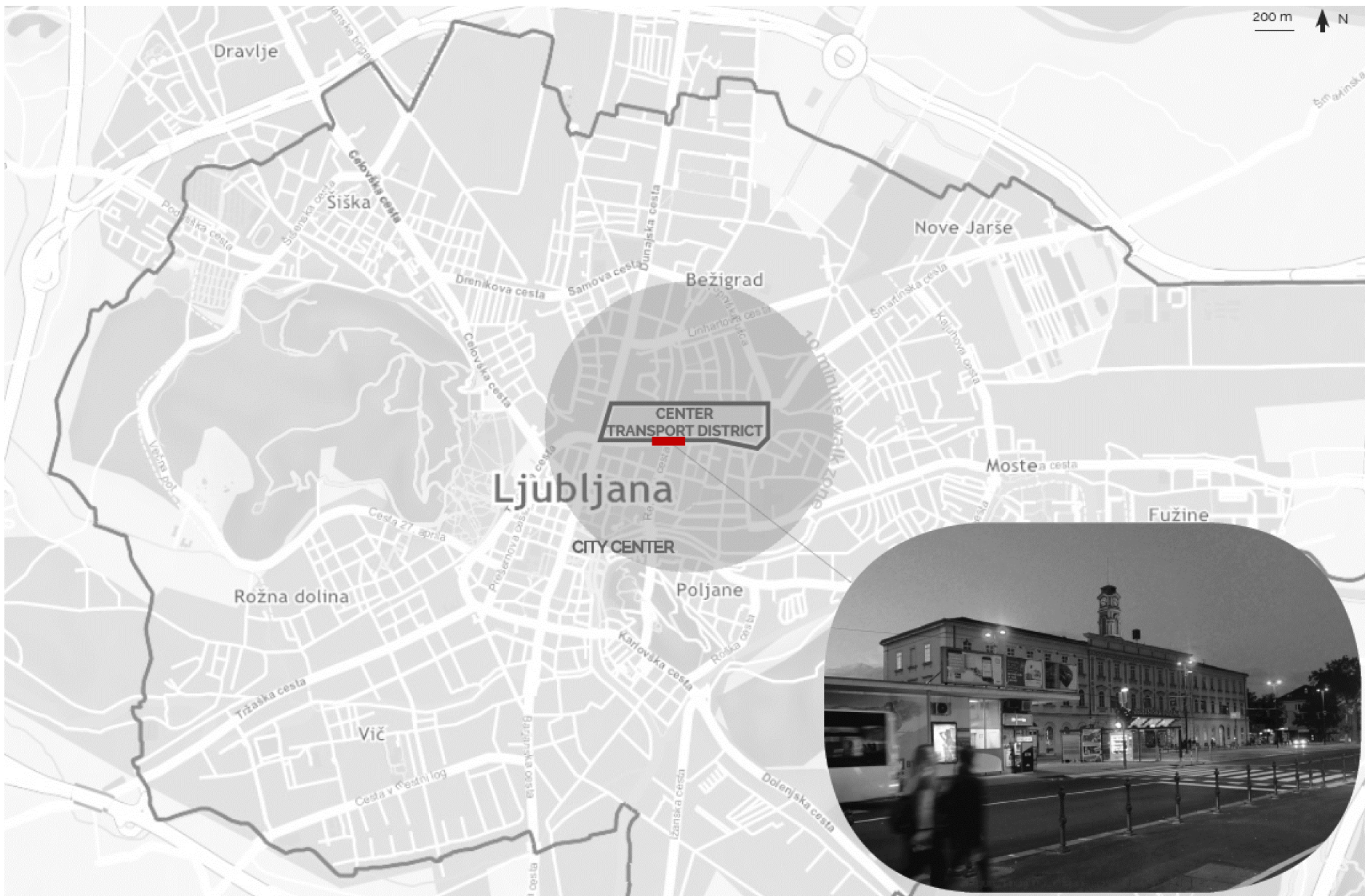


Lanlan WEI

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OUTDOOR LIGHTING PLAN

RETHINKING OF THE FAÇADE LIGHTING OF THE CENTRAL TRANSPORT DISTRICT OF LJUBLJANA



SKY PLANE

On a clear night, the brightness of the sky is generally below 0.1 cd/m^2 .

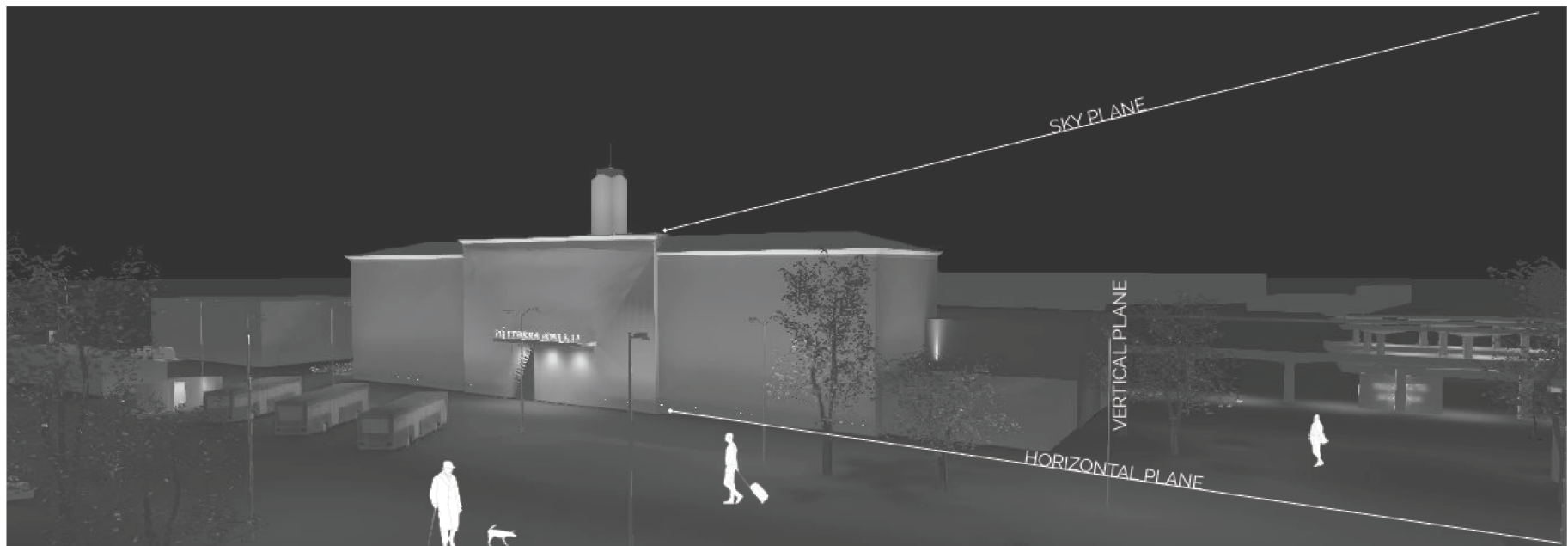
This area has been measured several times and the data shows the sky luminance between 0.02 cd/m^2 to 0.05 cd/m^2

VERTICAL PLANE

- Station sign
- Street billboard
- Cultural monument
- Clock tower
- Main facade
- Underpass
- Open platform
- Lighting box
- Traffic signals
- Bill board

