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# Illumination of historical architectonic facilities and buildings using as an example the St. Joseph Church in Poznań

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In the article, using as an example the St. Joseph Church in Poznań, there has been described selected problems connected with the illumination of historical architectonic facilities and building. The choice of the selected illumination method is made using the designer imagination and conservator's enquiry requirements. Technical conditions, related with the building location on the area equipped with utilities, may have significant influence on choosing the final solution for the lighting. In such situation computer visualizations become the tool facilitating determining the final illumination method. It is possible to select the appropriate illumination equipment taking into consideration location of luminaires which is directly depending on technical conditions.

KEYWORDS: outdoor lighting, illumination, lamps and luminaires selection, computer visualization

## 1. Introduction

Lighting for the purpose of the night illumination of the architectonic facilities and buildings becomes a particular task. The facility body and details when seen in the day light become less distinguishable even in case of the building having rich architecture. The daylight provides the flooding lighting that is in practice evenly illuminating façades. The night illumination of the facility or building with use of the light falling from various directions allows appropriate shaping of the building body and façade elements, such as recesses, portals, pilasters, cornices, etc. that creates also an opportunity to present the beauty of their architecture and to expose details difficult to notice in the day light.

Illumination should influence observers psychologically with its artistic look by attracting their attention and fixing positive impressions about seen facilities and buildings [1, 2, 3].

In the city agglomerations the illumination lighting performs also the function of the facilities and buildings protection and security as well as becomes an information factor concerning the importance and standing of the

illuminated building – Figure 1. The view of not illuminated building becomes very often the cause of fixing negative impressions.

Fig. 1. Illumination of the Cathedral in Gniezno

The elaboration of the illumination design requires a lot of preparation work including the necessity of identifying a number of limiting conditions that influence the assumed method of exposing the building with use of light and applied technical solutions for this purpose.

The final illumination design should precede the analysis and evaluation of:

- aesthetical and emotional aspects,
- conservation aspects,
- technical and economic aspects.

The aesthetical aspects are connected with the necessity of identifying the sightseeing perspective of the building and determining the required artistic effects which are influenced by the building body arrangement as well as by the building surface color and quality and also by the brightness of the neighborhood environment and surrounding. In case of church buildings, it is very important to include emotional factors and to expose and to underline symbols of the faith. In this case, it is also important that the selected illumination method expresses respect towards the building through avoiding for example the excessive and exaggerated mode of lighting the building.

In the designing practice, with reference to illumination, there are applied two basic methods - spot method and flood method [6, 7]. The spot method requires application of more pieces of luminaires which are usually assembled on the buildings façades. The illumination view is then often exaggerated and creates excessive contrasts between light and shadow that not always is

approved by conservators of monuments or historical buildings. Moreover, the technical execution of this method is more difficult because it requires assembling luminaires and placing electrical cables on the building façade – Figure 2.

Fig. 2. The spot illumination method

In the flood method, differently than in the surface method, there is applied a smaller number of luminaires of the wider light distribution which are usually located within some distance from the building. In this way it is possible to obtain the illumination view more similar to the building view in the daylight. The defect of such solution is too monotonous façade view and the possibility of causing glare by luminaires located within the observers' field of view – Figure 3.

Fig. 3. The flood illumination method

The compromise illumination method can result in applying a bigger number of luminaires of the narrower light distribution which are located within the appropriate distance from the illuminated building. The appropriate directing of luminaires on the selected façade places or details allows differentiating their illumination and limiting the possibility of glare – Figure 4.

Fig. 4. The mixed illumination method

The execution of the illumination lighting with applying the role for the night view creation of the building by placing on its surface light spots of different luminance becomes a compromise between the flood lighting which is too monotonous and the spot lighting which creates differentiated and often too theatrical expression of the illuminated building view.

This way of the illumination facilitates adaptation to conservation requirements and limits and at the same time allows maintaining the possibility of obtaining the required aesthetical and emotional effect. At the same time, the illumination execution does not require assembling luminaires on the building that is advantageous when considering conservation aspects as well as when considering the technical possibilities of the design execution. The luminaires maintenance is much easier that significantly decreases the operational costs of the installation.

## 2. Description of the building and its location

More than half of the historical facilities or buildings in Poznań are sacral buildings. Their historical role in the past brought about that churches and monastery groups of buildings became the real treasury of the most valuable pieces of art and monuments of the material culture history and their

architecture as well as interior outfit and decoration represents the historical record of the regional society and all the nation. The importance of this fact results also in taking decisions concerning the execution of the illumination and the good example is the St. Joseph church in Poznań.

The St. Joseph church is located on the St. Wojciech hill and it is the example of the early baroque architecture. The rich frontal façade is characterized by the rhythm of pilasters separated by recesses. The cornice system divides distinctly the façade into three levels. The church façades are covered with plaster and the roof is covered with red ceramic roofing tiles.

The church is surrounded with high trees so then in more distance perspectives from the north and south sides there are visible only roofs and top parts of the building. The significant part of the monastery buildings is located beyond the high brick wall.

The building shown on Figure 5 is rather well visible mainly from the front and also from a short distance from the south that determines the priority for choosing the architectonic details dedicated for the illumination and technical possibilities for obtaining the expected illumination effects.

Fig. 5. View of the St. Joseph church in Poznań

## 3. Concept of the building illumination

The church visibility conditions and views limits from various perspective have significant importance for the execution and obtaining effects of the undertaken illumination task issue. Dependently on considering within this illumination task the need of illuminating details which are visible from closer or more distant perspectives, it is necessary to select for them the appropriate number and type of luminaires as well as the appropriate type and power of light sources.

In the presented concept, there has been proposed the architectonic illumination, i.e. the illumination that provides illumination effects by applying the play of light and shadow by exposing pilasters, recesses between pilasters, cornices, walls cornices and roofs capping.

