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Effectiveness of a Perforated Light shelf for Energy Saving

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Abstract

Light shelves are natural lighting systems, the use of which has been highlighted in various studies as a suitable approach for reducing lighting energy consumption. However, external light shelves are at risk of being destroyed by high wind pressure when used on the upper stories of high-rise buildings. Therefore, this study proposes a perforated light shelf that minimizes the effects of wind pressure. Its effectiveness is verified through comparison of its lighting energy saving performance with that of previously tested light shelves in an actual testbed. The results showed that at vent ratios of 29.55%, 32.58%, 34.27%, and 35.35%, the lighting energy consumption of the proposed perforated light shelf (Case 4) increased by 20.6%, 20.6%, 42.9%, and 48.3%, respectively, in comparison with that of a non-perforated light shelf. However, at the same four vent ratios, the perforated light shelf was found to be capable of reducing the lighting energy consumption by 74.0%, 74.0%, 56.0%, and 51.4%, respectively, in comparison with a case without a light shelf (Case 1) and a case with a 0° fixed non-perforated light shelf (Case 2). In Case 4, the lighting energy saving rate of the perforated light shelf may be improved by increasing its width.

Keywords: *Light-Shelf; ; ; , Vent Ratio, Performance Evaluation, Energy Savings, Effectiveness*

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