illuminance	E_{max}	: 45.4 lx
Uniformity U_0	$E_{min}/\bar{E}_m$	: 1 : 1.39 (0.72)
Diversity U_d	E_{min}/E_{max}	: 1 : 1.94 (0.51)

[Handwritten signatures]

APPENDIX - 5

Signature

Signature

Signature

Signature

Signature

Amelia

Adri

Rob

Emma

James

Design Summary

Site Details	Information
Name Site	BBMP Tunnel
Type of Project	Road Tunnel
SOLUTION -1	Public Safety Solutions (FM/VHF/UHF)
SOLUTION -2	Cellular Solutions (850,900,1800,2100,2300 and 2600) MHz
Additional Facilities	Break-in system (FM)

Public Safety Solution

Handwritten signatures:
1. [Signature]
2. [Signature]
3. [Signature]
4. [Signature]
5. [Signature]

Design Consideration & Assumptions (FM/VHF/UHF)

- Road tunnel project have 2 Tunnels with Tube -1 & Tube -2 will have Radio Rebroadcasting for following technologies:
 - a. VHF with 7-Channels (Police) 136 – 174 MHz – considered for Duplex operation
 - b. UHF with 2-Channels (Tunnel Maintenance) 400 MHz – considered for Duplex operation
 - c. FM with 12-Channels (with Emergency Break-in System) 88 – 108 MHz
 - d. VHF with 2-Channels (Fire) 136 – 174 MHz – considered for Duplex Operation
- **Break-in System-** Break-in system allow to interrupt in FM system to convert the “Emergency voice message” over the FM channel Bandwidth.
- Assumed that Start and end of Tunnel , there will be an Operator who will operate the Break-in system for FM.
- Proposed Main and secondary Headend system with Off-Air BDA & Master Unit at Start of Tunnel Control Room (depending upon site condition and signal pick up) for mounting of donor antennas (UHF/VHF/FM) which will be connected to Main Base Station System.
- Consider 7/8” LCX cable for UHF/VHF/FM services which will be layed along the walls of Main Tunnel tubes to extend the coverage inside the tunnel.
- Optical remote units of single cabinet with UHF/VHF/FM its feed through Leaky Cable inside the Tunnel.
- Tube 1 and Tube 2 is connected through cross passage .Every 500m there is a passage to connect Tube 1 and Tube 2.
- Proposed Optical remote units at cross passage area.
- Signal KPI Considered for UHF/VHF/FM/AM is -95dBm

