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Title of paper :
**“Visualisation of illumination of the Sanctuary of Divine Mercy
in Poznań as an example of architectural illumination of
contemporary building”**

Properly selected illumination has a favourable effect on people's behaviour and decisions. The perception of light is not only a physical phenomenon. Light has a tremendous influence on our emotions by ensuring harmony in our environment and introducing a warm friendly ambience. Buildings which are floodlit at night using artificial light fully reveal the beauty of their architectural design which often goes unnoticed during the day.

“Building illumination is an effect of activities which, using artificial light and other means of expression, enhance the visual qualities of the building at night [16].”

A crucial element of building illumination design is the selection of an appropriate illumination technique. **“An illumination technique is to be understood as a distinctive means of lighting building facades, notable both for the final effects, luminance distribution in particular, and specific features of luminaire location and photometric data of the lighting equipment [16].”**

The following general methods of architectural illumination can be distinguished:

- spot illumination method (Fig. 1)



a)



b)

Fig. 1 Building illumination using the spot method a) Bazar Hotel in Poznań, b) Parish Church (Fara) in Poznań

- floodlighting method (Fig. 2 a))



Fig. 2 a) Bamberka statue in the Old Market Square in Poznań
b) Illumination incorporating spot and floodlighting methods – mixed technique

- mixed method (Fig. 2 b), combining both methods enumerated above (selected sections of the building facade are spot-lit, while others are flood-lit).

The selection of an appropriate illumination method is associated with yet another very important, and increasingly topical, problem of lighting modern buildings. **“From the point of view of illumination, the concept of modern building is to be understood as referring to an edifice or a structure whose distinguishing feature is neither its short existence, nor innovative spatial form, but rather the type of finishing materials used [18].”**

In order to obtain an appropriate illumination of architectural structures, a number of general principles must be followed, including [16]:

- image consistency
- organisation of image of the illuminated building
- concealment of luminaires
- enhancement of the “roundness” effect of the illuminated building
- accentuation of perpendicular wall edges
- depth and height enhancement

The selection of luminous colour is a subjective decision of the designer. However, there is a general principle of light colour application, whereby cold light is used to illuminate areas which have cool colours, while warm light is used for warmer hues. Whenever surfaces of cold colours are lit with cold light and, by the same principle, warm light matches the warm colour of the building facade, the sensation of colour is enhanced (Fig. 3) [16].



Fig. 3 a) Illumination of the Water Works (Aquanet) in Poznań b) Illumination of the Christ the King Church in Jarocin

Before embarking on a task of designing illumination of a building, an analysis of its intended application and functions must be performed. The rule applies in particular to ecclesiastical architecture. The basic aims that must be achieved in lighting church buildings and similar structures include: creation of appealing ambience, use of light to enhance architectural details and elements and creation of a “visual guide” showing the viewer the most important features of sacred art.

Illumination of church buildings

The section below outlines the illumination design developed for the Sanctuary of Divine Mercy. The structure is a contemporary example of ecclesiastical architecture located in Poznań. The interior of the church has a copy of the Shroud of Turin.



Fig. 4 Church interior: a) copy of the Shroud of Turin; b) paintings – St. Faustina and Christ

Modernisation of the lighting system inside the Church was designed and supervised by Małgorzata Górczewska (PhD, Eng) in 2007. (Fig. 5)



Fig. 5 a) High Altar b) section of a side wall

The follow-up to the previously implemented interior illumination project is the concept of illumination of the outside of the Church presented below.

At present, the area in front of the Church is lit with ball-shaped park-type luminaires. The luminaires illuminate both the surroundings of the Church and the front facade of the building – cf. Fig. 6.



