

Floodlighting of the St. Martin's Cathedral

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St. Martin's Cathedral, dominant church of the capital city of Slovakia is important part of the city image during day. But in night scene of Bratislava, image of this dominant church was fading out. That was the main reason for making up the night city image and accenting its historical identity.

Project of Floodlighting of the St. Martin's Cathedral was presented as architectonical conception in several variants.

1 IMPORTANCE OF THE BUILDING

St. Martin's Cathedral has cultural and sacral importance as well. St. Martin's Cathedral for unique architectonical, historical and urban value was announced the national monument in 1990. In past was St. Martin's Cathedral used for coronation of Ugrian sovereigns. At present, there in the cathedral are held Masses and sacred ceremonies.

St. Martin's Cathedral is the dominant church, what supports its location and pure architectonical shape. Together with castle create unique image of the capital city as the gate to Slovakia.



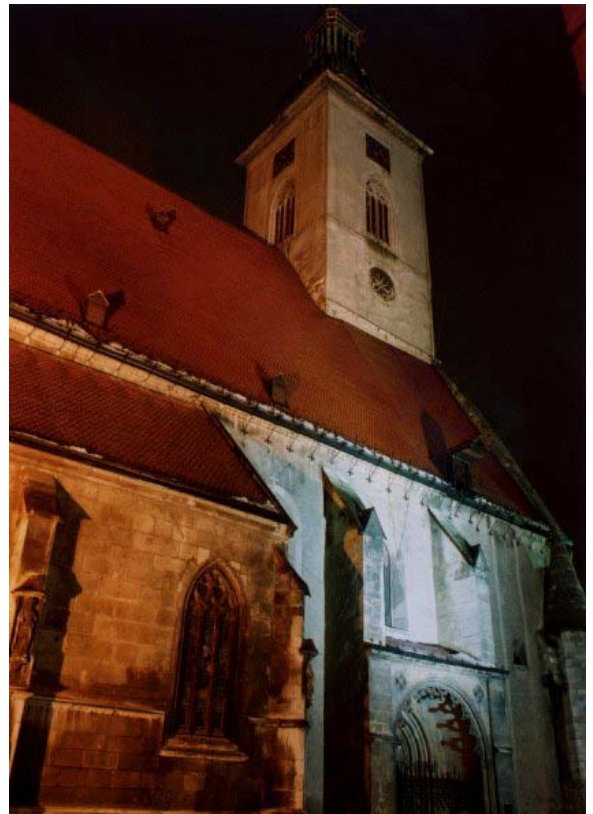
2. FIELDWORK SIMULATIONS

Goals: Necessary luminance level, illuminating way, colour temperature, input power, technical parameters of the relevant light sources and luminaires checking.

Process: Different surfaces (stone and external rendering) were illuminated by light sources with different kind of colour rendition. Several variants was created and documented by camera, that was base for approval process.

Results of simulation:

- type of illumination - illumination as whole
- type of colour temperature - white or warm-white
- colour rendering – more than 60
- accent of certain parts must be created by luminance increase , no colour temperature change
- it is necessary to create accent on casque, especially on golden crown
- suitable uniform illuminance will be achieved by luminaries with asymmetrical luminous intensity distribution curve, that will be placed on surrounding buildings or masts



3. ARCHITECTONICAL SOLUTION

The main idea of architectonical solution is presentation of the St. Martin's Cathedral as important part of night dominant system in Bratislava.

Aim:

- to present pair of important historical dominants castle – cathedral as duality “secular and sacral” in historical place
- to present St. Martin's Cathedral in the face of historical centre
- to differentiate St. Martin's Cathedral from another buildings
- to increase monumentality
- to accent historical value of heritage

4. LIGHTING-TECHNICAL SOLUTION

Quantification of the asked luminance level

For quantification of luminance level of the illuminating building it is necessary assume luminance level of surrounding and importance of relevant object. Recommended luminance levels of the facade are in following table:

Observant distance	luminous levels of the facade L_{pk} [cd/m ²]
Long distance	10 - 20
Surrounding view	5 - 10
Nearby view	1 - 5

Table 1 Recommended luminance levels of the facade

Required illumination of the facade for these luminance levels can be calculated from following equation

$$E = \frac{\pi \cdot L}{\rho} \quad (1)$$

E - illumination level [lx]

L - luminance [cd/m²]

ρ - reflectance coefficient

Recommended illumination levels for outdoor lighting are in following table. These values must be modified in accordance with condition of the surfaces. We don't need to forget for uniformity of illumination as well.