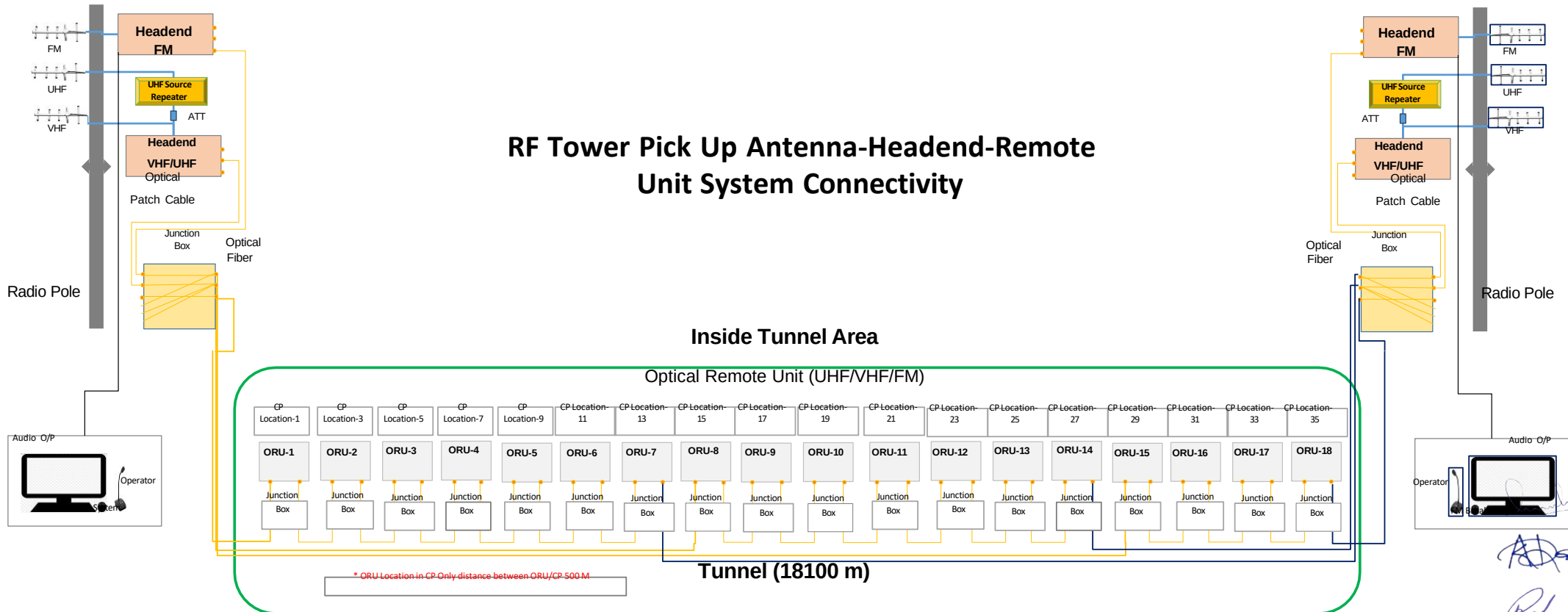
Tube 1 & 2 : Schematic Representation

UHF/VHF/FM

At Start of Tunnel
Headend-1 (Main)

At End of the Tunnel
Headend-2 (Redundant)

