

Electric lighting modelling in historical areas of small towns in agglomeration area

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Abstract. In the paper authors present the results of research and analysis of the strategy of modelling electric lighting systems in the historical urban space of small towns. The research was performed in Kórnik - a representative, selected example of a small town of Greater Poland. Spatial structure in correlation to electric lighting and its parameters was investigated. The work was summarized with conclusions in the field of modelling the lighting strategies of the historical space of small towns in the agglomeration area.

1 Introduction

Historical spaces are places defined as the oldest in a given city in terms of the date of their creation. These are areas under permanent conservation protection and included in the register of monuments. Kórnik is located about 20 km from Poznań, with a national road important for Poznań. The spatial structure of Kórnik also includes the urban complex of the former independent city of Bnin. Within a large agglomeration, the historical areas of a small town are the most important element in shaping its identity, additionally reinforced by electric lighting at night.

2 Kórnik's historical spaces and their artificial lighting

Figure 1 shows the development of the city of Kórnik within the administrative boundaries with the marking of historical spaces (red line) and their electric lighting (yellow) (Fig. 1).



Fig. 1. Construction of historical parts of the city of Kórnik and its electric lighting within administrative boundaries [1, 2]

The buildings marked on the drawing come from the turn of the 18th and 19th centuries. The character of the buildings is typical for the Greater Poland towns from the beginning of the 19th century. Buildings mostly in the ridge-shaped setting form narrow streets spreading from the extended market to the sides. The Kórnik square with the Town Hall situated on the longitudinal axis of the square is the main spatial layout, the closure of which is the Castle.

In the building, which is within the city's administrative boundaries, 38% it is the building of a historic urban layout. Lighting of this zone constitutes 11% of the installed power for lighting in the city [1]. The average luminance of this zone is about 17 cd/m² [1].

The main dominant feature in the historical part is the Castle, whose illumination is shown in figure 2 [1].



Fig. 2. Illumination of the Kórnik Castle visible from the shoreline of the lake [1]

The illumination of the Kórnik Castle combined with water is a unique showpiece of the small town of Greater Poland [1]. The average luminance of light on

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the facade of the Castle is about 25 cd/m^2 [1]. A high level of luminance in relation to nearby road lighting allows for a spatial connection of the Castle with an important part of the historical part of the city - Kórnik market (fig. 3).

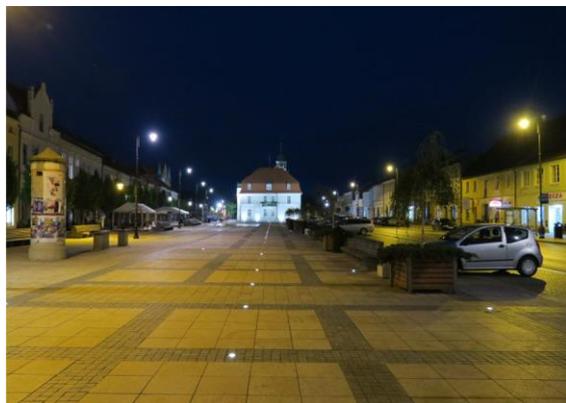


Fig. 3. Illumination and road illumination of the historical part of the city of Kórnik [1].

Visible on Fig. 3, the cold illumination of the Kórnik Town Hall coincides with the lighting of the conduct and part of the Market's lighting and warm sodium street lighting adjacent to the Market Square.

Town hall in Kórnik is illuminated with very big level of average luminance – over 15 cd/m^2 . In agglomeration area this value is not a big value.

3 Lighting of the historical space of small towns

The investment process in the city may exclude system lighting of some historical sites due to costs. The town of Kórnik with a unique palace and park complex and a well-preserved historical urban complex creates great opportunities for the development of tourism and recreation. City authorities attach great importance to the promotion of the city through these elements. A number of investments created in the second decade of the 21st century contributed to the positive reception of the city and its image [1].

Electric light played a big role in this process.

Illumination of the historical part of the city of Kórnik in the current state allows the city to remain a separate unit in the area of the Poznań agglomeration. Generalizing - lighting of the historical part of a small town allows it to remain a separate, but significant unit in the agglomeration.

The average levels of lighting in the historical part have to be raised in relation to the lighting level of the rest of the city by several cd/m^2 [1]. The percentage on the example of the city of Kórnik is the level by 21% larger [1]. The shape of the historical zone determines the increase in the level of illumination in this case [1]. Decisive factors in other cases are moreover [1]:

- percentage share of road lighting in relation to the entire lighting in a small city,
- percentage size and shape of the historical zone.

Modeling the lighting of the historical zones of small towns is a difficult task, mainly because the urban spaces of these zones are no longer subject to major spatial transformations. Lighting changes in the discussed areas mainly concern the conversion of orange-yellow sodium lighting into white, energy-efficient LED lighting and changes in the style of luminaires. The modelling possibilities are therefore limited.

4 Conclusions

The role of light in space is more and more often taken into account in decision-making and investment processes in the city. This is not only the distribution of street lamps, but also a comprehensive lighting project - including the calculation of luminance distributions and the colour of light [1].

The conducted research allows to draw the following conclusions [1]:

1. The uniqueness of a small city in the agglomeration scale is built by location, building structure, history and spatial strategy.
2. In cities with a high percentage of historical space, their lighting should be increased by 20 - 25% in relation to other built-up spaces.
3. The percentage of sodium lighting (about 200 lm/W , warm colour of light) of the historical space should remain at the level of min. 50% of lighting in this space.
4. LED lighting in historical spaces should be limited to the visual leading and illumination of cold colour facades of architectural objects.
5. In historical spaces, the lighting / illumination of objects related to water, greenery and small architecture should be intensified.
6. The number of stylized luminaires in historical space should be at least 65%.

References

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2. Source: <https://maps.google.com> (author's preparation, 2019)