

Abstract

This research aims to study the profile and installation characteristics of light-shelves and ceilings that can optimize the daylight performance and solar shading of a typical south-facing office in Bangkok. In this study, the daylight performance of proposed installations are determined by the light intensity and its uniform distribution on the working plane. The methodology used in this research involves the use of a structural model and calculations from the computer software "Dialux 4.1". Its accuracy has been verified by comparing the light intensity that the software generated with the measurements taken in a full-size test room.

The standard room used in this study is 8 meters wide by 8 meters long and 3 meters tall. Along one side of the room is a continuous window which takes up 75% of the total wall area. The profile of light-shelves and ceilings used in this study are flat, slope, concave, and convex with different lengths, proportions, and heights. The reflectance of 95% is specified for the light-shelves and ceilings in all cases.

The results suggest that the most appropriate characteristics of light-shelves for the south façade of a typical office building in Bangkok are a combination of external and internal light-shelves. The external light-shelves should be 1.2 meters-long concave form with proportion 2.3:4 and installed at 2.2 meters high; the internal light shelves should be 1.4 meters-long concave form at 2.2 meters high. The installation of the internal/external light-shelves together with the high reflectance ceiling above the light-shelves shows a much improved daylight performance within the standard room.

After the installation, the average light intensity and maximum light intensity also decreases by 20.43% and 42.67% respectively, but the minimum light intensity also increases by 26.00%. Uniformity actually increases by 0.19, which is 58.27% higher than the case prior to the installation.

On average, the installation of the proposed light-shelves would contribute to the efficient use of daylight in 52.28 m² or 81.70% of the total floor area (64 m²), which is 27.76% higher than the case prior to the installation.

This conclusion can be used to provide fundamental information in the design of light-shelves and ceilings for efficient daylighting in south-facing office building in Bangkok. Furthermore, this study can be an inspiration for the architects and designers to explore the design solutions that involve both the quantity and quality of daylighting design which may lead to further development.