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KEY WORD : DAYLIGHTING / TOP APERTURE / FENESTRATION CONTROLS

PATAMAPORN SIRIPOLWUTICHA: DAYLIGHTING DESIGN TECHNIQUES THOUGH TOP APERTURE WITH FENESTRATION CONTROLS, THESIS ADVISOR: PROF. DR. SOONTORN BOONYATIKARN, THESIS COADVISOR: DR. VORASAN BURANAKARN, 230 pp. ISBN 974-334-761-5

Toplighting is one of the most widespread techniques utilized in modern architecture. The main problems in design with toplighting are the ability to control the variation of inside illumination level and its distribution. This study is aimed to searching for a technique to control daylight level inside a building and establish a simple design tool for toplighting design.

The study conducted by building physical model to analyze and test the internal illumination. Types of models can be divided into 2 groups as an uncontrolled aperture and a controlled aperture that can prevent direct sun from 8.00 a.m. till 4.00 p.m.. The controlled aperture can be categorized in two types, which are horizontal shading device and vertical shading device. In this study the fenestration areas to floor areas ratios and the interior reflection were examined and control as follows; The ratios of fenestration area to working area were 4% 8% and 12% while roof reflectance were 10% 40% 60% and 75% of all cases. The experiments were conducted in the skydome and also under the natural sky condition.

The numerical results show that the controlled apertures are able to minimize variation of internal illuminant more than three times of that of the uncontrolled aperture. In case of the controlled apertures, the important factors are composed of diffuse radiation from the sky, the roof reflectance and characteristics of fenestration control. The highest daylight factor level occurs in the case of vertical shading plane. The contribution of interior illumination consists of the following; 20% from diffuse light from sky, 35% from reflected light from roof, and 45% from reflected light from fenestration controls device. It can be concluded that such a control device is the most significant element of toplighting design in terms of quality and quantity. With these control elements the direct light will be changed into scattered light, which minimize heat gain in to space below.

Data from this study were illustrated in a form of monograph to predict internal illumination level. The monograph represents the relationship of types, aperture sizes, roof reflectance and internal reflectance to interior illumination. The result of this study can be use as a good toplighting design tool for several building types in tropical climate. This technique can also be used in the large-scale building, by adding more modules to the previous areas.

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