HORIZONTAL PLANE

- Pedestrian path lighting
- Cycle way lighting
- Vehicle way lighting
- Public waiting area lighting
- Parking lots lighting
- Park lighting
- Underpass
- Open platform

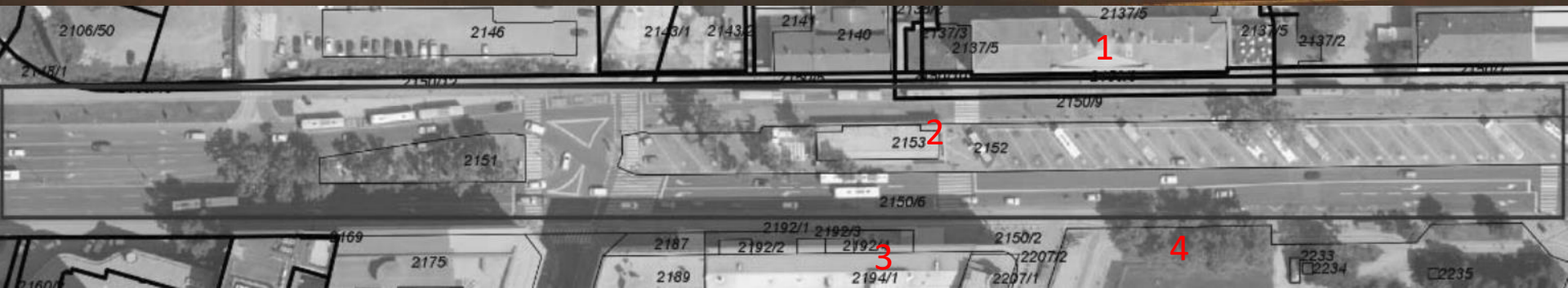
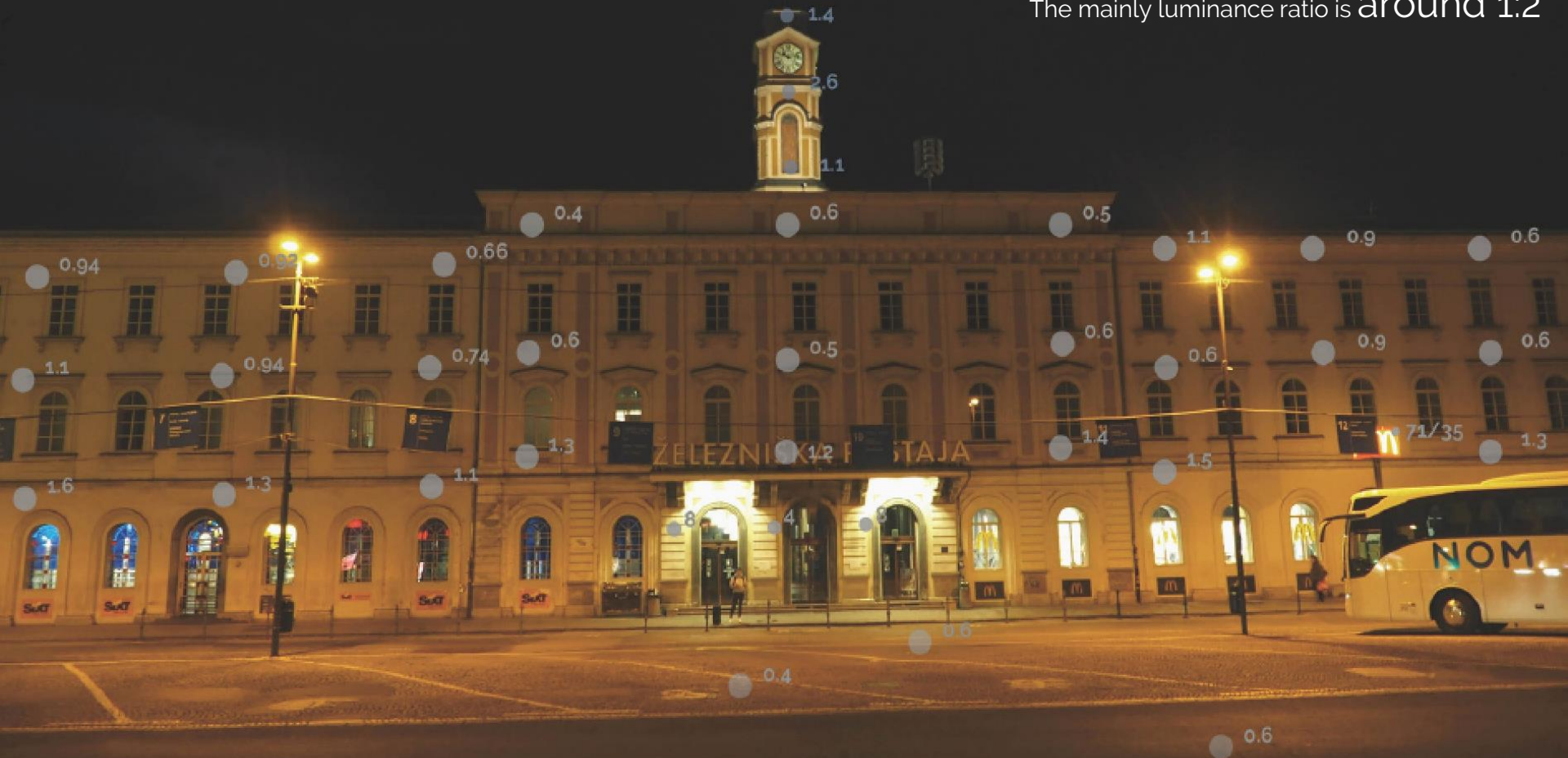


1

0.06

Luminance distribution map, main facade of the transportation services building

The mainly luminance ratio is around 1:2



Luminance distribution map, Ljubljana bus station

The mainly luminance ratio is around 60:1



1476 D U N A J S K A 1571 1320
PEKARNA IN SLAŠČIČARNA

Luminance distribution map, bakery entrance

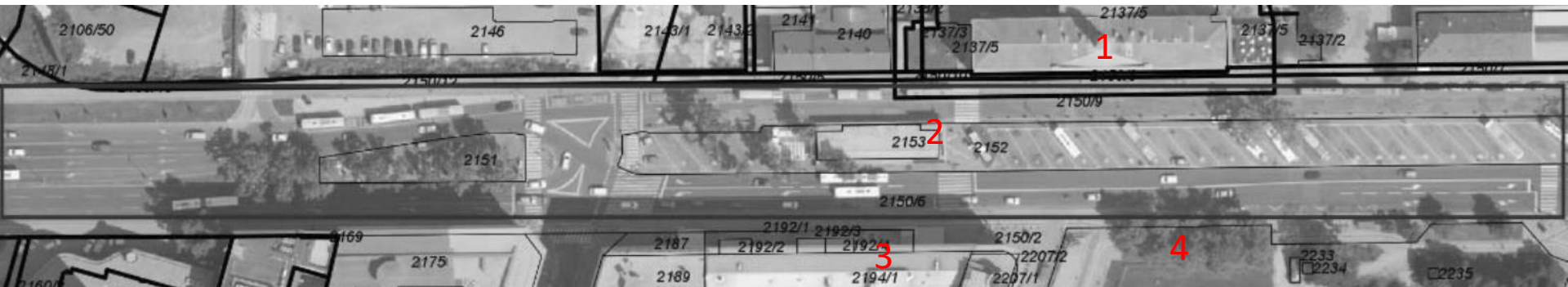
The average luminance of the light box surface is around 1400 cd/m^2 .



