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(USBET) 2023**

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ENVIRONMENT**

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THE NATURAL VENTILATION PERFORMANCE OF TRADITIONAL MALAY HOUSE AT RUMAH TOK SU, ALOR SETAR, KEDAH

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ABSTRACT

Natural ventilation is one of the passive methods that are necessary to provide indoor air quality. Its helps to gain better indoor air and increase awareness of energy saving. However, the problems related to the hot and humid climate in Malaysia will encounter heat problems that will cause discomfort in the house. Because of that, modern house nowadays prefers to apply mechanical cooling system such as air conditioning in providing thermal comfort. This problem contributes to not only high-energy usage, but it will also prevent ventilation from occurring and make people feel uncomfortable. The traditional Malay house was a good example that provided some space arrangement that was compatible with the local climate and better thermal indoor comfort compared to the modern house. As a result, the aim of this study is to explore how architectural details of traditional houses such as openings, roofs, or affect air movement performance, with the goal of incorporating thermal comfort design elements into modern houses. A case study of traditional Malay house at Rumah Tok Su, Kampung Warisan, Alor Setar, Kedah was chosen. The house shows that orientation of the house and the position of ventilation openings play an important role to determine the indoor air flow performance. The findings of this research are expected to show that passive design strategies such as cross and stack ventilation allow air flow through the house.

Keywords: *Traditional Malay House, Rumah Tok Su, Natural Ventilation, Thermal Comfort, Stack Ventilation.*

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INTRODUCTION

Malaysia is known as a country with a tropical climate, which is defined by a uniform temperature, high humidity, and copious rainfall. But these hot and humid climates are not considered when designing a house. Indoor thermal comfort and air quality supposed to be the main priorities when designing a building to give comfort and make occupants comfortable. It can be seen from modern houses nowadays that frequently use air conditioning systems because of no outdoor air flow into the house. That leads to environmental pollution and energy waste. Nishi (1981) describes the term when the occupants do not feel either too warm or too cold for the temperature as “an expression of satisfaction” with the thermal environment.

Therefore, in terms of thermal comfort and passive methods, a traditional Malay house created with a profound awareness nature and the tropical environment may be incorporated into a contemporary dwelling. There are many architectural characteristics at the traditional Malay house that useful in providing efficient air flow into the buildings (Ghaffarian Hoseini & AmirHosein, 2014). Because of that, it is necessary to identify the characteristics and elements of traditional Malay architecture that enable for natural ventilation to be introduced into the interior area.

The aim of research is to examine the natural ventilation performance of traditional Malay house at Rumah Tok Su, Kampung Warisan, Alor Setar, Kedah. The objective of this study are:

1. To find out the importance of natural ventilation and its affect for thermal comfort inside the house.
2. To identify the architectural details of traditional Malay house that allow natural ventilation into the house.

LITERATURE REVIEW

Natural ventilation is the flow of air between the outside and inside of the building with the goal of supplying cool air and removing heat and air pollution. It was one of important approaches in building design but gained less attention from architects who desired to use air conditioning. A sustainable house concept depends on natural ventilation in providing comfortable thermal comfort and better indoor air quality (IAQ) to the occupants while maintaining acceptable energy (Schmidt, A.Maas, & G.Hauser, 1999). There are two approaches for natural ventilation occur, which are cross ventilation and stack effect ventilation. According to Schmidt, et al. (1999), cross ventilation is an approach to gain natural air supply in a building, but it always depends on natural forces such as wind direction and availability. Meanwhile, the

existence of stack ventilating is caused by differences in air pressure between the exterior and interior structure, which cause air movement through the building's uppermost and lowest openings.

METHODOLOGY

This study was carried out by using a method of qualitative. Qualitative data is a systematic subjective method used to define life experiences and provide meaning with the purpose to gain understanding and explore the intensity and complexity inherent in the experience. Findings are gathered over three major methods which are literature review, case study and site visit which involves in textual or visual analysis from publications and observations at the place.

The literature review discussed about the importance of natural ventilation and the architectural details such as roof, openings, building orientation and more details of traditional Malay house that need to be consider to achieve good natural ventilation and thermal comfort. The data are collected through materials such as journal, books, article and other reliable sources. Other than that, A case study at Rumah Tok Su, Kampung Warisan, Alor Setar, Kedah is carried out to observe the building and surrounding environment as well as to collect data regarding the natural ventilation performance and its affect for thermal comfort. Site visit at Rumah Tok Su was also conducted. The aim for this site visit was to look at the environment and the architectural details of Rumah Tok Su. It can help to achieve better understanding and gain deeper knowledge on how the natural ventilation flow inside the traditional house.

