Abstract

The current energy crisis leading to global warming has continuously promoted the ideas of energy-efficient houses through the uses of natural ventilation. A good natural ventilation design can contribute to the reduction of a building's cooling load. However, in order for a naturally ventilated residential building design to perform at its best in commercial housing projects, one has to consider the master planning of the whole project, an aspect that has often been overlooked in most commercial housing projects.

This research paper studied the efficiency of natural ventilation in various master plan configurations of housing project using Computational Fluid Dynamics (CFD) software. The simulated parameters are plan configurations (grid and staggered) and the distances between buildings. Then further studied the effects of different wind directions of 15, 30, 45, 60 and 90 degree from the building's façade in a 5 (rows) x 9 (houses in each row) configuration by measuring the wind velocity coefficient of houses in the 5^{th} row. The results indicated that wind velocity coefficient is directly related to the ventilation efficiency. The results of this study showed that 1) in a windward condition, if the wind direction is 15, 30 and 45 degree from the building's façade, the designer should use a staggered configuration, otherwise use a grid configuration, and 2) in a leeward condition, use a staggered configuration.

In conclusion, this research can clearly show the followings. 1) A staggered configuration has higher ventilation efficiency, compared to a grid configuration. 2) Increasing the distance between rows to 2, 3 and 4 times of the building's height can increase ventilation efficiency, respectively. 3) The most appropriate wind direction in terms of ventilation efficiency is 30, 45 and 60 degree from the building's façade. Finally, not only that the results of this research can be used to aid in the master planning of commercial housing projects to allow better ventilation efficiency within a project. The calculated wind velocity coefficient at the opening of each building can also be used to aid in the design of an effective indoor natural ventilation system.