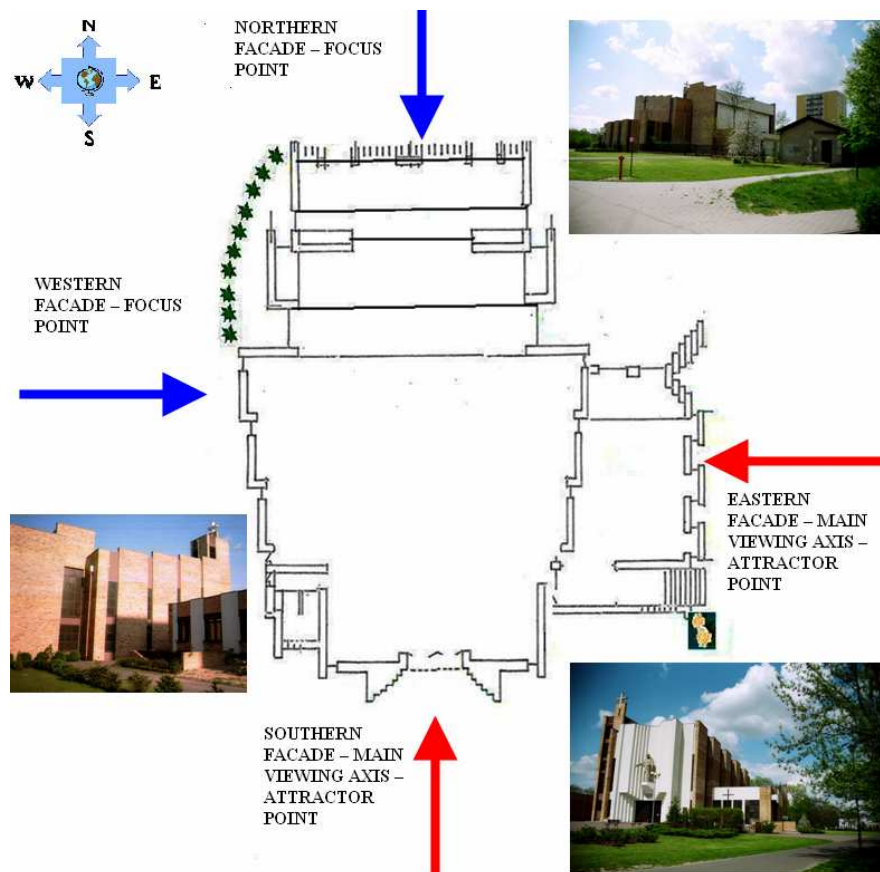
Fig. 6 Southern and western facades seen at night

This type of illumination not only causes night sky contamination with light emitted upwards, but also produces unfavourable glare as one watches the illumination of the building.

Design of church building illumination

The starting point in designing an illumination scheme for the building was **determination of the main viewing axes**. Fig. 7 shows the layout plan of the Church with viewing axes and the most important observation points.

The southern and eastern facades are the main viewing axes and, at the same time, central points attracting viewers' attention, as this section of the Church faces the car park and the nearby housing estate. Another attractor point is the tower of the Church featuring a cross visible from the housing estate. The cross, overlooking the entire structure, guides members of the congregation to the Sanctuary. The western and northern facades, due to the presence of surrounding buildings, are focus points, i.e. sections of the building that are visible from a short distance.



Rys. 7 Layout plan of the Church together with surroundings, viewing axes, attractor points and focus points



Fig. 8 Southern facade – view from the housing estate



Fig. 9 Southern and eastern facades – view from the car park



Fig. 10 Eastern facade – general view



Fig. 11 View of the tower of the Church with the cross visible from the housing estate



Fig. 12 Western facade – view of buildings – presbytery obscuring the view of the church



Fig. 13 Northern facade – view of low buildings of the presbytery which obscure the view of the church

Determination of reflection properties and colour of facade elements

The building's facades are built of sand-coloured clinker brick, metal sheets around the windows, painted brown, and white plaster. The statue of Jesus placed above the door is made of concrete. The colour of the figure is slightly darker than the plaster coating (Fig. 14) of the facade. All of these are materials distinct for high light reflection coefficients.



Fig. 14 Facades of the building – colours and textures

Selection of illumination method

The mixed method was chosen for the illumination project. The method will make it possible to achieve even floodlighting of the large surface of the building. This illumination will be complemented by a sophisticated arrangement of spot lights (a light spectacle). By supplementing floodlights with spot lights, e.g. around the entrance to the Church or on the sculpture of Jesus, a unique impression can be created to focus the attention of churchgoers on the key elements or accentuate the rhythmical structure of the building.

