A STUDY OF PASSIVE WIND VENTILATION STRATEGIES FOR HIGH-RISE OFFICE BUILDING IN MALAYSIA

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By

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Malaysian climate is very hot and humid. The best known way to cool down fast is by using air conditioning units that is very high in energy consumption. Currently, the cost of energy is rising and the need to reduce energy is a must. If the rise of cost in energy continues, Malaysia will be hard hit because of the need of constant cooling throughout the year. That is why there is a need of natural ventilation and cooling in high-rise buildings particularly in urban settings. Malaysia is one of the developing countries. Even though buildings in Malaysia also are accounted of 40% of all energy used in the region.

Atrium can be a solution for energy saving element in building. An atrium is the social center of a building where people gather for social activities and also is a significant element of passive building systems when well designed to provide user requirements. Atrium contributes to passive heating and is useful in an overall ventilation and cooling strategy, and always makes daylight more available to the spaces that surround it. Properly designed atria have the potential to significantly reduce building energy consumption. That is why research is needed for atrium and its passive wind ventilation strategies.

The aim of this study is to provide knowledge about atrium, its history, its various contents and its condition in high-rise office building in Malaysia. For these reason, four basic generic types of atriums history are discussed and also its environmental, economical, energy conservation and its thermal condition is presented. After that, the best atrium solution for high-rise office building in Malaysia is found out through a simulation process. For simulation test, four types of atrium building are selected according to four basic generic forms (centralize, semi-enclosed, attached and linear) of atrium. Autodesk CFD 2017 is selected to run the simulation test.

The objective of this study is to find out the best atrium solution for high-rise office building in Malaysia. For these reason, simulation test is done through four types of atrium buildings. After running simulation test, thermal condition of these models are found out and observed. According to these results it is found out that semi-enclosed atrium and linear atrium are the best performer for high-rise office building in Malaysia.

According to the above discussion, this paper presents definition of atrium, its contents and uses. After that the best atrium solution for high-rise building in Malaysia is found out through a simulation test for energy conservation & to reduce dependence in mechanical ventilation.

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APPROVAL

This thesis was submitted to the Senate of Infrastructure University Kuala Lumpur (IUKL) and has been accepted as fulfilment of the requirement for the degree of Master of Science in Built Environment. The members of the thesis Examination Committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Infrastructure University Kuala Lumpur or at any other institution.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Climate is considered one of the most important elements affecting the building's design. The world faces an energy problem, which appears as the depletion of conventional energy resources, as well as the global warming and the climatic changes as a consequence. Buildings are considered the main energy consumer, especially for the purposes of heating, cooling and lighting. The architectural design plays a fundamental role in achieving thermal comfort. Accordingly, a climate requires to be one of the most important design criteria in order to obtain building design, which can be energy efficient, environmentally friendly and an achievable to the highest degree of thermal comfort (Abdullah, Meng, Zhao, & Wang, 2009).

Malaysian climate is very hot and humid. The best known way to cool down fast is by using air conditioning units that is very high in energy consumption. Currently, the cost of energy is rising and the need to reduce energy is a must. If the rise of cost in energy continues, Malaysia will be hard hit because of the need of constant cooling throughout the year (Elotefy, Abdelmagid, Morghany, & Ahmed, 2015).

Building sector is responsible for at least 40% of energy use globally in both developed or developing countries such as the middle east region (UNEP, 2009) and almost 33% of its energy is known to be used by HVAC systems in buildings (Salib & Wood, 2013). Amongst all building types, tall buildings use more energy due to deep plans and provision of HVAC to maintain comfort levels (Holford & Hunt, 2003).

That is why there is a need of natural ventilation and cooling in high-rise buildings particularly in urban settings. Using atrium can be a solution for natural air movement in high-rise building. The development of atrium buildings in Malaysia is growing in number. This design trend is recognized as one of the most popular and environmentally stimulating spaces of today’s architecture, often shutting out the harsh

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