RF Tower Pick Up Antenna-Headend-Remote Unit System Connectivity



Handwritten signatures and notes:

Adar

Robo

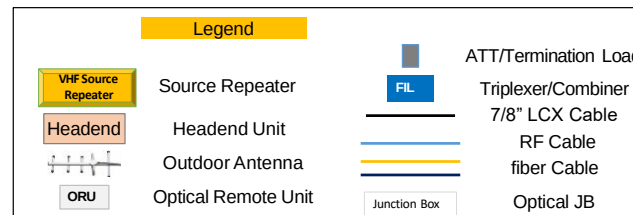
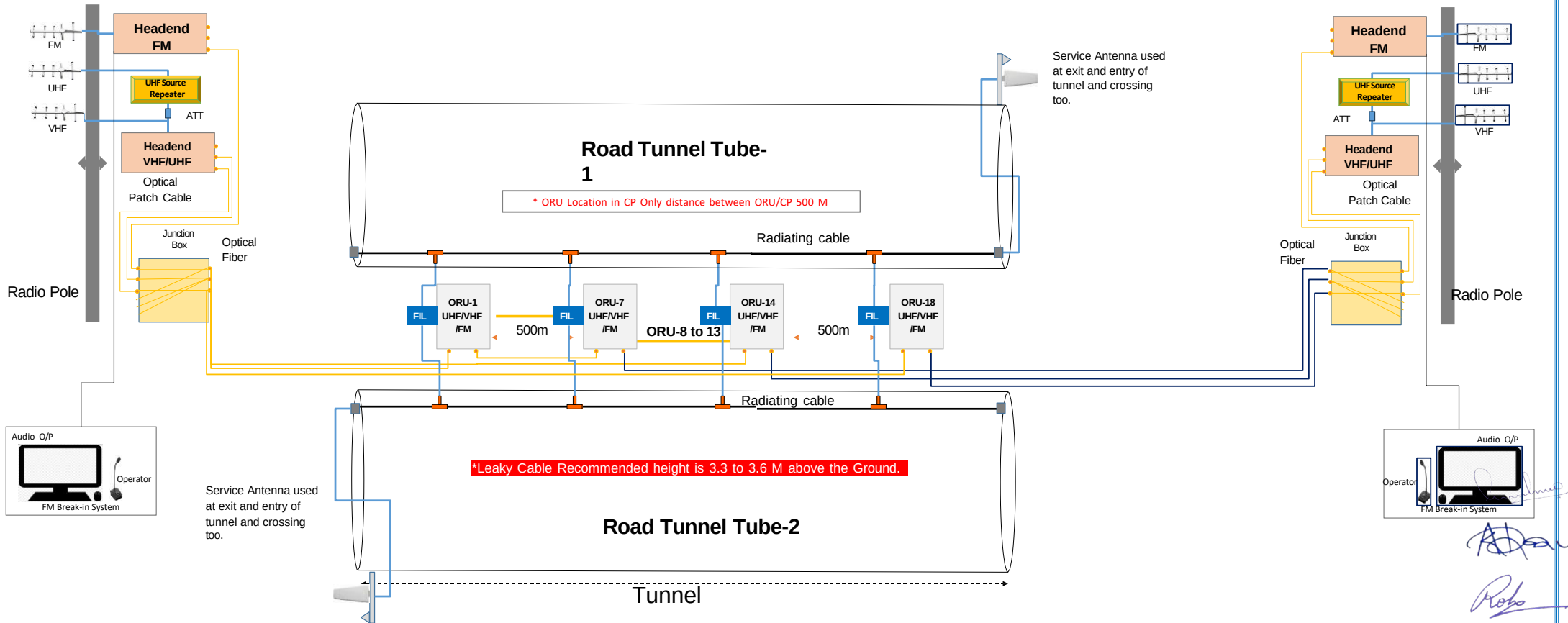
exa Son