Surface	Condition	Dark surrounding	Bright surrounding	Highly bright surrounding
White marble		25 lx	50 lx	100 lx
Concrete		50 lx	100 lx	200 lx
Cement-sand		100 lx	200 lx	400 lx
White brick	relatively clean	20 lx	40 lx	80 lx
Yellow brick		50 lx	100 lx	200 lx
Red brick		75 lx	150 lx	300 lx
Granite		150 lx	300 lx	600 lx
Dark stone		75 lx	150 lx	300 lx

Table 2 Recommended illumination levels

Total luminous flux calculation and number of floodlights

Needed total luminous flux for relevant illumination levels is calculated by lumen method using the formula:

$$\Phi = \frac{E \cdot S}{\eta \cdot M} \quad (2)$$

Φ total luminous flux (lm)

E desired illuminance (lx)

S area of surface illuminated (m²)

η utilisation factor

M maintenance factor

Utilisation factor can be specified by following table [1]

Reflector type	η
Deep specular reflector	0,33 - 0,37
Shallow specular reflector	0,23 - 0,26

Table 3 Utilisation factor

Measurements

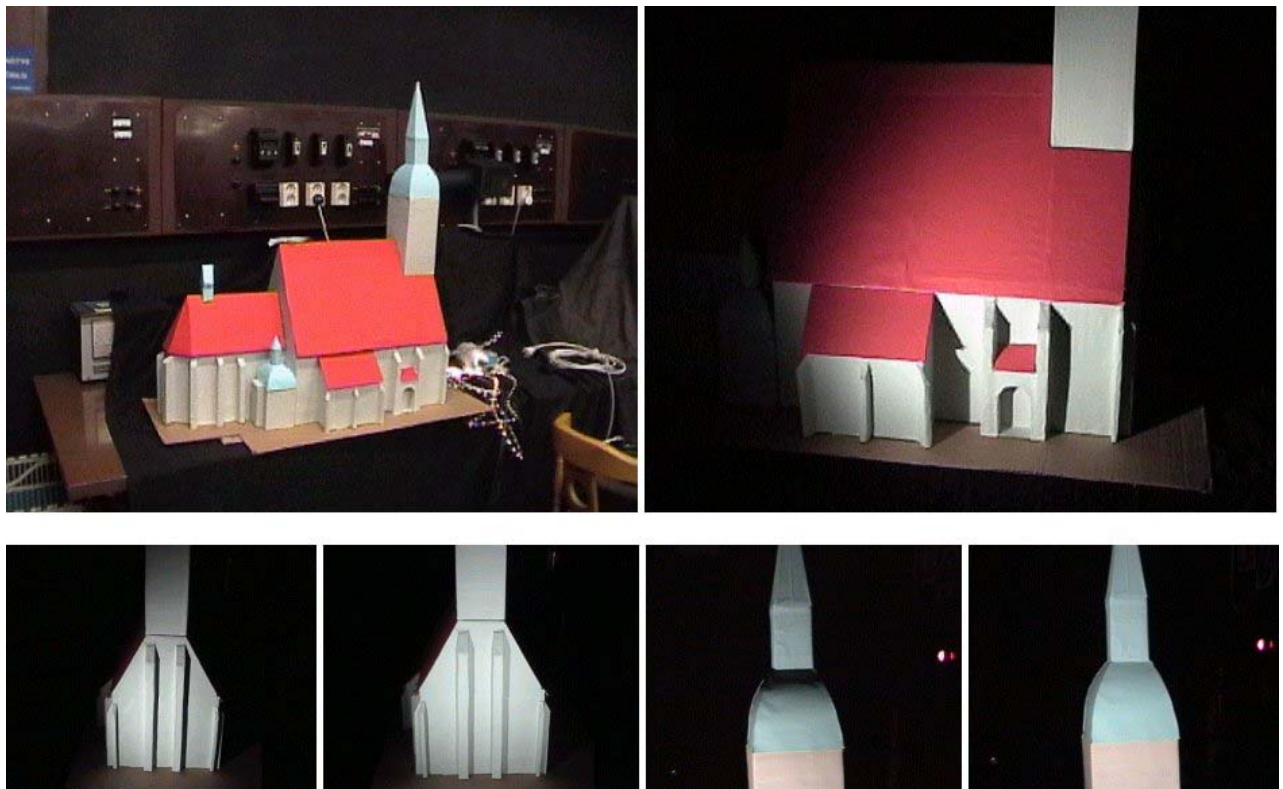
To meet the idea of architectural solution of the St. Martin's Cathedral and conception of the night city image, it was necessary to synchronise illuminance and luminance levels of the surrounding buildings. Luminance levels measurements of the dominant objects in Bratislava were made.