4



Park south of the station



Case study

01. THREE LOCATIONS IN THE CENTER OF ROME, ITALY

Source of data: Z Design and Planning Co. (北京远瞻照明设计有限公司)
measuring tool: Sekonic L-758C Cine Light Meter (CE Version)

The brightness data "<" on the image indicates that the brightness in this area is less than the minimum brightness value of $0.25 \text{ cd} / \text{m}^2$.



Figure 2.01: Monumento Nazionale a Vittorio Emanuele II, Roma, Italy, © ZDP lighting
Measurement time: 2019, 11 December 2013



Figure 2.02: Piazza del Popolo, Roma, Italy, © ZDP lighting
Measurement time: 17.49, 11 December 2013

The brightness ratio around **5:3:1** is the common ratio at three areas.

The ratio of focused to non-focused is around **5:1**.
(Z Design and Planning Co.)

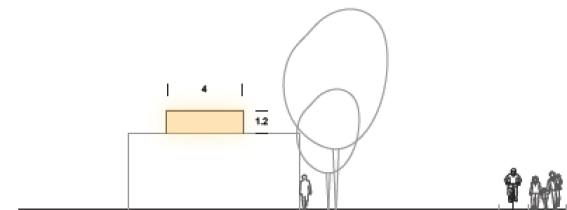
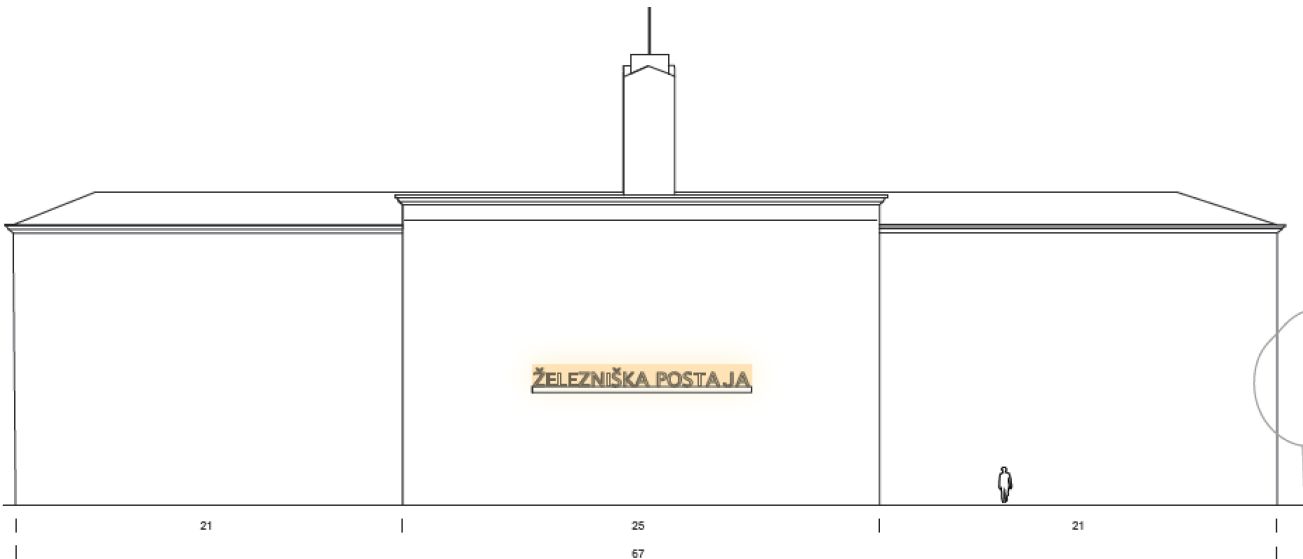
Station sign and street billboard

- Define the maximum level, adjust the brightness gradually over time.
- Billboard Size Limits.
- Power Density Limits.
- Advertising lighting with rapid color changes is not permitted.
- LED interior light box lighting is recommended
- Billboards shall be switched off completely after 00:30, or 30 minutes after the close of business

Lighting Zone Nighttime Maximum Luminance (cd/m²)

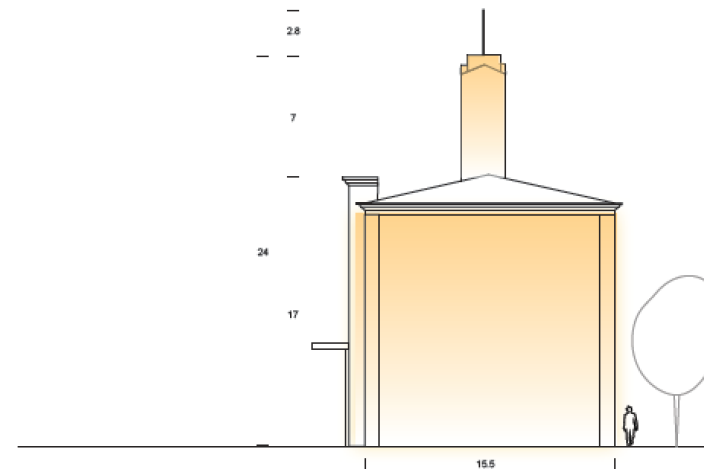
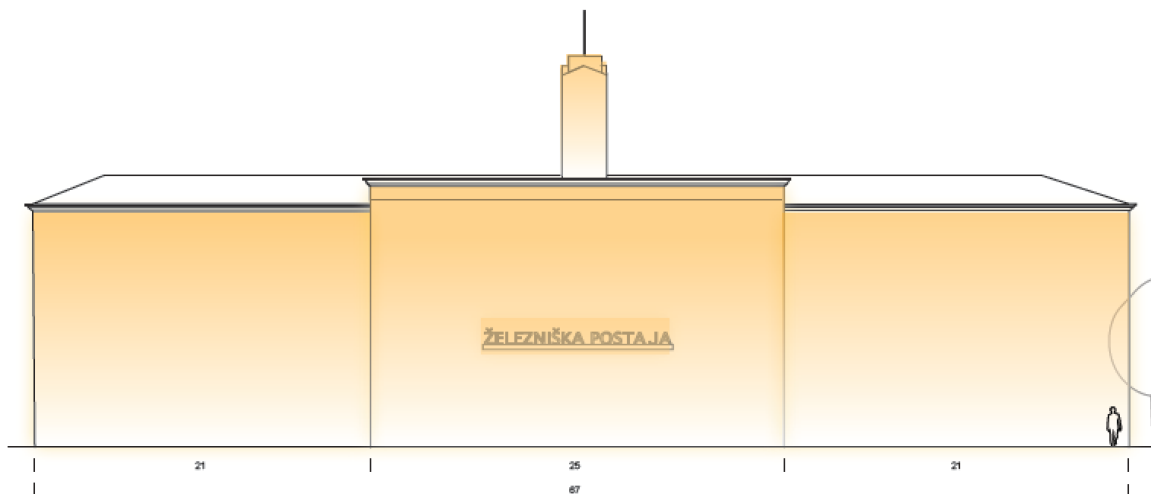
LZ1

20



Façade and clock tower area

- The luminance of the facade lighting section calculated from the average value of the total area of the facade lighting section shall not exceed 1 cd /m^2 .
- LED lighting fixture and intelligent control system are required.



