

Article

Sustainable City Lighting Impact and Evaluation Methodology of Lighting Quality from a User Perspective

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Supplementary Material: SITES DESCRIPTION

Table S1. Description of the situation at the Gosposka Street (SITE – 1).

SELECTION CRITERIA	Situation description at the Gosposka Street (SITE – 1)
Urban characteristics	It is the main shopping street in the city center, closed to car traffic. The ground floor of the building is intended for commercial activities, above it there are residential units.
Lighting purpose	Street lighting, commercials lighting
Lighting infrastructure	The lamps are installed on the right side, on the walls. Some entrances are additionally illuminated due to the shops inside. Illuminated billboards are installed on the walls of the buildings.
Type of lights	Older date lamps have antique shapes. The metal poles are black. The lamps are partially shaded.
Lighting characteristics	The light rays are directed onto a paved area reserved for pedestrians and cyclists and are therefore unevenly illuminated. The light coming from inside can also be perceived.
Lighting effect	Increased visibility, steady use of the space at night during shop opening hours.
Illuminance intensity	Street lamps emit light of low intensity, which is particularly noticeable after the end of shop opening hours when the light inside the buildings is completely or partially switched off.
Lighting color	Predominates cool white and warm white, multicolored billboards.



Figure S1. Gosposka Street during the day-time



Figure S2. Gosposka Street at night

Table S2. Description of the situation at the Poštna Street (SITE – 2)

SELECTION CRITERIA	Situation description at the Poštna Street (SITE – 2)
Urban characteristics	The side street is located in the city center and is closed to car traffic. Access to the delivery area is open. The ground floor is intended for pubs, the upper floors are residential units.
Lighting purpose	Street lighting, commercials lighting.
Lighting infrastructure	The lamps are installed on the walls on the ground floor. Above the entrances of the restaurants the promotion lighting is greased.
Type of lights	Older date lamps have antique shapes. The metal poles are black. The lamps are partially shaded.
Lighting characteristics	The light beams are directed onto a paved area reserved for pedestrians and cyclists. Parts of the street remain dark.
Lighting effect	The lighting is barely sufficient, as parts of the street are completely dark.
Illuminance intensity	Street lamps emit light of low intensity.
Lighting color	Warm white and multicolored billboards.



Figure S3. Poštna Street during the day-time



Figure S4. Poštna Street during the night-time

Table S3. Description of the situation at the Kneza Koclja Street (SITE – 3)

SELECTION CRITERIA	Situation description at the Kneza Koclja Street (SITE – 3)
Urban characteristics	The street is located on the edge of the city centre. It is one of the most important transit streets leading to the city centre. The lanes are separated by a green line. There is a separate pedestrian and bicycle path on each side. The ground floor is intended for central activities (restaurants, shops), the upper floors are residential units. Some objects along the street are public buildings such as National Event Hall, Hotel City, Kolosej movie theatre, etc.
Lighting purpose	Street lighting, commercials lighting.
Lighting infrastructure	Free-standing pole lamps are mounted on both sides of the carriageway. Floor lamps are installed along the northern corridor, which is reserved for pedestrians and cyclists.
Type of lights	Lamps have a simple modern form. The metal poles have a silver color. The lamps are completely shaded.
Lighting characteristics	The light is distributed evenly over the entire surface. The ground floor of the buildings is also illuminated, but this is less noticeable due to the illumination of the open space. Floor lamps direct the light into stone pins.
Lighting effect	The lighting enables uninterrupted use of space at night. The traffic lighting is dominant.
Illuminance intensity	Street lamps emit light of moderate intensity.
Lighting color	Predominates warm white.



Figure S5. Kneza Koclja Street during the day-time



Figure S6. Kneza Koclja Street during the night-time

Table S4. Description of the situation at the Lent (SITE – 4)

SELECTION CRITERIA	Situation description at the Lent (SITE – 4)
Urban characteristics	The site is located on the edge of the medieval city along the occasional transit road. There is a separate pedestrian lane between the riverbank and the roadway. Parking spaces interfere with the pavement area. On the other side of the road there is a larger public space owned by restaurants.
Lighting purpose	Street lighting, sidewalk lighting, architectural lighting.
Lighting infrastructure	Free-standing pole lamps are installed on one side, at the edge of the pavement, about four meters above the ground. In sections where the sidewalk is very narrow, the masts obstruct the movement of the users.
Type of lights	Partially shaded lamps have simple shapes. The metal poles are silver or red.
Lighting characteristics	The lighting is directed towards the pavement. Only a small part of the light falls on the roadway. The ground floor level of the buildings and the area in front of it is not illuminated at all and is therefore hardly noticeable.
Lighting effect	The lamps are partially shaded.
Illuminance intensity	Street lamps emit light of low intensity. The lighting is not sufficient because some parts are completely dark.
Lighting color	Predominates cool white.