5/10/2024

Remote to Leaky Cable Connectivity via Passive Equipment

At Start of Tunnel
Headend-1 (Main)

At End of the Tunnel
Headend-2 (Redundant)



Handwritten signatures and initials:
 A. A. A.
 R. S.
 P. S. S.
 S. S. S.
 6

Cellular Solution

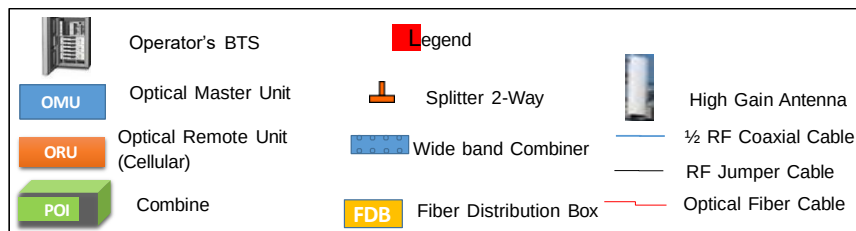
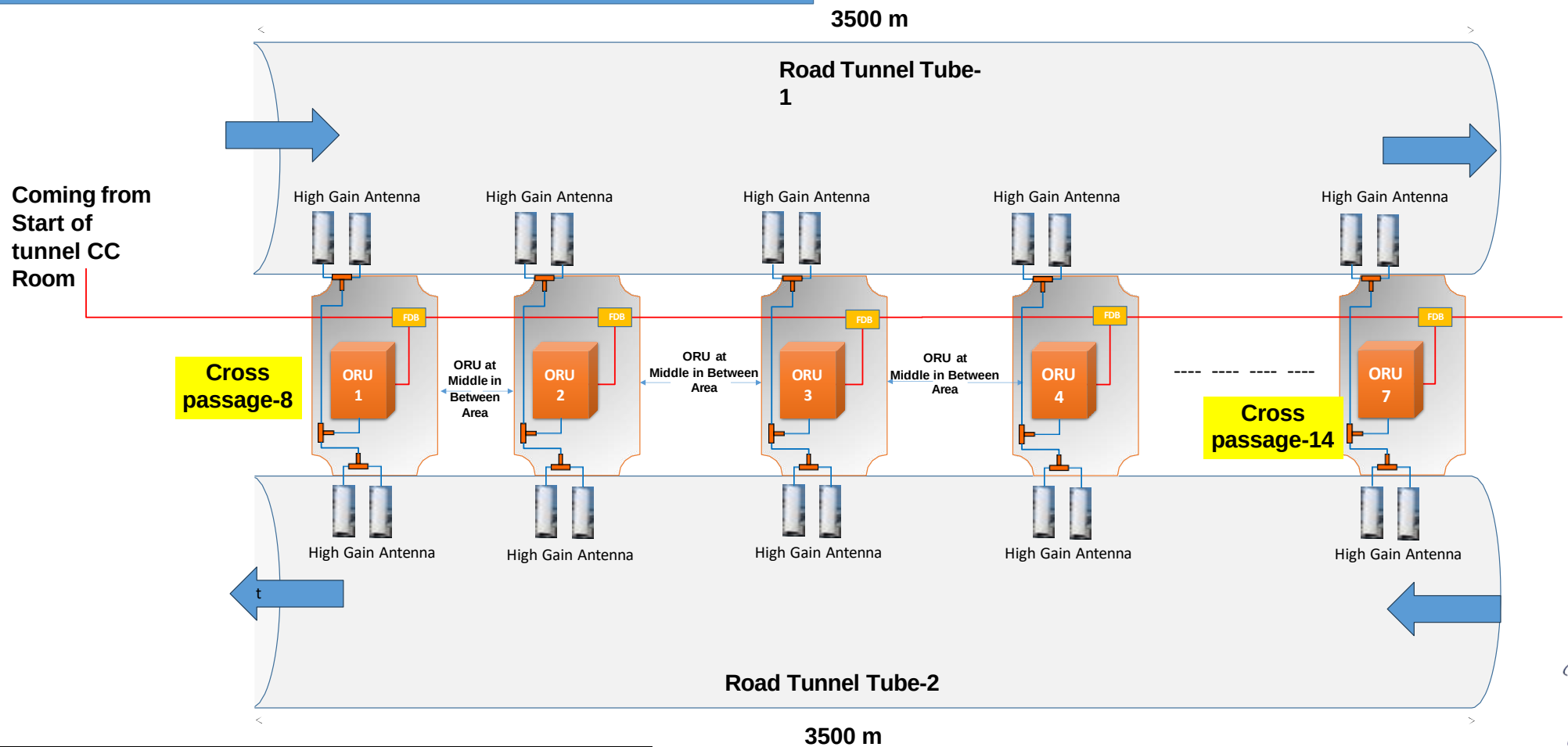
Handwritten signatures and initials in the bottom right corner, including "Handwritten", "A. D.", "Rob", "C. S.", and "G. S.".