Section B-B

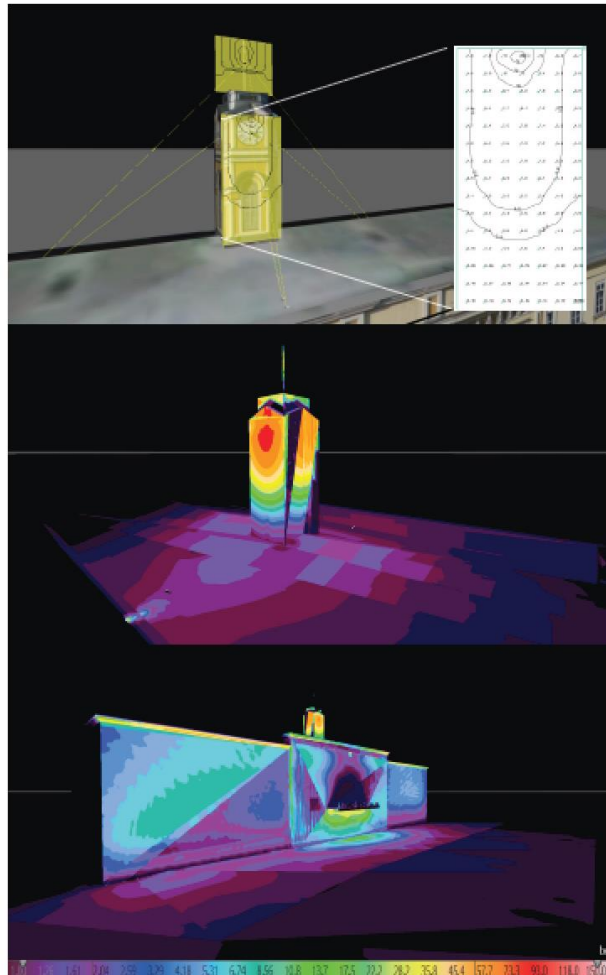


Figure 4.16: False colour rendering image of clock tower

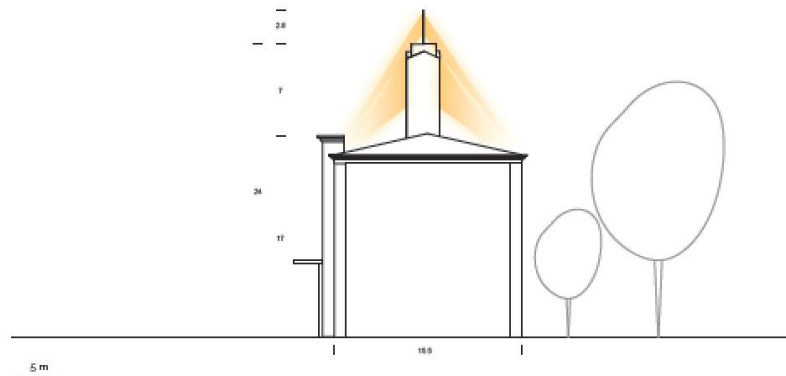


Figure 4.15: Clock tower light projection diagram

Target plan values:

Clock tower lighting		
Luminance ave cd/m^2	5.00	Lave
Luminance min/max	0.40	
Luminance min/ave	0.60	

Simulation calculation results:

Clock tower lighting		
Luminance ave cd/m^2	5.12	Lave
Luminance min/max	0.42	
Luminance min/ave	0.61	

Section B-B

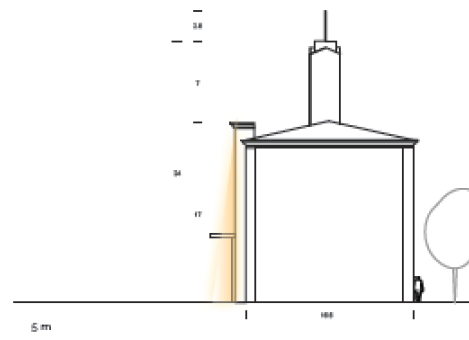


Figure 4.17: Main facade light graze light projection diagram

Section B-B

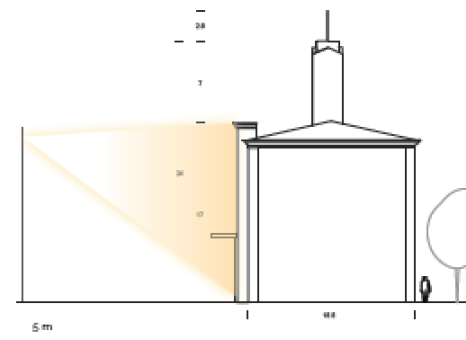


Figure 4.18: Main facade light flood light projection diagram

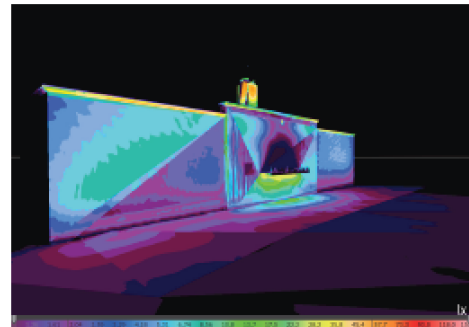


Figure 4.19: False colour rendering image of main facade graze light

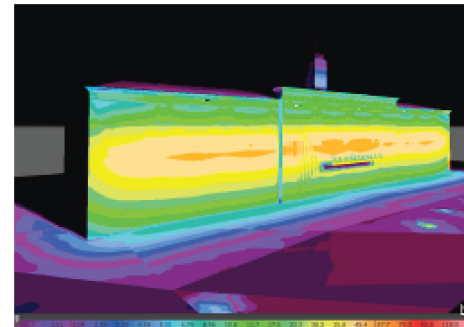


Figure 4.20: False colour rendering image of main facade flood light



Figure 4.21: Main facade graze light simulation diagram
(Software, Dialux evo.)