For the illumination lighting of the St. Joseph church, there have been selected the "white sodium" type SDW-T light sources which are characterized by golden-white light that perfectly matches the façade color. Both from the front and from the sides, there has been provided the application of the luminaires of narrow, medium and wide light distribution, dependently on their assembly location. The proposed luminaires location included the possibilities and limits both for conservation and technical execution.

The example of the luminaires distribution and directing for the illumination lighting of the frontal and rear wall of the church has been presented on Figure 6.

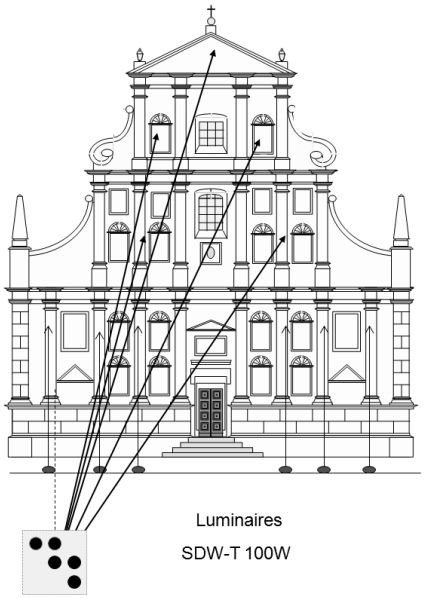


Fig. 6. Dsitribution and directing of luminaires for illumination of the St. Joseph church

## 4. Computer visualization of the church illumination

Visualization of the illumination of the St. Joseph church in Poznań has been created in 3ds Max programme.

The preliminary stage of work consisted in modeling the building geometry on the basis of the façade drawings made on the basis of the site viewing and prepared on-site photographic documentation.

In the next step, the elaborated geometric model has been given the appropriate surface appearance with choosing parameters such as color, warmth

and reflection coefficient. The values of the mentioned parameters have influenced the final visualization view of the building façade that has been presented on Figure 7.

Fig. 7. Computer visualization of the St. Joseph church body

Fig. 8. Computer visualization of the St. Joseph church illumination

The next step consisted in inserting photometric parameters of lamps and luminaires and their distribution, in accordance with the concept elaborated by the designer including considering all limits and conditions referring to the possible equipment location and positioning.

For the selected luminaires located within a longer distance from the front of the illuminated building, there has been provided the additional equipment with half-tone screens to limit the possibility of glare. It has been particularly important in consideration of the necessity of assembling luminaires on the ground level. This location resulted from the conservation requirements determining the necessity to avoid negative exposition of the pilaster with luminaires appearance on the brightly illuminated front wall of the church.

After considering all conceptual assumptions and location limits, there have been created computer visualizations of the church façade illumination as presented on Figure 8, providing the possibility of analysis and evaluation of the anticipated artistic effects.

## 5. Execution

The elaborated design has been executed in accordance with the conceptual assumptions, visualization of which has been presented on Figure 8. There has been applied connection of forty reflectors having total power of approximately 4kW.

In the luminaires there have been mainly used lamps of "white sodium" type characterized by warm-white light color. There has been obtained, with use of it, underlying the church original façade color. The light color creates also the appropriate mode for admiring the building architecture. The obtained realistic illumination effects have been presented on Figure 9 and 10.

Fig. 9. Execution of the St. Joseph church illumination

Fig. 10. Execution of the St. Joseph church illumination

## 5. Conclusions

Obtaining the appropriate illumination effects depends on many conditions such as selection of the appropriate luminaires, light sources and their location and directing to provide the required aesthetic effects.

The author of the illumination concept has no influence on some conditions, however, he must consider them during the elaboration of the design that is to be executed in practice.

Using computer visualizations allows practical approximation of the illumination effect and provides the possibility of introducing possible corrections [4, 5].

The limit for applying widely visualizations in the lighting designing is time-consuming elaboration while the undoubtedly the advantage is the possibility of analysis and evaluation of the illumination variant solutions that eliminates the need of executing complicated technically, time-consuming and very expensive on-site trials.

## References

[1] Górczewska M., Some aspects of architectural lighting of historical buildings. Conf. Light in Engineering, Architecture and the Environment, WIT Press, Southampton, Boston 2011, ISSN: 1743-3509, str. 107 – 116.

[2] Górczewska M., Mroczkowska S., Iluminacja dziedzińca Collegium Maius UAM w Poznaniu. Przegląd Elektrotechniczny, ISSN 0033-2097, R. 88, NR 5a/2012, str. 173-176.
[3] Górczewska M., Mroczkowska S., Iluminacja współczesnych obiektów architektonicznych na przykładzie Collegium Nowum w Poznaniu. XIX Konferencja Naukowo-Techniczna „Zastosowanie komputerów w Elektrotechnice", Poznań, 15-16. 04. 2013, No 79, ISSN 1897-0737, s.239 – 244.
[4] Krupiński R., "Istotne etapy i elementy wykonywania wizualizacji komputerowych oświetlenia i ich wpływ na dokładność" Przegląd Elektrotechniczny, ISSN 0033 – 2097, NR 11/2009, str. 297 – 299.
[5] Słomiński S., „The correct image of illuminated object registration – problems arising from software capabilities and equipment limitation" Przegląd Elektrotechniczny, ISSN 0033 2097, R. 89 NR 8/2013, pp. 259 – 261.
[6] Żagan W., Wasserfurth N. Wizualizacja komputerowa oświetlenia – nowa jakość w projektowaniu. *Przegląd Elektrotechniczny*, 78 (2009), nr. 9, 388-392.
[7] CIE Technical Report No 94 - Guide for Floodlighting.

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