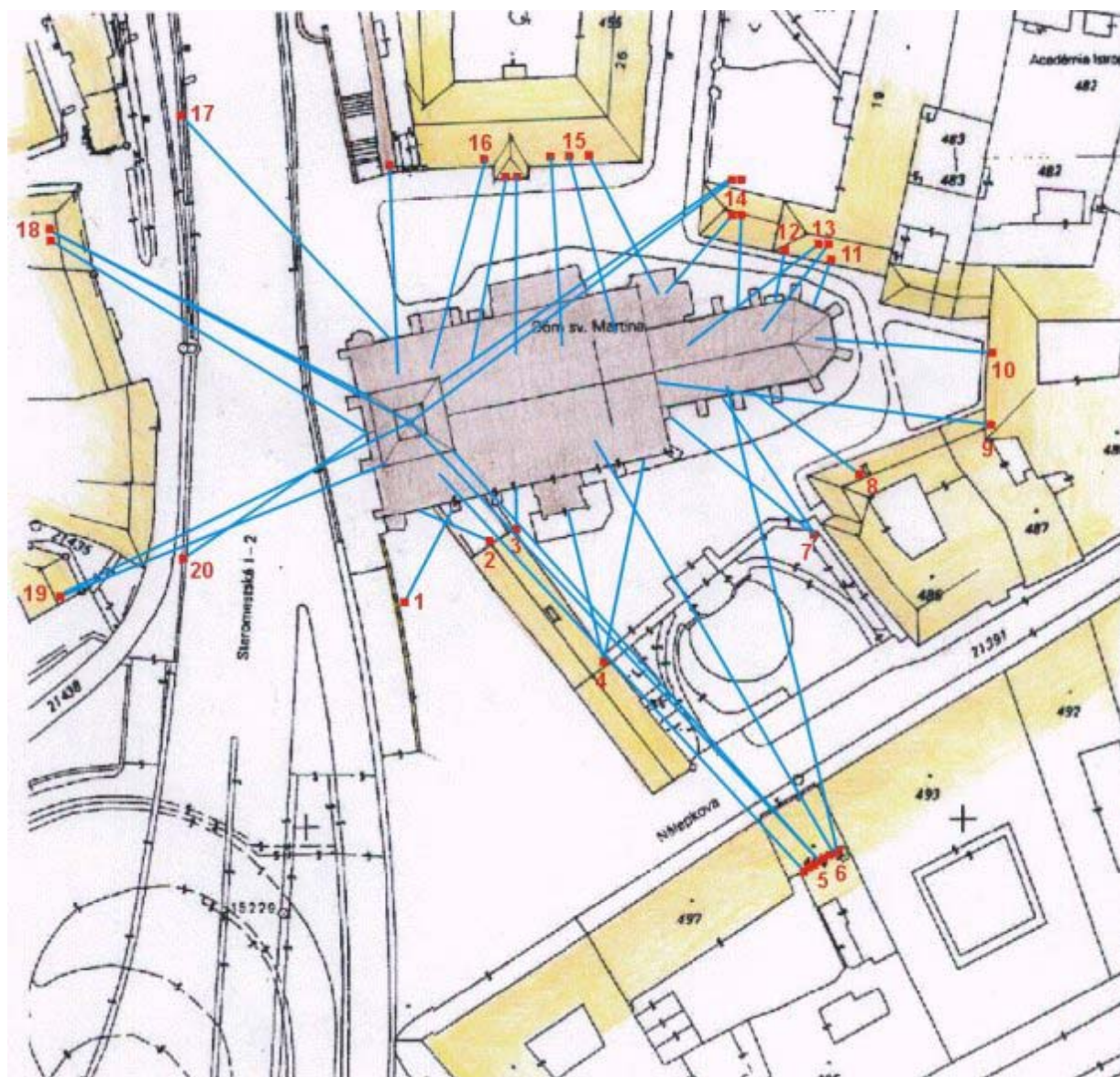
Measured object	Direction	Average luminance (cd.m ⁻²)
Bratislavský castel	facade tower	6,9 0,42 - 2,9
St. Martin's Cathedral	facade roof tower	0,065 - 1,02 0,035 - 0,48 0,027 - 0,127
Michalská gate	from Ventúrska str.	1,5 - 2,6
Primaciálny palace	facade	10
Parliament		5,1 - 30
Hotel Carlton	Façade (part 1) Façade (part 2)	13 - 40 300
Town hall		0,3 - 0,8

Table 4 Luminance levels measurements of the dominant objects in Bratislava

Model simulations

For simulations and checking illuminating way was created St. Martin's Cathedral model in scale 1:100. By the help of model was simulated direction of floodlights and shading as you can see in following figures:





REFERENCES :

- [1] Šula, O.: Příručka osvětľovacej techniky, SNTL Praha 1979
- [2] Plch, J.: Světelná technika v praxi, IN-EL Praha 1999
- [3] Katastrálna mapa v mierke 1: 1000
- [4] Fotodokumentácia 10 - 12/2001, autori: B. Polomová, F. Krasňan.

