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THE EFFECT OF DIFFERENT PICTH OF THE ROOF FOR VENTILATION

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This project report attached hereto, entitled **"The Effect of Different Pitch of the Roof for Ventilation"** is prepared and submitted by Sri Rumi Ananda Melanos B. basri in partial fulfillment of the requirement of Bachelor's Degree with Honours in Civil Engineering is hereby accepted.

(Dr. Siti Halipah Bt. Ibrahim)	11th MAY 2005 Date

Dedicated to My Beloved Family

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THE EFFECT OF DIFFERENT PITCH OF THE ROOF FOR VENTILATION

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ABSTRACT

In this study of roof technology particularly on ventilation which is aimed on residential located in Kuching area. The main aim is to maximize the roof ventilation, by the wind pressure which create pressure differential (suction). In produce this effect, it is important to analyze the mechanics of the wind, especially the force produced and the direction of the wind. From the analysis, it will assist in designing the roof especially in locating the roof vent, where ventilation can be promoted effectively. With effective roof ventilation, it may allow built up heat to dissipate. Even in cooler climates a minimal amount of ventilation is desirable to allow built up moisture to escape. However, in hot humid (tropical) climates can result in excessive condensation under the roof. Although, roof ventilation only has a marginal effect on cooling compared to good insulation in these climates, ventilation and circulation with outdoor air are the major moisture control strategies for attics.

ABSTRAK

Dalam kajian teknologi bumbung ini terutama sekali dalam pengudaraan adalah tertumpu ke kawasan Kuching. Sasaran utama adalah untuk memaksimakan pengudaraan loteng (ruang antara siling dengan bumbung) dengan tekanan angin yang menghasilkan sedutan. Untuk menghasilkan kesan sebegini, adalah penting untuk menganalisa sifat mekanik angin, teruma tekanan yang dihasilkan dan arah angin tersebut. Analisis sebegini, akan membantu dalam merekabentuk bumbung terutama sekali kedudukan pengudara bumbung, iaitu di tempat pengudaraan boleh dihasilkan dengan efektif. Dengan pengudaraan bumbung yang effektif, ia membolehkan haba yang terkumpul untuk dikeluarkan. Dalam iklim yang agak sejuk juga, pengudaraan yang minimum adalah diperlukan untuk mengeluarkan kelembapan. Walau bagaimanapun, dalam iklim panas dan lembap (tropical) boleh menyebabkan berlakunya kondensasi yang tinggi di bawah bumbung. Walaupun pengudaraan bumbung hanya memberi kesan yang kecil untuk penyejukan dalam iklim sebegini, pengudaraan dan kitaran dengan angina sekitar adalah strategi utama untuk mengawal kelembapan loteng.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

The study of passive cooling with natural ventilation made as to enrich the living of occupants in both residential and other purpose of building. It is undeniable that the role of ventilation in the energy balance of buildings is very important as the understanding of such area would nevertheless increase our ways in designing building and seeing it from different perspective, such as structure.

These researches was made in line with the matter arise in many countries with different climate. Studies were conducted with different methods adapting to the purpose of the research.

Recent studies had been done in examining the factors contributing to the effective ventilation of spaces in a warm, humid climate using Government residential areas as a case study. From the studies, it is found that most spaces in modern building are not adequately ventilated and recommends that effort should be directed towards the use of windows to achieve physiological comfort (Ajibola, 1994). The study focuses on ventilation as a means of attaining physiological comfort. Ajibola stated that ventilation in a space is a primary factor determining human health, comfort and well-being. Studies by Givoni (1969), Koenigsberger et al (1973), states that the type of spaces most suited to this climate are spaces, which are cross ventilated. Alternatively, the designer can also make openings on the wall or openings on the adjacent walls.

According to Ajibola, most housing in Nigeria, evaluation studies have focused on the optimal used on the optimal use of space, building materials and technology in relation to cost. Studies of residents' satisfaction to date have focused on socio-psychological issues, while physiological issues such as ventilation have been taken for granted, and thus have been relegated to the background. However, due to the specific environmental problems of high temperature, high humidity, low wind velocity and variable wind direction in warm humid climate, a proper naturally ventilated space seems to be a difficult task. Even though, the type of spaces most suited to this climate are spaces which are cross-ventilated (Givoni) such as making some openings at least on the opposite sides of the wall, but difficulties occur as there are design constrains such as security, privacy and the desire of users for large spaces. Givoni, Koenigsberger et al, identify the factors affecting indoor air movement as follows:

1. Orientation of the building with respect to wind direction
2. Effect of the external features of the openings
3. The position of the openings in the wall
4. The size of the openings
5. Control of the openings

Ajibola stated that, to get all the spaces in a building cross-ventilated is not really feasible within the limitation of the land and other economic considerations. He believes that by considering the combination of both pressure and buoyancy forces as a mean of encouraging air movement in spaces may provide a better solution.