Figure S7. Lent and the old city center during the day-time



Figure S8. Lent and the old city center during the night-time

Table S5. Description of the situation at the Leon Štukelj Square (SITE – 5)

SELECTION CRITERIA	Situation description at the Leon Štukelj Square (SITE – 5)
Urban characteristics	The square is located in a closed traffic zone and is an important path node. It is a closed square surrounded by public buildings, mainly from the banking sector. The central part of the square is dedicated to events and is therefore only occupied occasionally. The outer edges of the square are slowly being taken over by cafés. Trees, benches and garbage bins are lined along the edges.
Lighting purpose	Architectural lighting.
Lighting infrastructure	Hanging lights are stretched across the entire width of the square. Free-standing and floor lamps are also installed at certain points.
Type of lights	The lamps have a simple regular shape. The metal poles are colored red-brown. The lamps are shielded and suspended, free-standing or mounted on the floor.
Lighting characteristics	The light of the hanging lamps is directed onto the paved surface in a surface-oriented manner, the light of the floor lamps is directed in a point-like manner. The ground floor of the buildings and the space in front of it, with the exception of the bank, is not illuminated.
Lighting effect	The lighting enables uninterrupted use of space at night. Different lighting environments are created by switching floor lamps on and off.
Illuminance intensity	The lamps emit light of medium intensity.
Lighting color	Hanging lamps changes color at short intervals from cool white to multicolor like green, blue, yellow and pink.



Figure S9. Leon Štukelj Square during the day-time



Figure S10. Leon Štukelj Square during the night-time

Table S6. Description of the situation at the Castle Square (SITE – 6)

SELECTION CRITERIA	Situation description at the Castle Square (SITE – 6)
Urban characteristics	It is located in the city center in a pedestrian zone. The location is an important route noodle, as it can be reached from all four directions. The central part of the square is owned by restaurants. The buildings on the edges are architecturally very recognizable. During the day the vertical of the castle tower dominates over place.
Lighting purpose	Architectural lighting, commercials lighting.
Lighting infrastructure	The lamps are installed on the walls of buildings
Type of lights	The wall lamps have antique shapes of older date. The metal brackets are black.
Lighting characteristics	Wall lamps illuminate the vertical. The central part of the market is not illuminated. The light coming through the shop windows from inside the buildings and the illumination of the castle are perceptible.
Lighting effect	During the day the castle tower is a strong dominant. At night it is not particularly emphasized or illuminated and is therefore less perceptible. An indirectly illuminated monument in the middle of the square moves into the focus of the observer. The square is otherwise very unevenly illuminated. The central part of the paved area is in semi-darkness. This condition has a strong effect on the movement of the users. During the day the users move all over the square, at night they walk along the illuminated edges.
Illuminance intensity	Wall lamps emit light of low intensity. This is particularly noticeable when shops are closed and the light inside the building is completely or partially switched off.
Lighting color	Predominates cool white and warm white, multicolored billboards.

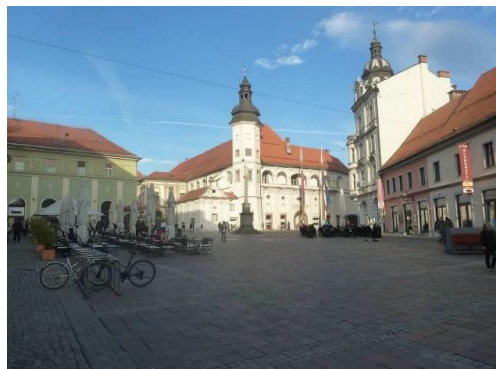


Figure S11. Castle Square during the day-time



Figure S12. Castle Square during the night-time

Table S7. Description of the situation at the Main square (SITE -7)

SELECTION CRITERIA	Situation description at the Main square (SITE -7)
Urban characteristics	The square is located in the heart of the old medieval center and is one of the oldest squares in Maribor. The central area is closed for traffic. A road runs along the southern edge of the square for its entire length. The square is an important route noodle accessible from five directions. The buildings on the edges are architecturally very recognizable. They have central activities on the ground floor. The vertical of the town hall tower is dominant. The monument in the middle of the square is considered a recognizable sign.
Lighting purpose	Street lighting, architectural lighting, decorative lighting.
Lighting infrastructure	The lamps are installed on the walls and along the street (free-standing lamps on poles).
Type of lights	Street lamps and wall lamps.
Lighting characteristics	The light from wall luminaires is directed onto the facades of buildings. The central part of the square and its northern edge are not illuminated. Light entering from the south can be seen because of the intensively illuminated roadway. During the day, the vertical of the town hall is strongly perceptible. At night it is not completely illuminated. The monument is much better perceptible due to its illumination
Lighting effect	Reflector lamps installed on buildings at the northern edge of the square dazzle the viewer unpleasantly.
Illuminance intensity	Although individual lamps radiate a high light intensity, the place is quite dark.
Lighting color	Predominates cool white and warm white.