Model of the illuminated building

The design was created with the Relux Professional 2007 application. Using the programme, a building model "by daylight" was developed. The section below presents a selection of drawings created during model construction. [12,13]



Fig. 15 Model of illuminated building – view of the western facade



Fig. 16 Model of illuminated building – view of the southern facade



Fig. 17 Model of illuminated building – view of the southern and eastern facades



Fig. 18 Model of illuminated building – view of the eastern and northern facades





















Fig. 19 Model of illuminated building – view of the northern facade

Selection of luminaires and sources of light for the project

The concept of illumination of the Sanctuary of Divine Mercy in Poznan is based on illuminating different parts of the Church and the square in front of the building, taking into consideration main viewing axes. The description includes names of luminaires used for computations [21,23].

In order to enhance the visual appeal, the illumination of greenery was also designed.

Key/ Legend:		
Number	Ground recessed luminaires	Luminaires on the lamp – post
1.	 6 no – Mica I HIT 150W/830 20° transparent glass	11  10 no – LEGEND MODERN HIT 70W/830
2.	 5 no – Mica A HIT 70W/830 transparent glass	12  1 no – Qba R EXT HIT 20W/830
3.	 6 no – Mica I HIT 70W/830 20° transparent glass	13  1 no – Qba R INT HIT 20W/830
4.	 2 no – Mica AT HIT 35W/830 frosted glass	14  1 no – Qba R INT HIT 150W/942
5.	 2 no – Mica I HIT 150W/830 6° transparent glass	15  1 no – Mini PINSPOT QT 35W 12V EXT (arm 54cm)
6.	 2 no – Mica I HIT 150W/830 20° frosted glass	Luminaires on the roof
7.	 2 no – Mica I HIT 70W/830 6° transparent glass	16  4 no – Qba C1 S/S HIT-DE 70W/830
8.	 12 no – Mica S QPAR 16 20W/830 transparent glass	17  2 no - Areaflood HIT-DE 7 70W/830
9.	 18 no – Mica AT TC-T 18W/830 transparent glass	Luminaires for entrance lighting
	Luminaires behind statue	18  2 no – LEOPARD TC – DD 16W /830
10.	 2 no – Qba R EXT HIT 35W/830	

