

## Abstract

This research investigates the natural ventilation of two connected rooms installed with two openings of area  $A_1$  and  $A_3$  on the top of the rooms, doors of area  $A_2$  between the rooms and the occupants represent the heat sources. This research applies with, but not limit to, an occupied office building in which all occupants initially occupies one room before moving to another room for lunch or meeting. As the heat source moves, the amount of heat within each room also change, altering the direction of air movement and the ventilation flow rate.

The research studies the effect of varying the opening ratio ( $A_1: A_2: A_3$ ) and the changing of the amount of heat on the airflow between the two rooms and the outside. The experimental model is made of clear acrylic board with the dimensions of 0.20 m x 0.39 m x 0.20 m, and the adjustable heating plate of 0-500 W is installed at its floor. The model is placed in a 0.90 m x 0.50 m x 0.50 m transparent glass chamber filled with water and the direction of airflow is illustrated by dropping of blue ink into the water. The heat sources in the first and second room start from 0 and 500 W and are gradually increased with time until the heat sources in the two rooms are 500 and 0 W, respectively. The opening ratio  $A_1: A_2: A_3$  used for comparisons are 2:2:2, 5:2:2, 2:5:2, 2:2:5, 2:5:5, 5:2:5, 5:5:2 and 5:5:5.

The experimental results show 1) The opening ratio of 5:5:5 provides the largest amount of flow rate and the opening ratio of 2:5:2 provides the smallest amount of flow rate. This means large opening of equal area in every position produces the largest amount of flow rate while increasing just the area of the door produces the smallest amount of flow rate. 2) Increasing or decreasing only the area of one stack opening increases the flow rate between 44.21% to 75.74% compared to the 2:2:2 opening ratio 3) Alteration of the opening area in any position changes the room temperature in only one room, except for the opening ratio of 2:2:5, which is able to decrease temperature in both rooms regardless of the amount of heat. 4) Increasing of the area of opening on the top of the warm room shows insignificant effect on the temperature of the warm room. However, it is able to delay the increase of temperature in the other room and it also increases the average flow rate to 56%.

This study can be used to explain air movement in the two connected rooms with different usages. The relationship of the ratio of the openings, the heat sources and the room temperatures may be manipulated to bring about thermal comfort to occupants inside a ventilated space.