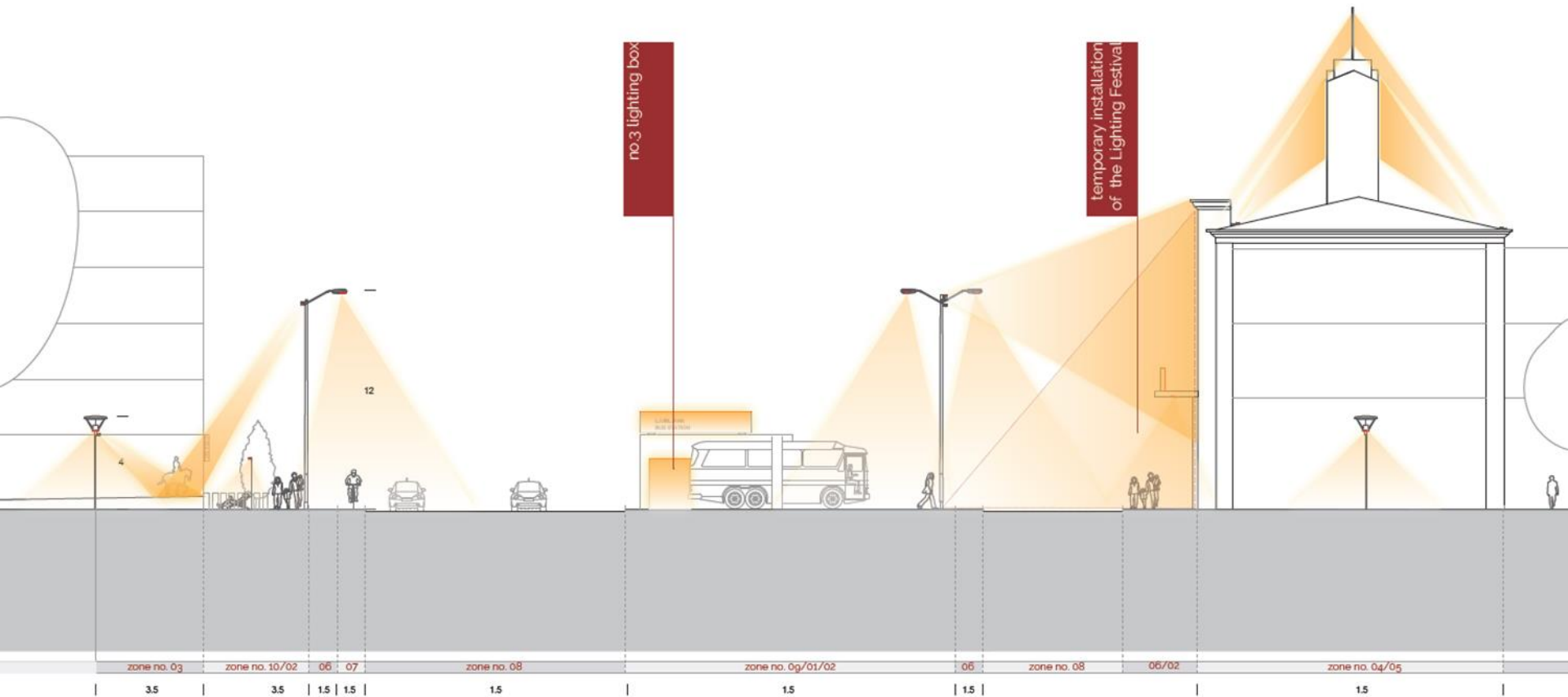
Better detail presentation with graze light.



Figure 4.22: Main facade flood light simulation diagram
(Software, Dialux evo.)

Uniform brightness performance with flood light.