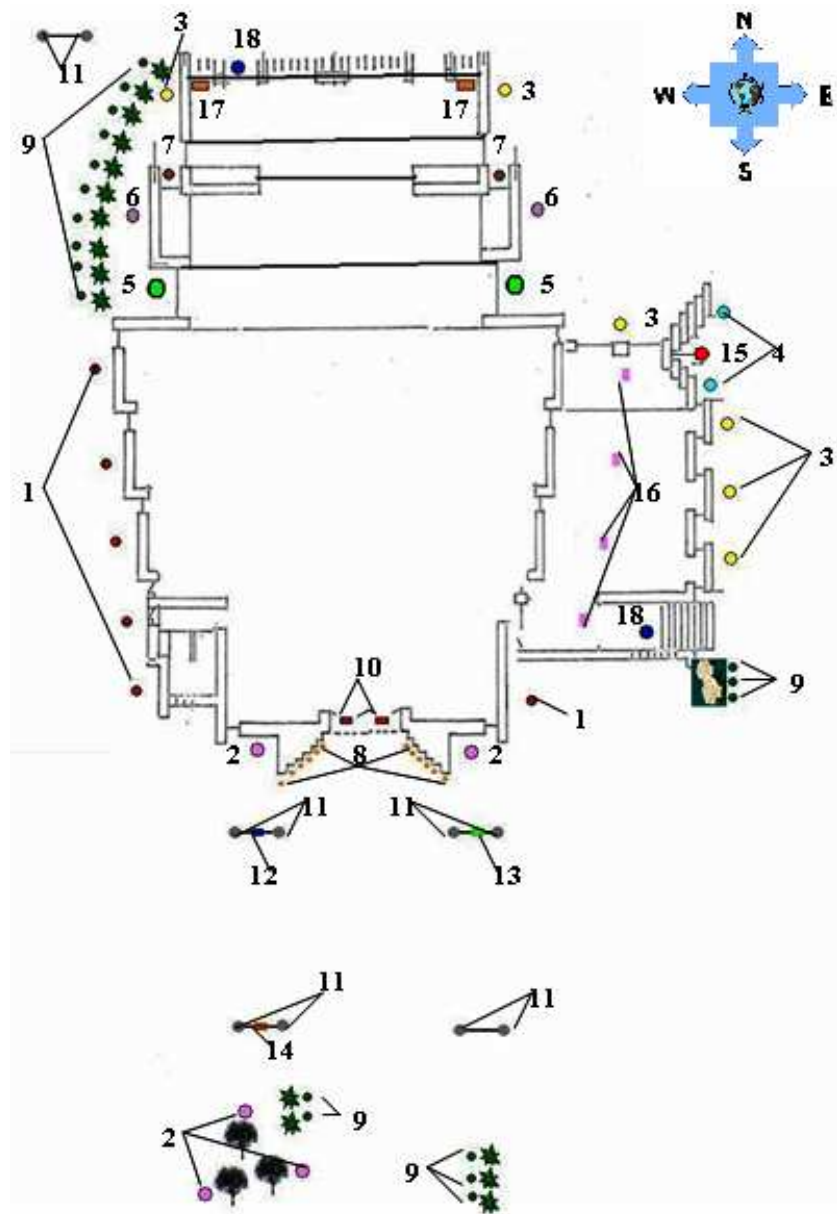


Fig. 20 Layout of luminaires used for illuminating the Church of Divine Mercy

The figures below present the arrangement of luminaires designed using Relux Professional 2007 [12,13].



Fig. 21 Spatial arrangement of luminaires – view of the southern facade and greenery

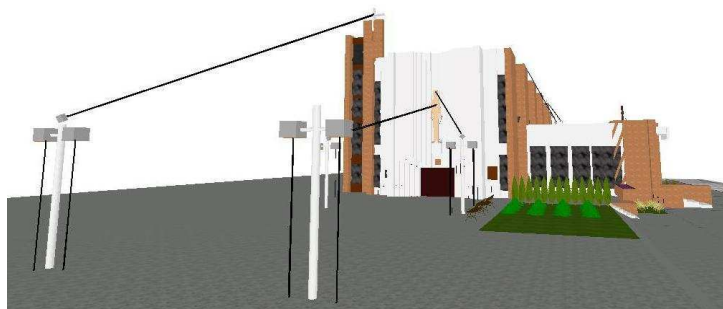


Fig. 22 Spatial arrangement of luminaires – view of the southern facade and the square in front of the church

