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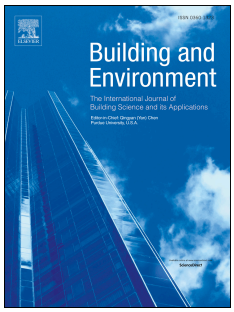

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Improving the air change rate in high-rise buildings through a transom ventilation panel: a case study

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Abstract

Passive ventilation techniques can both improve indoor air quality (IAQ) and reduce energy consumption and costs in buildings. In particular, using wind-driven ventilation as a passive design strategy can increase indoor air velocity in naturally ventilated buildings. In tropical regions, where there are only limited differences between indoor and outdoor air temperatures, wind-driven ventilation through a transom ventilation panel (TVP) can be a positive ventilation technique. In this study, we evaluated through experimental tests the efficiency of single-sided ventilation and cross-ventilation through a TVP in a unit within a high-rise residential (HRR) building. To this end, we carried out a series of numerical simulations to calculate the airflow patterns and the indoor air velocity for various outdoor wind speeds when cross-ventilation was applied. The results show that TVP can increase indoor air velocity by up to four times, depending on the outdoor wind speed and the location within the unit. Also, in windy conditions, the mean air change per hour (ACH) in a unit equipped with a TVP is 27% greater than a unit without a TVP. Moreover, a TVP can improve air change rate even when the outdoor wind speed is less than 0.02 ms^{-1}.

Keywords: numerical simulation; wind-driven ventilation; single-sided ventilation; cross-ventilation; atmospheric boundary layer (ABL); air change rate