Figure S13. The Main Square during the day-time



Figure S14. The Main Square during the night-time

Table S8. Description of the situation at the Liberty Square (SITE -8)

SELECTION CRITERIA	Situation description at the Liberty Square (SITE -8)
Urban characteristics	It is located in the city center in a zone closed to traffic. It is accessible from three directions. The central part of the market is occasionally dedicated to the seasonal market. The buildings on the edges are architecturally recognizable. The dominant element of the square is the monument.
Lighting purpose	Indirect architectural lighting
Lighting infrastructure	The square is not lit.
Type of lights	The square is not lit.
Lighting characteristics	The square is not lit.
Lighting effect	The image of the square changes a lot due to the lack of lighting during the day and night. The monument, which is clearly visible during the day, is hidden in the dark at night.
Illuminance intensity	The square is not lit. Light coming from inside the building (castle) is perceivable. The square is indirectly illuminated by the street at the edge.
Lighting color	Indirect lighting (warm colours).



Figure S15. Liberty Square during the day-time



Figure S16. Liberty Square during the night-time

Table S9. Description of the situation at the Slomšek Square (SITE – 9)

SELECTION CRITERIA	Situation description at the Slomšek Square (SITE – 9)
Urban characteristics	It is located in the city center. The distinctive feature of the square is its elliptical shape and the variety of social facilities on its edges, such as: University of Maribor, Slovenian National Theater Maribor, State Post Office and Institute for the Protection of Nature and Cultural Heritage. The cathedral is located in the middle of the square. A one-way street and a bicycle lane run along the perimeter of the square. Rectangular parking lots are attached to it. The central part of the square is planted with trees. Pedestrians cross it and stop there, because the square is an important noodle accessible from five directions.
Lighting purpose	Architectural lighting, decorative lighting.
Lighting infrastructure	Free-standing pole luminaires stand along the street and paved paths across the central part of the square. The facades of all social facilities are partially or completely illuminated with floor or wall reflectors. All statues in the middle of the square are also illuminated with floor reflectors.
Type of lights	There are free standing lamps along the transit routes, reflector wall lamps for architectural lighting and floor lamps installed between the cobblestones.
Lighting characteristics	The light from the lamps along the road is directed onto the paved surface. The light of the wall lamps is directed in a point-like manner onto the facades of buildings. The central part of the square is not illuminated.
Lighting effect	The appearance of the place is strongly influenced by the foliage of the trees, because fully foliated canopies absorb the light strongly. The place is illuminated very differently. The central paved area is in semi-darkness, the edges of the square are clearly visible at night through the illuminated facades of the buildings.
Illuminance intensity	Although there are many lamps of different typologies in the square, most of the square is semi-dark.
Lighting color	Predominates cool white and warm white.



Figure S17. Slomšek Square in late autumn during the day-time



Figure S18. Slomšek Square in late autumn during the night-time

Table S10. Description of the situation at the Maribor City Park (SITE – 10)

SELECTION CRITERIA	Situation description at the Maribor City Park (SITE – 10)
Urban characteristics	It is located on the outskirts of the city on the left bank of Drava River. The main walking axis divides the park into two parts. The site is completely closed to car traffic.
Lighting purpose	Architectural lighting, decorative lighting.
Lighting infrastructure	The main promenade is illuminated. The lamps are placed in the middle of the promenade. The immediate vicinity of the pavilion and the pavilion itself are also illuminated. Sidewalks and street furniture are not illuminated.
Type of lights	Unshielded lamps are simple round shapes mounted on concrete beams.
Lighting characteristics	There are great contrasts between light and dark surfaces.
Lighting effect	The appearance of the park changes throughout the year due to the changing foliage of the trees. In winter, when the park is covered with a blanket of snow, one can notice a stronger reflection of night light from the white surface.
Illuminance intensity	The lamps emit a weak, very bright light. There is an enormous loss of energy due to unshielded light.
Lighting color	Predominates cool white.



Figure S19. The Maribor City Park

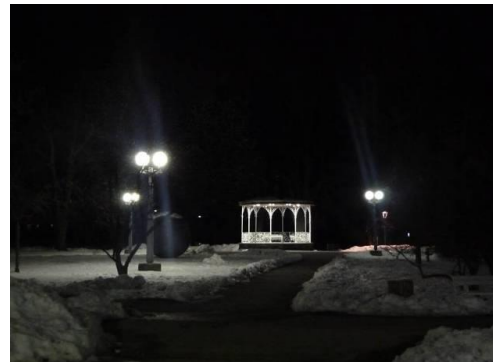


Figure S20. The Maribor City Park at night