Design Consideration & Assumptions (Cellular)

- The proposed Cellular Coverage System in Road Tunnels with Multiple-Operators with Multi-Cellular Technologies.
- OPCOs are operating in following bands. Hence considered following frequency accordingly.
 - 850 MHz LTE
 - 900 MHz. GSM + LTE
 - 1800 MHz. GSM + LTE
 - 2100 MHz. UMTS + LTE
 - 2300 MHz. LTE
 - 2600 MHz. LTE
- Considered 5 POI/Combination Combiner + 5 OMU and 35 ORU
- Considered handsets receive Target level of -95 dBm
- Considered High gain Antenna for Cellular services which will be Installed in both Tunnel tube to extend the coverage inside the tunnel.
- Fiber cable is not considered in BOQ and same to be provided by Main contractor/Client.

Tube 1 & 2 : Schematic Representation

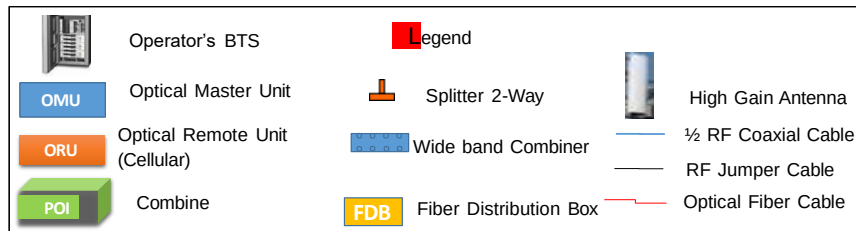
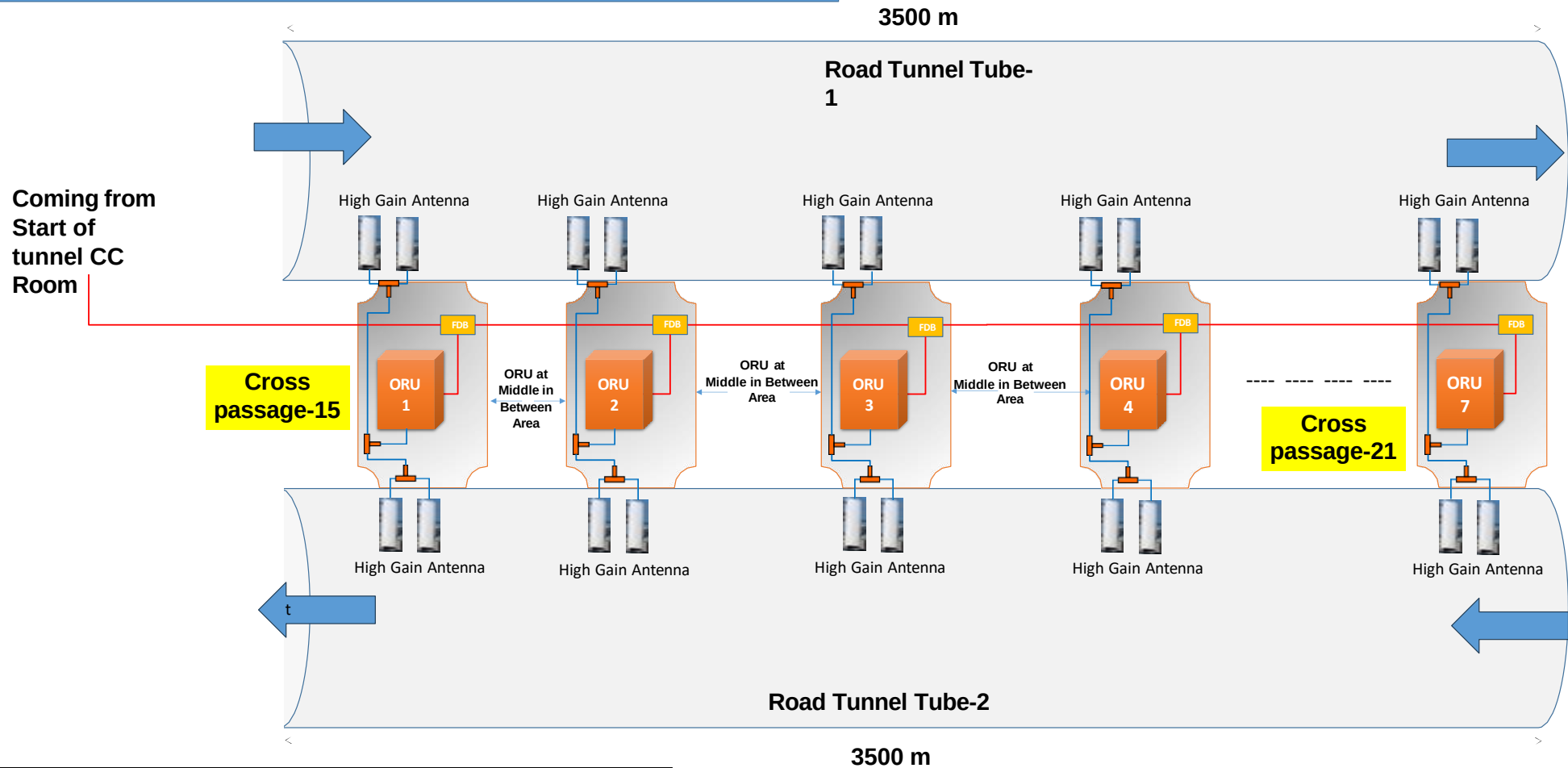
Cellular Solution Sector-2



- Proposed Multiple Operator BTS , BTS Output signal will be combined through Combiner and feed to Master Unit, MU will convert the RF to Optical signal and send it to ORU inside the tunnel.
- ORU will convert Optical Signal to RF signal and extend the coverage with High gain Antenna