M. Fordman (1999) also proves that, building should be designed with controllable natural ventilation as a very high range of natural ventilation is necessary so that the heat transfer rate between inside and outside can be selected to suit conditions. He also mention that, the ventilation rates are selected to control temperature, pollution and air movement. Moreover, natural ventilated buildings can minimize the use of fossil fuel energy.

Mulfida (1994) stated that in Indonesia due to limited budget, the housing provided for the poor people has been built without taking the comfort standard into consideration. Moreover, the thermal comfort has been worse, due to inappropriate selection of building materials. Besides that, the use of massive thick walls increases the temperature inside the building. While the openings on the wall are not enough to allow air changes and air movement within the building. His research also show that the indoor temperature below the roof to be much higher when the noon sun is heating the roof.

He also mention that the improvement of the indoor thermal comfort could be achieved by considering the thermal behaviour of the building that is caused by sun exposure and by considering the characteristics of the wind (velocity, direction and frequency). Moreover, the use of building materials with low heat capacity, low conductivity and low absorptance could improve the indoor thermal comfort. A proper design of roof can control the solar heat gain at a low level. Ventilation of the roof or alternatively by thermal insulation can be used for the purpose.

In warm and humid areas where mean solar radiation is relatively high, the heat received by the building fabric significantly affects the internal air temperature. Most of the heat received is from solar radiation. According to Hanafi, the value of radiation received by building fabric depends on many factors as indicate below: -

i. Angle of radiation against the building surface.
ii. Type of roof and wall
iii. Type of window
iv. Site latitude
v. Building orientation at the site

vi Season in a year

The rate of solar radiation received by building surfaces vary depends on the season. In the figures below shows the solar radiation both on vertical and horizontal in different time.

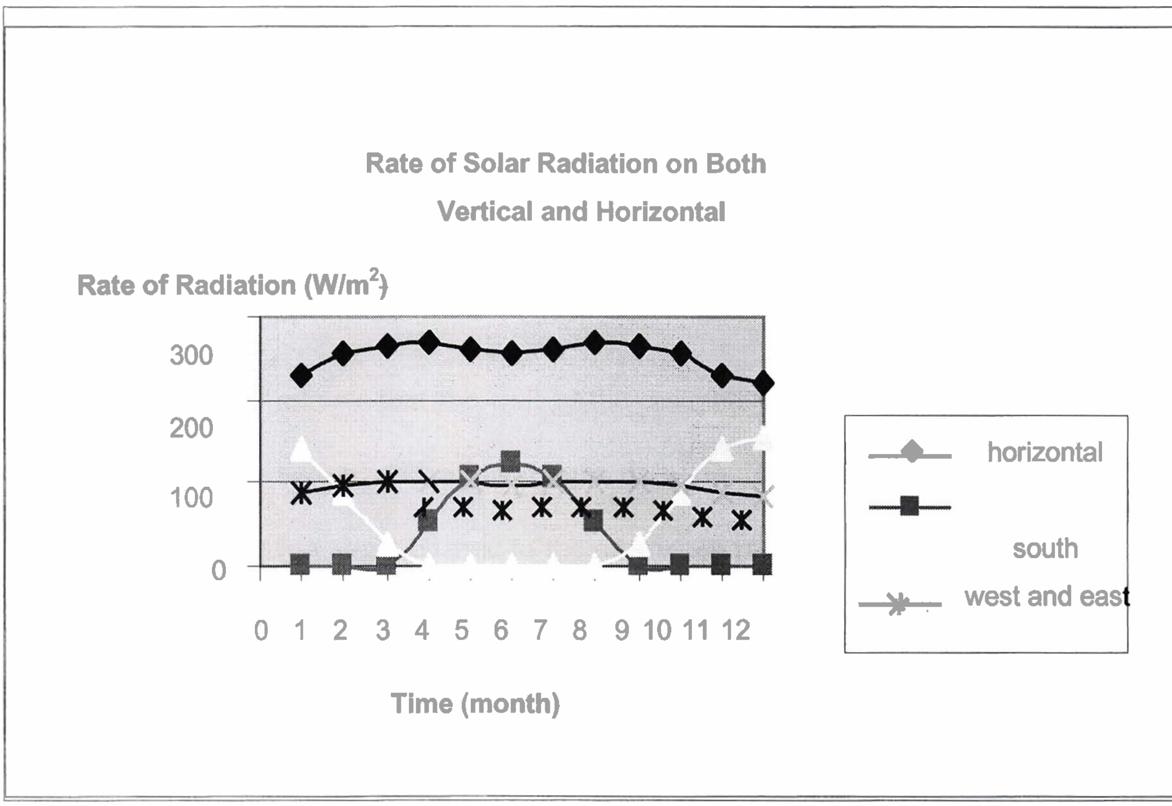

Fig 1.1: Rate of solar radiation (Source: CIBSE,1986)