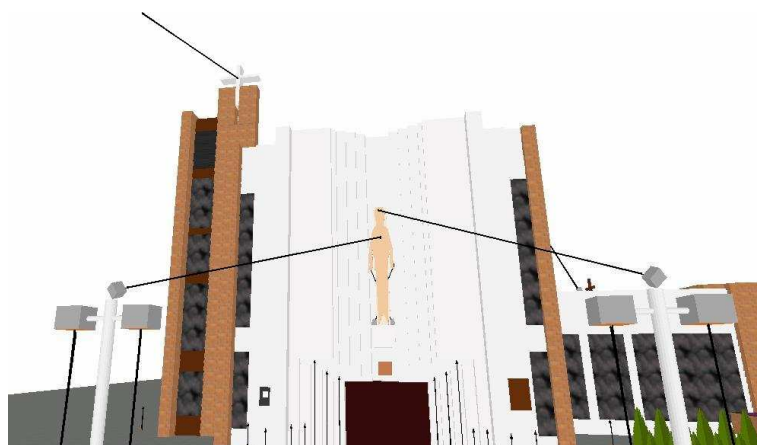


Fig. 23 Spatial arrangement of luminaires – view of the southern facade



Fig. 24 Spatial arrangement of luminaires – view of the northern facade

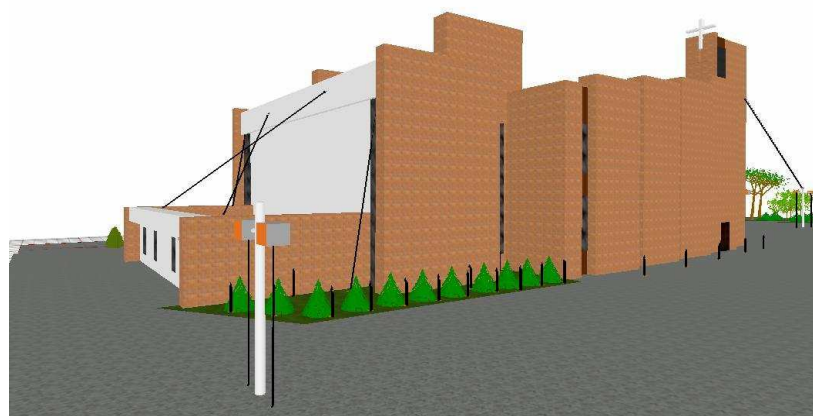


Fig. 25 Spatial arrangement of luminaires – view of the northern and western facades

Computer visualisation of building illumination

Visualisation of the illumination effect of the Sanctuary of Divine Mercy was based on the layout of luminaires shown in Fig. 20 and the spatial arrangement presented in Fig. 21-25.

The section below presents a selection of drawings “by night” created during simulation [12,13].



Fig. 26 Building illumination – result of simulation – view of the southern facade



Fig. 27 Building illumination – result of simulation – view of the southern and western facades, greenery and the square in front of the Church



Fig. 28 Building illumination – result of simulation – view of the southern and eastern facades

