

ANALYSIS OF NATURAL VENTILATION EFFECT FOR AN OFFICE BUILDING CONSIDERING MOISTURE ABSORPTION BY MATERIALS

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ABSTRACT

Natural ventilation of buildings is becoming one of the major design approaches for sustainable buildings all over the world; however, the control strategies of vents or windows have not been well established especially when applied to hot and humid climate such as the Asian summer. In humid weather natural ventilation accelerates the absorption of water vapor by books, papers, materials used for furniture and furnishing, etc. This effect may increase the air-conditioning load when ventilation is performed intermittently in an air-conditioned building. Therefore it is important to determine ventilation control strategies on how and when vents or windows should be open and closed. For this analysis the authors developed a simulation code that can calculate air-conditioning load and room conditions by taking both natural ventilation and moisture flow analysis into account. In the present paper how much the vent schedules and quantities of moisture absorbing materials affects air-conditioning loads and room thermal conditions is evaluated and investigated. The results show that the natural ventilation controlled by temperature plus humidity ratio during nighttime is the best scenario among the considered scenarios, but enthalpy based control is not adequate contrary to expectation. Air-conditioning load is reduced by 37% in comparison to that for the no ventilation scenario.

KEY WORDS

Natural ventilation, Simulation, Moisture absorption, Air-conditioning load, Energy conservation, Asian climate

INTRODUCTION

Natural ventilation has come to international attention as a means to harmonize buildings with the natural environment and achieve energy conservation. Traditionally residential buildings relied deeply on natural ventilation for environmental control but other types of buildings depend mostly on HVAC systems. Recently however a number of naturally ventilated nonresidential buildings with a new concept can be found especially in European countries and the number of this type of project is increasing in Japan (Enomoto, Yoshida and Morita (1988) and Sako et. al. (1999)) and other countries as well. Most of the time in those buildings natural ventilation is achieved with the provision of specific features like vent shafts and automatically controlled vents instead of providing only manual opening/closing of windows.

Utilizing natural ventilation for controlling building environment and achieving energy conservation is a conventional technology but at the design stage comparing several design ideas and determining optimal control strategies for vents to maximize natural ventilation advantage is not an easy task. For the best design sophisticated computer simulation should be used to predict airflow rates and wind speed distributions in compartments. However the