

Topic: An Experimental and Simulation Study of Daylighting in Atrium Building in a Tropical Region

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ABSTRACT

Daylight in the tropics is voluminous and offers good potential for the illumination of a building's interior. This work investigates daylighting, through a square roof-aperture, in an adjoining space of an atrium building. A series of physical experiments using a 1:25 scale model of ten-storey atrium building was conducted to measure the interior daylight illuminance and its distribution in the model under real tropical skies. A software based its daylight calculation on ray-tracing method for beam light transmission and flux transfer method for diffuse light transmission was run to compare its calculations with the measurements. The software was also run to evaluate the daylighting performance of the atrium model. The results show that the light well's configuration, the space depth from the well, and the sun's position greatly influence the interior daylight in the atrium space in a tropical climate. The daylight in the adjoining space is generally sufficient for circulation area throughout the day and all year round. The contribution of the sunlight to the northern area of the adjoining space is larger than of other areas. More uniformity of the daylight distribution is observed for the southern area of the space. The upper floors (8th-10th fl.) have a large variation of the daylight over the space. The effective daylighting zones are in 4-10 m. from the light well edge of the upper floors. For the middle to lower floors, effective daylighting zones are only at 2m. apart from the light well. The relationships between the daylight illuminances in the adjoining space can be adapted for free-hand calculation. The maximum ratio of interior to exterior diffuse illuminance (E_{di}/E_{do}) of shallow atrium ($WI=0.4$) is about 13% and the maximum ratio of interior to exterior beam illuminance (E_{bi}/E_{bo}) of shallow atrium ($WI=0.4$) is about 7%.

Keywords : Daylighting, Atrium, Illuminance, Well index, Tropics