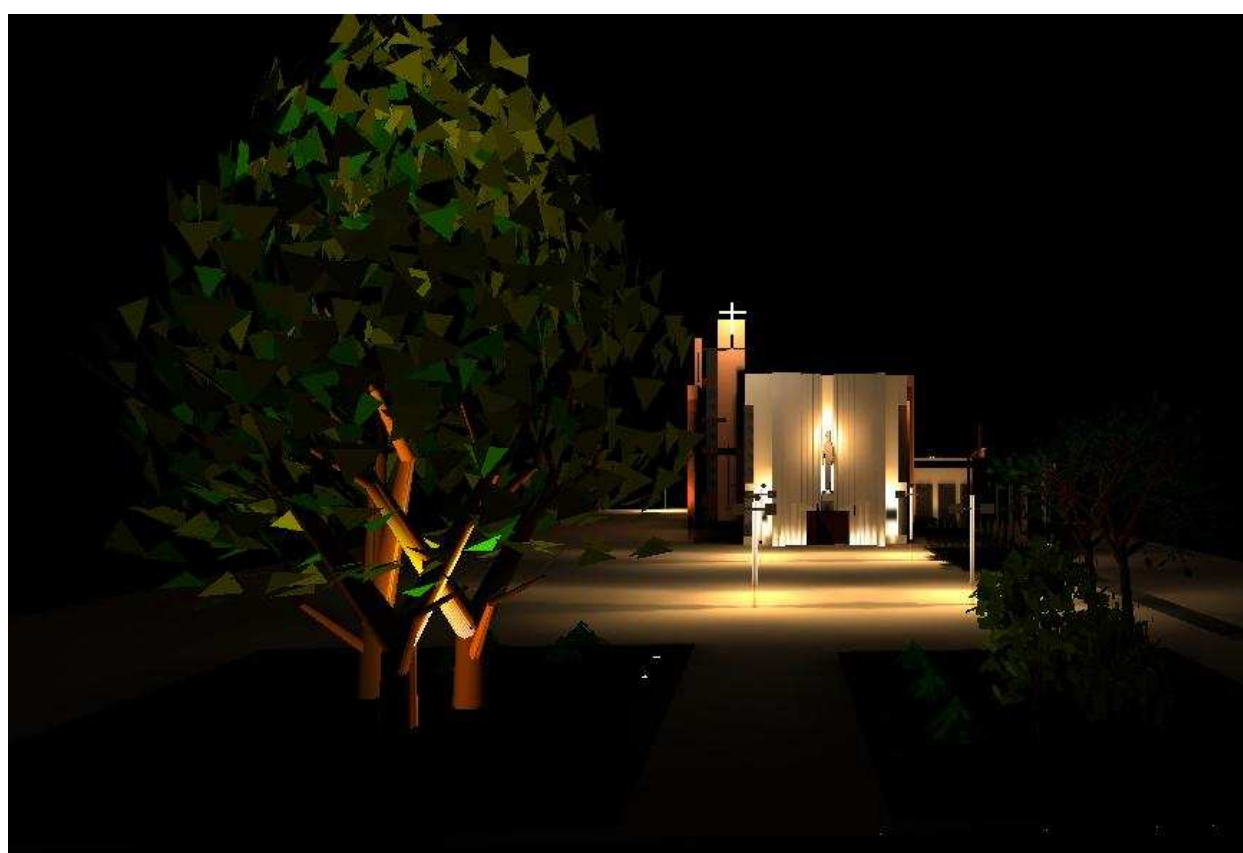


Fig. 29 Building illumination – result of simulation – view of the southern facade and greenery

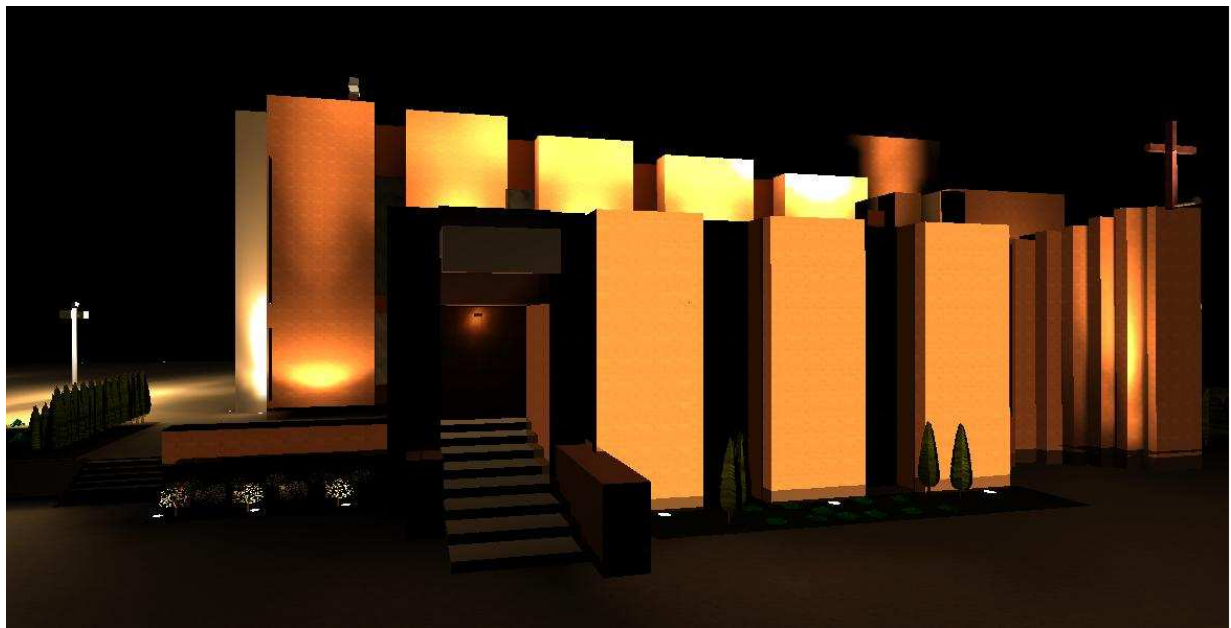


Fig. 30 Building illumination – result of simulation – view of the eastern facade