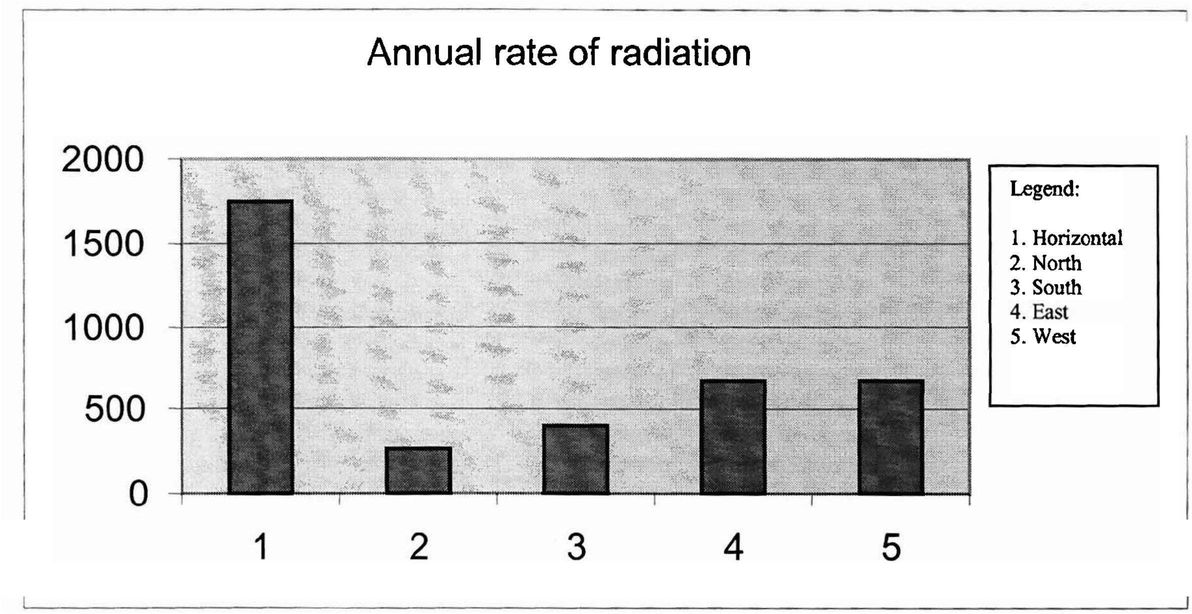

Fig 1.2: Annual rate of radiation (Source: CIBSE,1986)

From the figure indicate that the wall to the east and west received the same amount of solar radiation at least 6 hours daily in September and March. However, there is only a slight change to the roof when radiation against the roof occurs with difference in season. The highest radiation occurs at the roof with an average 251 W/m^2 monthly. It also indicate that the roof is the part where maximum heat to the building during diurnal and causing the air temperature to increase exceeding the comfort level.

Building standards, driven by energy shortages, have sewn up the houses that we live in tighter than a drum. Therefore, most homes are woefully under ventilated.

Roof ventilation should be a major concern to anyone who is contemplating having their home re-roofed. It is common for the average household to produce from four to five pounds of water vapor per day years (Maynard, 1990). In poorly ventilated homes, this moisture has nowhere to go. So it forms condensation on the underside of the plywood sheeting of the roof, causing the plywood to expand, buckle and delaminate. This degrading plywood has an ill effect on the roofing, including reduced nail holding power, wind damage due to an uneven deck and stress cracks due to unstable decking materials.

During hot weather, when temperatures can soar above 100 degrees, your attic is 145 degrees and the temperature on your new roof is nearly 180 degrees (Maynard, 1990). It is now more important than ever for a total roof ventilation system. A proper attic vent system consists of an intake and an exhaust. Most often, this system works much like a fireplace. As warm air rises, it creates a slight suction at the intake vents. This relatively cooler air removes excess heat from the underside of the sheeting as it exits the exhaust. This cycle of heat exchange regulates the temperatures of the new shingle, saving your investment in roofing from becoming a cinder.

When it comes to ventilation, more is always better. Choices are many in ventilation. The turbine ventilators are a good product, however the aesthetics are poor and they can become a maintenance headache as they get older. Dormer