Doctorate thesis

CHROMATIC INTEGRATION OF ARCHITECTURAL AND ORNAMENTAL LIGHTING IN THE URBAN ENVIRONMENT

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Architectural and ornamental lighting systems in public lighting constitute a special category, with the dominance of estetic characteristics as oposed to the functional ones. The light and the space allow an integrated and complete approach of the urban ambient design, since they repsresent all we see around ourserlves. The composition of the light reflected by the surrounding surfaces provides knowledge on the arhictectural world, creates the limits and directions for our movements in this environment, and thus, brings light over the space. The Ph.D. thesis analyses the modality to integrate the architectural lighting systems in the urban ambient, seen from a chromatic perspective.

The chapter **Current aspects concerning the architectural and ornamental public lighting** describes theoretical elements on View and colour, Luminotechnical equipment, Light comfort in urban enviroment, and Architectural and ornamental public lighting systems, with examples of some of the most well-known achievements.

The chapter **Architectural and ornamental public lighting systems design** completes the currently available information with aspects specific to lighting systems calculus. There are highlighted aspects to be studied in the theoretical and experimental research of the author, with respect to evaluation of chromaticity of lighted architectural surfaces, to characterisation of the reflexive properties of surfaces, and to the luminotechnical calculus of lighting systems.

The chapter **Experimental research concerning the study of some characteristics of building materials for lighted surfaces** is dedicated to the reflectant properties of exterior surfaces of the buildings, with measurements on spectral behaviour of reflexivity and spatial variation of luminance factors:

- Photometrical and colorimetrical characterisation of buildings materials used in the developement of lighted surfaces – describes the reflexive spectral characteristics of the most important materials for buildings and natural surfaces from the vicinity of buildings and the general study model of the materials reflexivity.
- Experimental study concerning the reflexive properties of some buildings materials, realised based on measurements from the Romanian National Metrology Institute laboratory on a set of four pieces of limestone and marble. The spatial variation of the luminance factor is determined through comparison, by measuring the luminances of the analysed piece and of a standard of luminance factor. The measured variable has been the luminance factor for lighting angles of 0°, 15°, 30° and 45° and measurements angles in the interval -70°...70°.
- Experimental study concerning the determination of colorimetric properties of some construction materials – measurements of the spectral reflectance on eight pieces of granite with different colors and having well finished surfaces (Figure 1), realised at the

Technical University of Berlin, Department of Luminotechnics, by the kindness of Dr. Sirri AYDINLI. A component of the database has thus been created, necessary for developing of computations for corect dimensioning of architectural lighting systems on chromatic aspect.

- Experimental study concerning the evaluation of visibility of façade details of buildings lit with projectors – brings a human, subjective component, of the perception by different observers of different details on a lighted building, by following the model described by Masuyama, 2003.

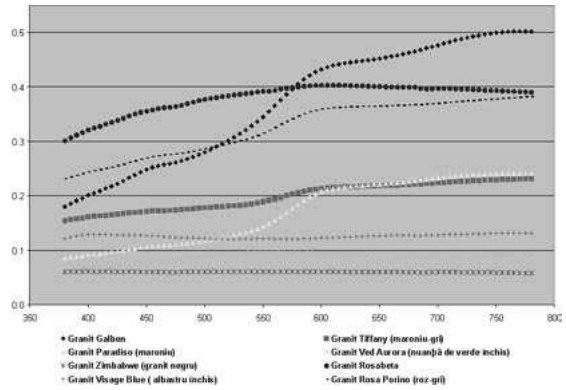

Figure 1 Spectral reflexivity of different samples of granite used as buildings surfaces

The chapter **Theoretical research concerning the design of lighting systems** presents: • The mathematical model for the design of architectural public lighting systems, based on the calculation of ilumination and luminance on the surface of the architectural objective and of chromaticity of the lighted surface of the architectural building; • The study of the behaviour of surfaces of lighted architectural buildings on the effect of different light sources, facilited by a specific module of the computer program, that allows a user to analyse the changes of colorimetrical characteristics – chromatic coordinates and correlated colour temperature – for different surfaces and light sources; • The BUILDLIGHT computer program with specific modules necessary for this work, that allows the user to optimise the design of architectural lighting systems.

The **Appendices** present a database with relevant information on • Spectral characteristics of radiation of the light sources– illuminants and usual electric lamps – Philips, Luxten; • Distributions of light intensity for projectors used in architectural lighting – Energobit Schréder Lighting; • Spectral characteristics of reflexivity and spatial distributions of luminance factors for some construction materials, part of the data being kindly provided by Professor J.J. EMBRECTHS, University of Liège; • Behaviour of surfaces of architectural buildings lit by different light sources.

Finally, overall conclusions are presented.

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