Connection areas with the park and Kolodvorska ulica



Promote the use of adaptive control system

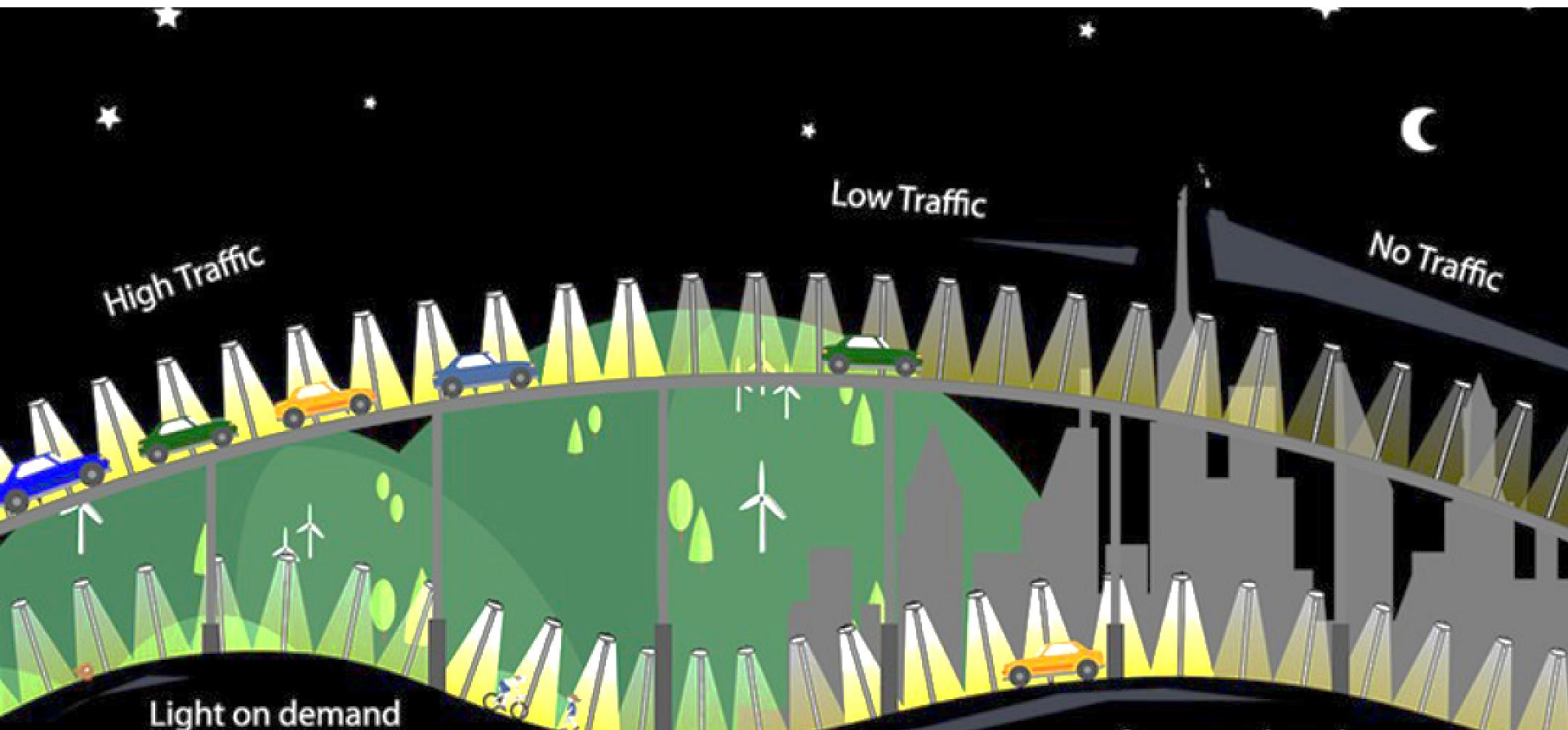


Figure: Adaptive intelligent lighting, © esave ag

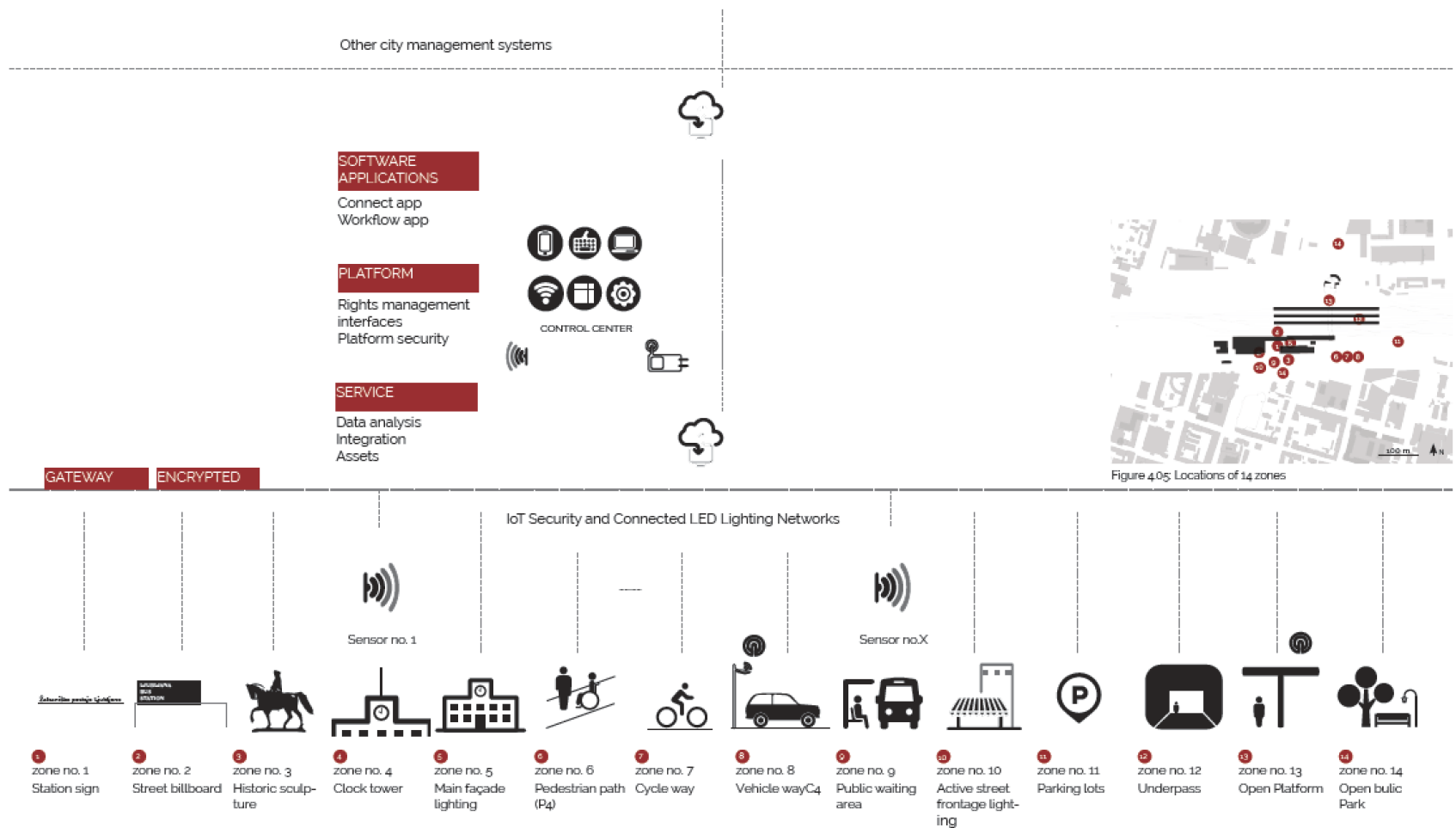


Figure 4.4g: System topology diagram

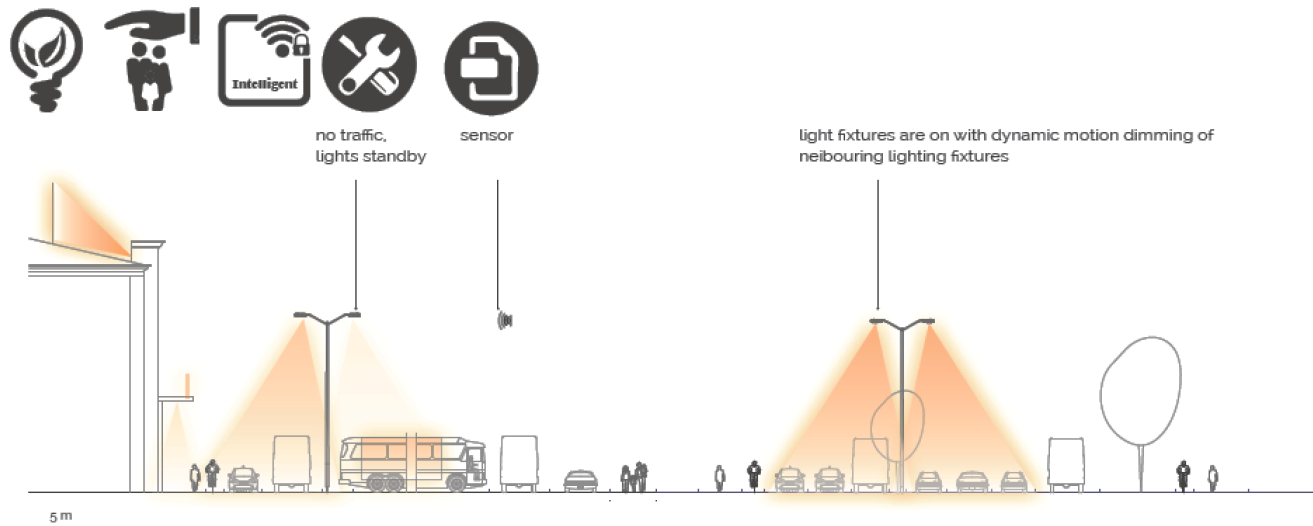
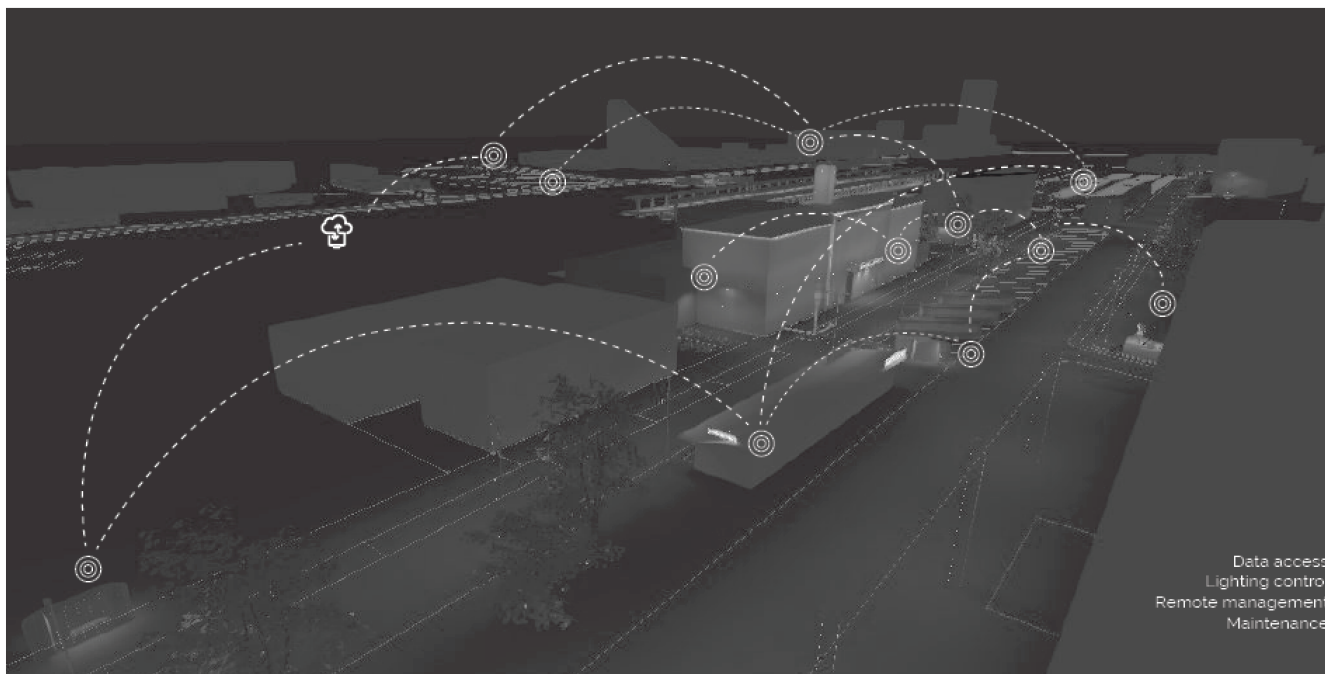


