

Indoor environmental quality performance of mixed-mode ventilated shopping malls in hot-humid climatic region

ABSTRACT

Studies have revealed important roles quality indoor environment plays on human health and productivity; consequently, its influence on certain shopping behavior has also been well spelt out. In order to keep up with the demand for quality indoor environment, new trend has been evolving in the design of Malaysian shopping malls. From fully air-conditioned to newly designed ones that integrate passive ventilation strategies; and as such operating under mixed-mode ventilation system. These passive ventilation strategies are implemented to reduce energy consumption and also to improve the indoor environment within the mall's indoor space. However, the potentials of these designs in terms of their indoor environmental quality (IEQ) performance have not been studied nor have their advantages been revealed. In this study, occupants' thermal perception and IEQ performance was investigated in two mixed-mode ventilated malls selected based on their design concept ('open' and 'enclosed'). Both subjective and objective measurements were carried out in accordance with the ASHRAE performance measurement protocol for commercial buildings. Five IEQ factors (indoor air temperature, operative temperature, relative humidity, air speed, and carbon dioxide concentration level) were evaluated in the two malls. The results revealed that both malls fell below the ASHRAE comfort requirement but majority of the occupants still found the indoor thermal performance acceptable despite the high indoor air temperature recorded. For both malls, high air speed and low humidity level were recorded. However, higher air movement was still preferred by the occupants while the recorded mean carbon dioxide (CO₂) concentration was within the recommended level. The 'open' concept mixed-mode ventilated mall proved superior compared to the 'enclosed' concept by providing a more thermally tolerance indoor environment for its occupants. Generally, results from this study contribute to the knowledge on the advantages of adopting sustainable designs in commercial buildings for improving the indoor environment as well as the health and general well-being of the occupants. The study will open more opportunities for future IEQ studies to be carried out in hot-humid climatic regions.

Keyword: Hot-humid climate; Indoor environmental quality; Mixed-mode ventilation; Thermal comfort.