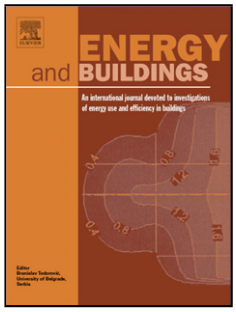

Title: Thermal comfort in naturally ventilated buildings with double skin façade under tropical climate conditions: The influence of key design parameters

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Thermal comfort in naturally ventilated buildings with double skin façade under tropical climate conditions: the influence of key design parameters

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Double skin façade; Tropical climate; Thermal comfort; Natural ventilation; Design parameters

Abstract: This paper evaluates the influence of key design parameters on the thermal behaviour of a naturally ventilated building with Double Skin Façade (DSF) under tropical climate conditions. Using a reference model of a conventional office building in the city of Rio de Janeiro and two groups of design parameters, dynamic thermal simulations are systematically applied to optimise design options with the aim to maximize the annual acceptable thermal comfort levels within the occupied spaces. This study not only defines the dimensional parameters to maximise the system airflows, but also investigates the significance of design decisions such as thermal mass and shading devices on the system performance. Options to avoid unintentional reverse flow on the upper floors and maintenance of balanced horizontal airflow rates across the floors are also addressed.

Two optimized naturally ventilated building models with DSF are developed and evaluated in terms of thermal performance. Results show that acceptable thermal comfort levels can be met for nearly 70% of the occupied hours. Although the office building will still require other means of cooling during peak summer periods, the incorporation of DSF as part of a mixed-mode ventilation strategy can potentially have a significant impact on annual energy consumption.

Highlights

- Optimised DSF models demonstrate acceptable thermal comfort levels for nearly 70% of the occupied hours
- Shading device characteristics are the most influential parameter on the thermal performance of DSF
- Extending the cavity height by one and a half floors above the roof avoids reverse airflows on the upper floors
- Similar airflows on all floors can be achieved by optimizing the free area of window openings