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الملخص الإنجليزى

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NATURAL LIGHTING AS AN IMPORTANT FACTOR IN THE DESIGN OF MUSEUMS IN EGYPT

Presented by

Hanan Mostafa Kamal Sabry

A Thesis Submitted to the Faculty of Engineering
Ain Shams University, in Partial Fulfilment
of the Requirement for the Degree of Ph.D. in Architecture

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1996

Ain Shams University
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Thesis for Ph.D Degree in Architecture

NATURAL LIGHTING AS AN IMPORTANT FACTOR IN THE DESIGN OF MUSEUMS IN EGYPT

Presented by : Hanan Mostafa Kamal Sabry

SUMMARY

This research work aims at introducing "Natural Lighting" as an effective and attractive way of museum lighting, and as a convenient alternative which can, during day time hours, provide the illuminance necessary for displaying different articles, thus replacing, during the said hours, artificial (electric) lighting usually employed at museums around the clock.

The research work, in this respect, concentrates on museum halls, utilized for displaying paintings hanging on the walls, and fed by natural light through upper openings (top lighting).

The research work also aims at identifying the main architectural elements usually taken into consideration when designing such museum halls, viz : shape and dimensions of hall, shape, number, positions, dimensions and transmittance of the upper openings, and different finishings of the inner surfaces of the hall (ceiling, walls, floors) expressed as reflectances thereof. Identifying the different alternatives of each of the said elements then follows, together with relationships among then. Accordingly, under Egyptian weather, the lighting conditions (illuminance values and graduation) at different points in the hall are calculated for each of the cases relevant to the said alternatives, thus determining whether those lighting conditions suit the paintings from the points of view of both clear vision and

freedom from harmful effects. The rules that would enable the architect to correctly design the hall are thus laid down, taking the form of a computer program which indicates the illuminance resulting from each design alternative.

PROCEDURE:

- Study of natural lighting requirements in museums and getting acquainted with the principles, solutions and different opinions, quantitatively and qualitatively.
- Choice of the RESEARCH POINT, viz: a museum hall used for displaying paintings hanging on its walls, and lit by natural light coming from a clear sky through one or more openings in the ceiling of the hall.
- Study of the methods of analyzing the natural lighting and choice of the method most convenient for the research point, viz : the Flux Transfer Method, Computer Aided.
- Performance of experiments on the basis of the different alternatives of the architectural elements of the museum hall under study, and identifying the effects of those alternatives on the illuminance, quantitatively and qualitatively.
- Comparative analysis of results of the said experiments and formation of a computer program.

CONTENTS OF THE RESEARCH WORK:

Chapter (1): Requirements of Natural Lighting Inside Museums:-

Advantages and problems of natural lighting inside museums and how they are overcome; study of illuminance needed for different art exhibits; main factors that ensure good lighting inside museums.
Choice of the Research Point, viz: a museum hall used for displaying paintings hanging on its walls, and lit by natural light coming from a clear sky through one or more openings in the ceiling of the hall.

Chapter (2): Methods of Analyzing Indoor Natural Lighting:-

Study of the different methods of analyzing indoor

natural lighting and the possibilities and limitations of each method.
Identifying the most suitable one for the Research Point, viz: "The Flux Transfer Method".

Chapter (3): Experimental Study on Architectural Alternatives of Museum Halls:-

Experiments performed on the basis of choosing certain values for the different alternatives of the architectural features pertaining to the museum hall (RESEARCH POINT); study of their effects quantitatively and qualitatively on illuminance.
(Hall shape and dimensions - number, positions, dimensions, shapes and transmittance of the top openings - finishing of internal surfaces hence their reflectances).

Chapter (4): Analytical Results of the Experimental Study:-

Comparative analytical results of the experiments; identifying the extent of the effect of each design alternative on illuminance inside museum hall quantitatively and qualitatively.

Chapter (5): Computer Program for Analyzing Natural Lighting in a "Museum Hall for Displaying Paintings":-

The resulting computer program is built on the basis of the analytical results of the experimental study.
This program enables the design to obtain the necessary information in this respect, viz: lighting conditions (illuminance and graduation) resulting from choosing any of the architectural alternatives available for such a museum hall, at different points there in, and consequently, the designer may choose the best possible design to suit the exhibits to be displayed from the point of view of illuminance.