Tube 1 & 2 : Schematic Representation

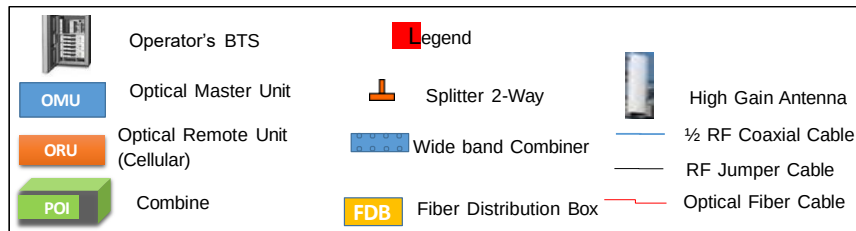
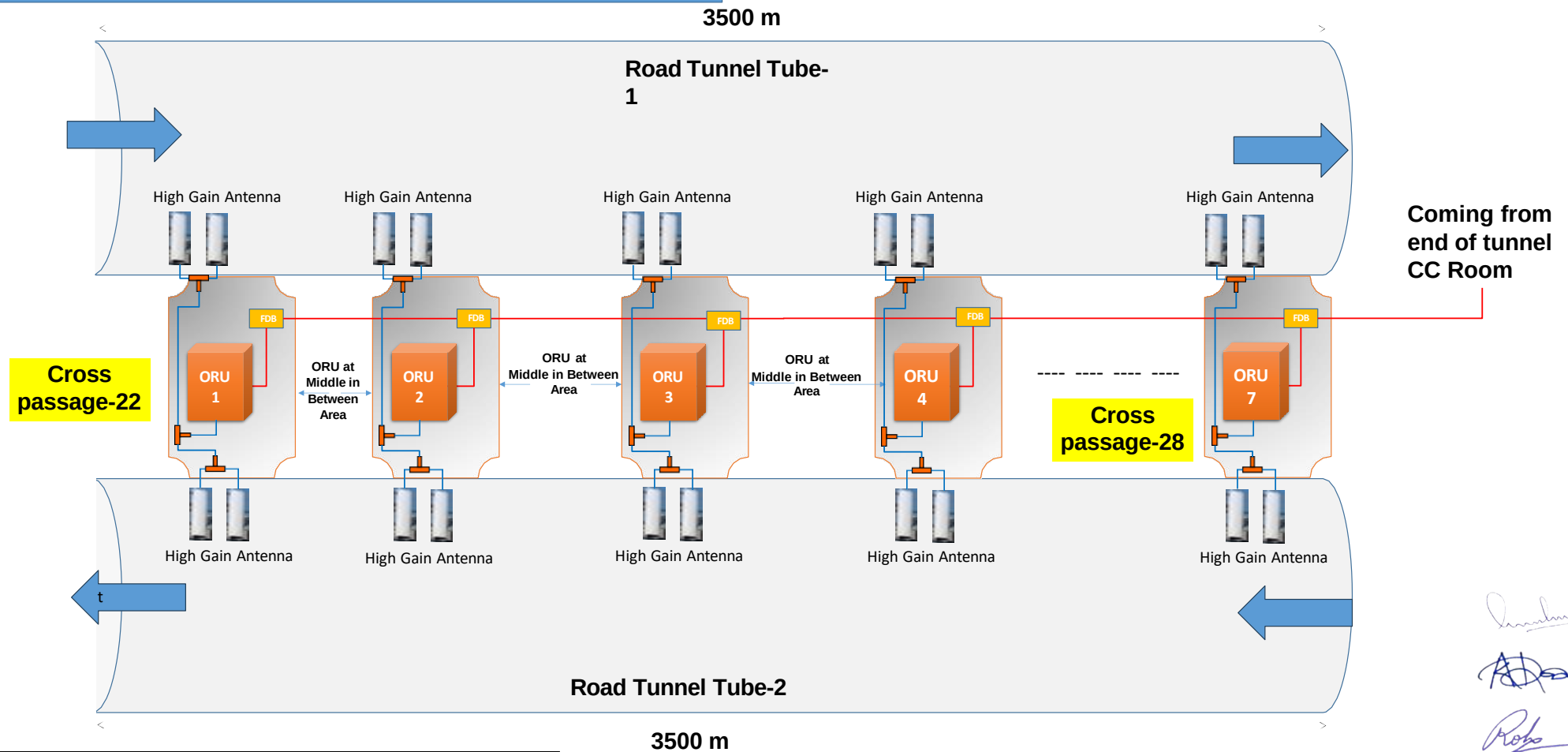
Cellular Solution Sector-3



- Proposed Multiple Operator BTS , BTS Output signal will be combined through Combiner and feed to Master Unit, MU will convert the RF to Optical signal and send it to ORU inside the tunnel.
- ORU will convert Optical Signal to RF signal and extend the coverage with High gain Antenna