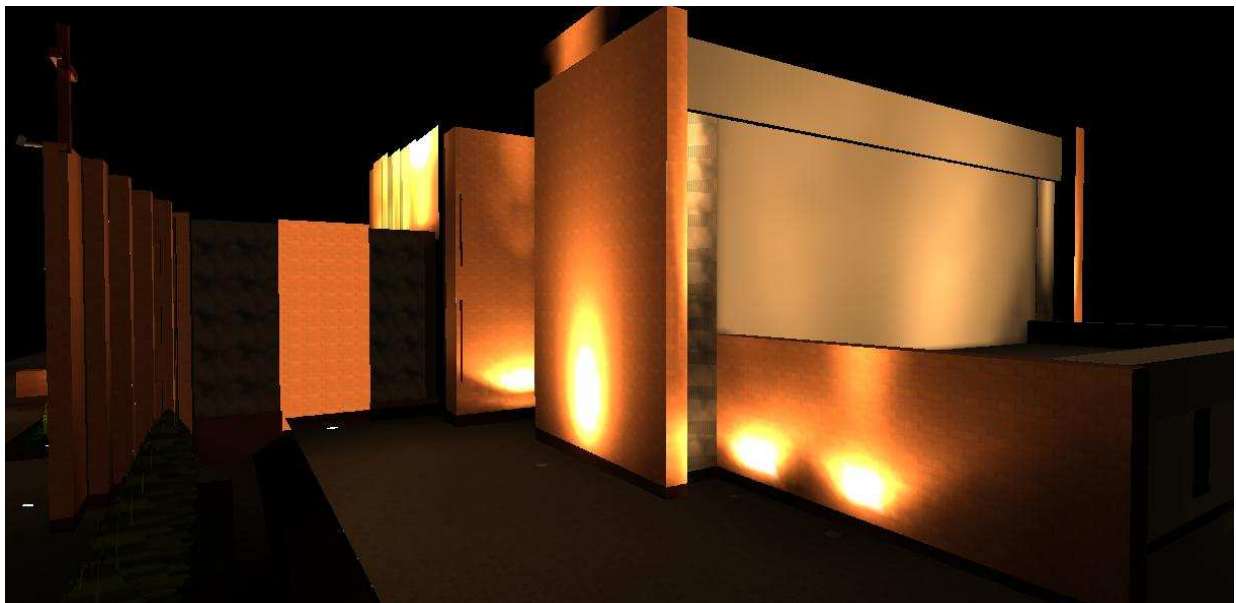


Fig. 31 Building illumination – result of simulation – view of the northern facade and the cross above the chapel



Fig. 32 Building illumination – result of simulation – view of the northern and western facades



Fig. 33 Building illumination – result of simulation – view of the western facade



Fig. 34 Building illumination – result of simulation – view of the western and southern facades

4. Summary

Problems involved in the creation of illumination designs are very complex. Firstly, it is necessary to be familiar with parameters of the lighting equipment and photometric data. An equally important, if not more important, factor is the knowledge of symbolism and art. Therefore, designers must have multi-faceted knowledge, thorough understanding and comprehensive approach to the problem at hand, i.e. the ability to analyse all aspects of the task to be accomplished. Secondly, it is necessary to skilfully use quantitative requirements described in literature. They should not be the core of the problem, but rather guide the designer towards the best lighting solutions.

Before the illumination concept for the Sanctuary of Divine Mercy was developed, complete documentation relating to the structure had been gathered, including project maps of the building and photographs taken on site. An analysis of the lighting environment and the architecture of the church made it possible to design the most effective illumination method and, consequently, determine the final image of the Church.

The final form of the concept was also affected by the history and meaning of the Church, modern architectural style of the structure and the desire to accentuate religious symbols.

The article presents the visualisation of the illumination concept developed using the Relux Professional 2007 application. Such simulations offer designers a cheap and quick method of introducing corrections to the design, if any are needed, and discuss the best solution with the investor. It should also be noted that using the software also has a number of weak points. The most time-consuming stage of the task is creating a model of the building. The next stage is the selection of luminaires and sources of light, as well as luminaire layout and spatial arrangement.

Moreover, the effect of visualisation is just an approximation of reality. In real-life conditions, light spots are not as intense and appear more blurred. This is largely a result of the building's lighting environment which creates a light foundation on the structure. In Relux Professional 2007, the environment is completely dark, while introducing other luminaires to represent housing estate lights would markedly extend computational time.

Summing up, it should be concluded that despite their limitations, visualisations made using computer applications are a considerable aid to designers.

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