Figure 4.47: Section in the front of the main facade



4.2.3. PROMOTE THE USE OF ADAPTIVE CONTROL SYSTEM.

Zone	Description	Dimming by the time of using				
		after sunset-22:00	22:00-23:00	23:00-0:30	0:30-5:30	5:30- before sunrise
zone no. 1	Station sign	100%	60%	40%	40%	0
zone no. 2	street billboard	100%	60%	40%	off	0
zone no. 3	Historic sculpture	100%	60%	40%	off	0
zone no. 4	Clocher	100%	60%	40%	40%	0
zone no. 5	main facade lighting	100%	60%	off	off	0
zone no. 6	pedestrian path	100%	60%	40%	off	0
zone no. 7	cycle way	100%	60%	40%	off	0
zone no. 8	vehicle way (C4)	100%	60%	40%	off	0
zone no. 9	public waiting area	100%	60%	40%	off +sensing on	0
zone no. 10	active street frontage lighting	100%	100%	40%	off	0
zone no. 11	Parking lots	100%	40%	40%	off +sensing on 10%	0
zone no. 12	Underpass	100%	60%	40%	+sensing on 10%	+sensing on
zone no. 13	Open Platform	100%	60%	40%	40%	0
zone no. 14	Open bulic Park	100%	60%	40%	40%	0

Table 4.03: Plan of adaptive control systems are used within one day

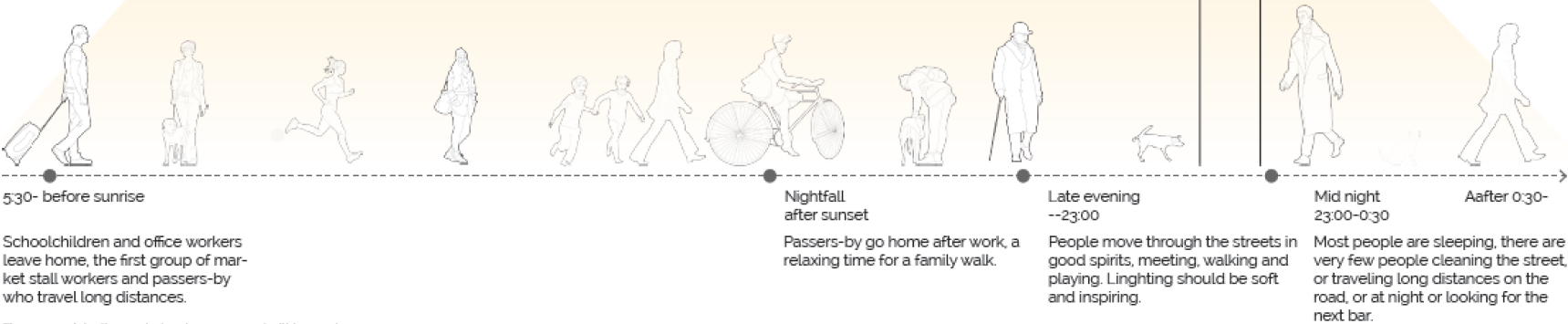
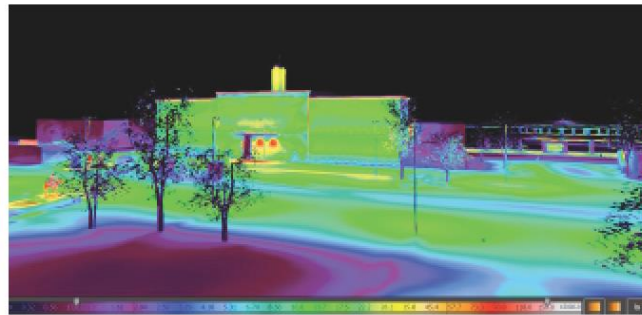


Figure 4.50: Adaptive control systems are used within one day

- After sunset
- around 5:30- before sunrise
- System power utilization: 100%

The sensor adjusts the dimming time of the fixture according to the amount of natural light.

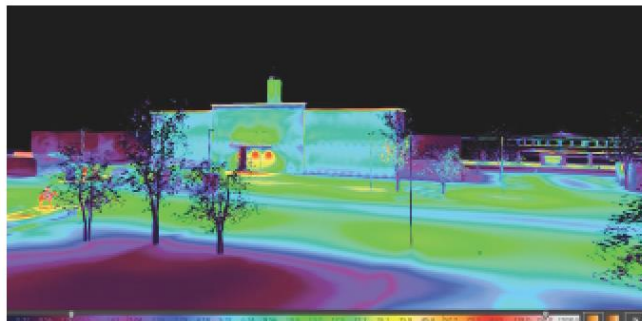


false-colour diagram with lights on 100 % in 3D view



lighting spatial distribution in 3D view with lights on 100 %

- Late evening around 23:00-0:30
- System power utilization: 50%



false-colour diagram with lights dimmed to 60 % 3D view



lighting spatial distribution in 3D view with lights dimmed to 60 %

- Middle night around 0:30-05:30
- System power utilization: 5-7%



false-colour diagram with lights dimmed to less than 40 % 3D view



lighting spatial distribution in 3D view with lights dimmed to less than 40 %

Figure 4.51: Adaptive lighting scene simulation effect, a view from south-east side of the district

4.4.2. LIGHTING FESTIVAL, THE NOCTURNAL TOURIST ROUTE FROM THE STATION TO THE CENTER DISTRICT



Figure 474: LJUBLJANA LIGHTING GUERRILLA 2020, map of the projects

The LJUBLJANA LIGHTING GUERRILLA 2020 tour is centered in the center and extends to the block across the transit district



Figure 475: The potential LJUBLJANA LIGHTING GUERRILLA 2022, map of the projects

The potential LJUBLJANA LIGHTING GUERRILLA 2022 route is centered in the center, extends to the central transport district and Slovenska cesta.



Figure 476: The central transport district project, interactive diagram of lighting system