Tube 1 & 2 : Schematic Representation

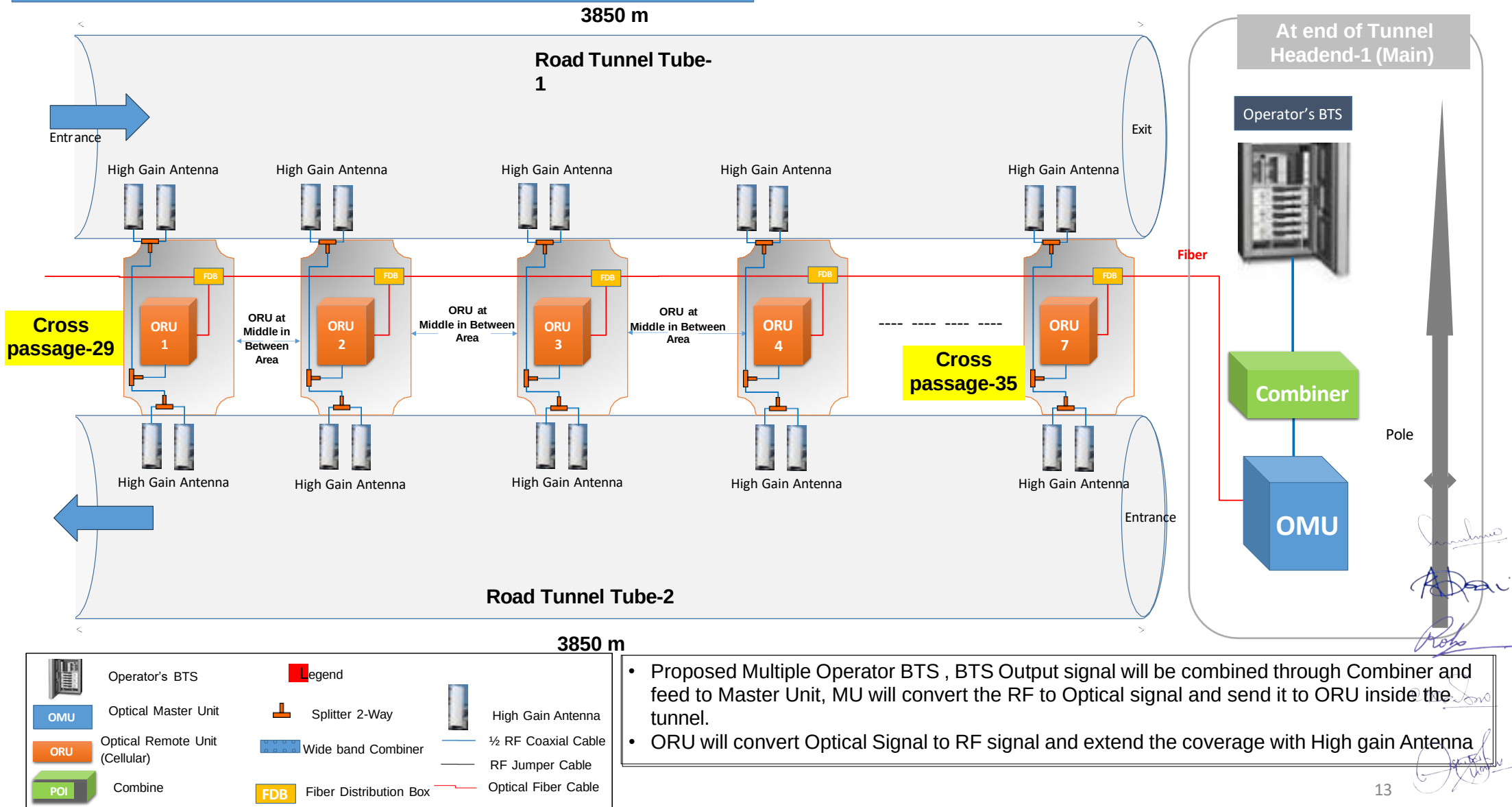
Cellular Solution Sector-4



- Proposed Multiple Operator BTS , BTS Output signal will be combined through Combiner and feed to Master Unit, MU will convert the RF to Optical signal and send it to ORU inside the tunnel.
- ORU will convert Optical Signal to RF signal and extend the coverage with High gain Antenna

Tube 1 & 2 : Schematic Representation

Cellular Solution Sector-5





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