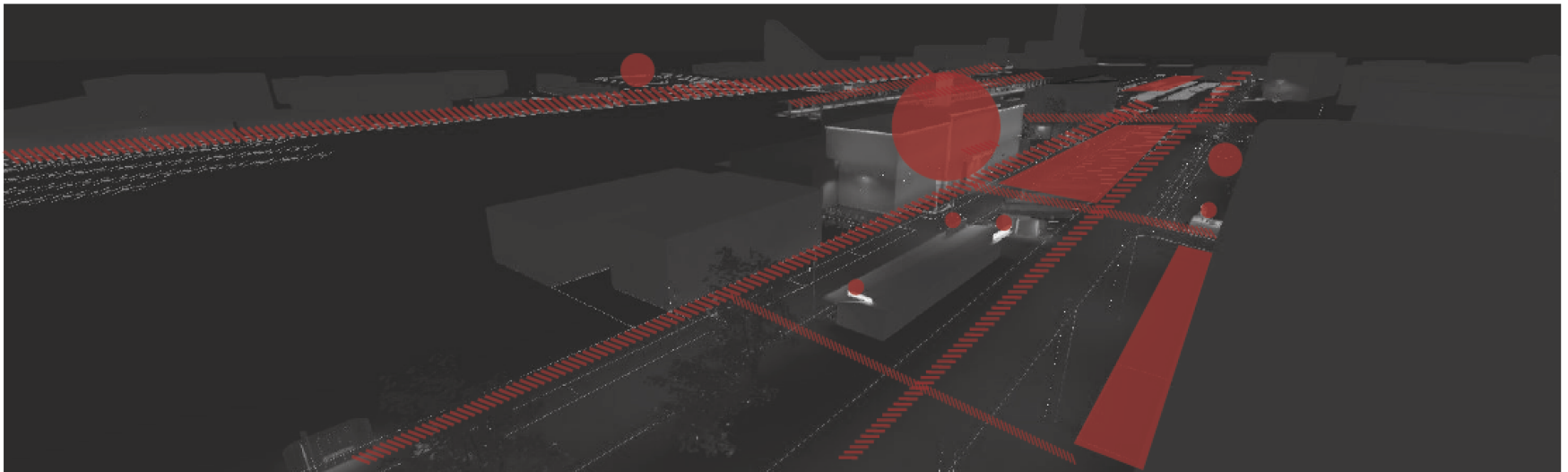
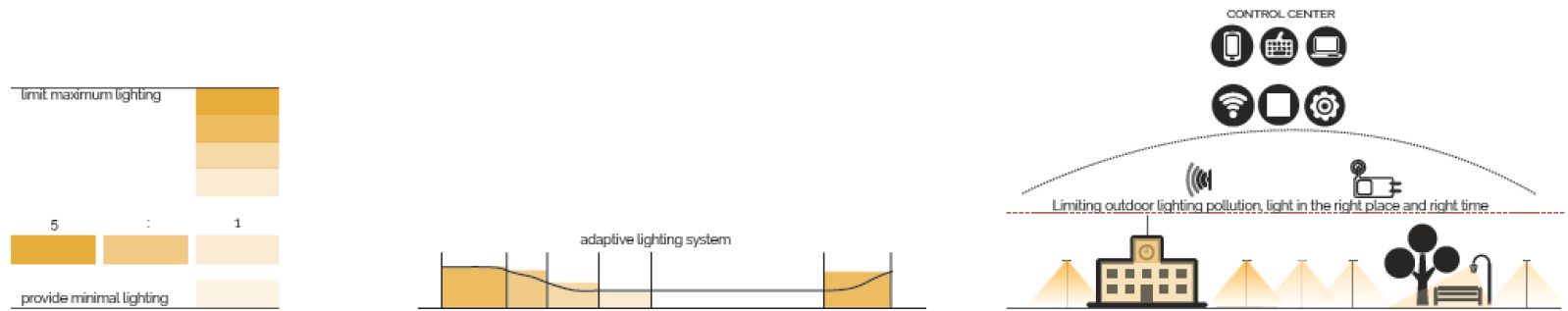
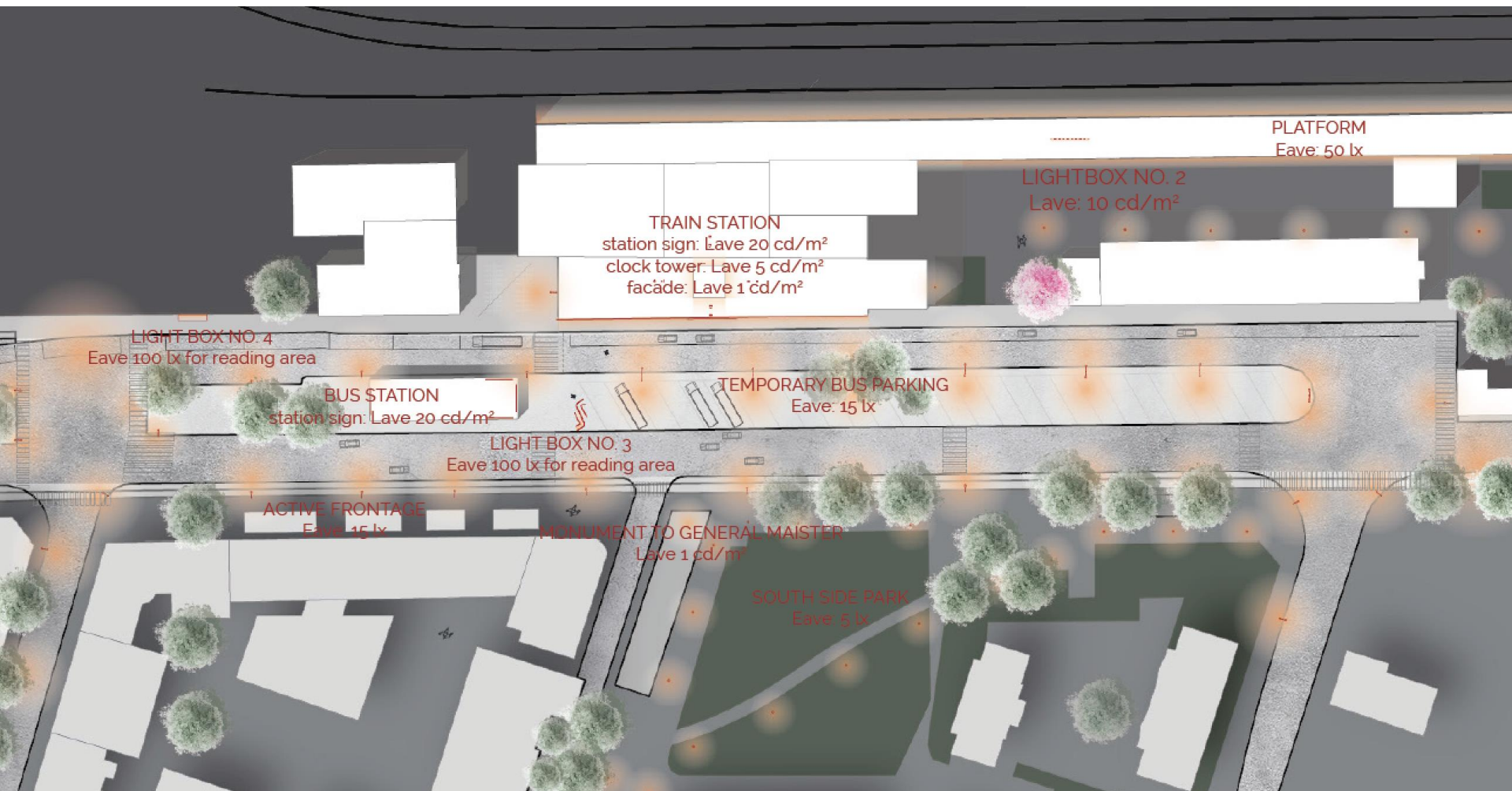


Figure 5.06: Scheme for proposed lighting plan, step one



Conclusion

There are many possibilities for lighting as a tool and material for night-time public spaces, lighting use enhance the night-time public environment with a small number of inputs, promote safety, consistent directions, beauty and diverse lifestyles, and contribute to sustainable development.

This presentation is a part of the master's thesis DEVELOPMENT OF ADAPTIVE PLAN FOR OUTDOOR LIGHTING IN THE CENTRAL TRANSPORT DISTRICT OF LJUBLJANA

mentor: izr. prof. dr. Alenka FIKFAK, co-mentor: Prof. dr. Grega BIZJAK

done at the Faculty of architecture, University of Ljubljana September 2020.

16.10.2020

Hvala