There are several limitations in this study such as the lack of quantity of pervious research and case study that related to natural ventilation of traditional Malay house at Kedah in articles, books or website. So, a site visit should be done to get more information and experiences. Other than that, during the site visit, permission to enter the house was given but not allowed to take pictures inside the house.

RESULT AND FINDINGS

Rumah Tok Su has a thatched roof covered with nipah palm leaves that commonly used as roofing material for Rumah Bumbung Panjang. Thatched roof made from palm leaves which are lightweight materials and a good thermal insulator. Atap roof does not absorb much heat from solar radiation and cools down the interior during the day and night. The roof gaps between the roof rafters and the roof panelling as shown in Figure 1 act as ventilation openings for the area due to the lack of ceiling. It also allows natural lighting to penetrate the indoor environment.

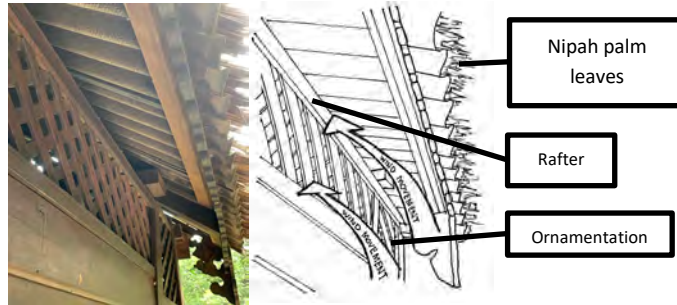


Figure 1: Air movement flow through roofing gaps and ornamentation.

Rumah Tok Su has a lot of full-length timber panel windows (Figure 2) built on the wind direction flow which is the east and west façade. The windows are around 1.8 meters height and 0.9 meters width. Cross ventilation could occur because of these windows been left open most of the time and with the help of large overhangs, it could help to offering protection from the driving rain and reduce the glare.



Figure 2: Openings such as windows and doors in Rumah Tok Su.

Timber became the main material structure of Rumah Tok Su including walls, doors, windows, floors and more. These materials are good heat insulators and do not absorb much heat from solar radiation that could bring good thermal comfort.

Other design strategies that can be seen in providing climatic comfort to the traditional Malay house is shading devices. Rumah Tok Su has shading devices such as large roof overhang and a shady trees as a buffer. The roof overhangs in the Rumah Tok Su range from 1000mm to 1400mm. Large roof overhang could control direct solar radiation, give a good shading and provide good protection against heavy rain.

All of the spaces of Rumah Tok Su are built in stilts with variety levels. The core house spaces (ruang tamu, ruang tengah, kelek anak, bilik tidur and ruang dapur) are raised about 1.95 meter, meanwhile at other spaces (ruang basahan and verandah) are raised about 0.5 meter to 1 meter above the ground. As shown in figure 3, the raised floor that built higher than the ground, allow natural ventilation under the floor and the gaps between the timber planks for the floor can sip the air into the inner space.

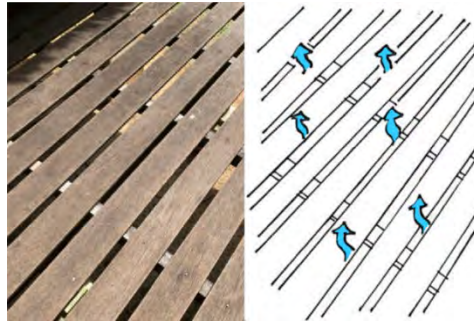


Figure 3: Wind movement through timber flooring gaps.

CONCLUSION

As a conclusion, this study can conclude that architectural details of traditional malay house could affect the thermal comfort by allowing natural ventilation into the house. Traditional Malay house is an excellent references for architects and designers in understanding climatic, design flexibility, environmental design, and building systems. It is important to adapt and considerate to the present and future modern passive design of a house. Highly recommended for better future building to build suitable with the climate based on materials, opening, roof and environment surrounding. As example, a terrace house that built attached to each other lead to lack of openings. Ample numbers of opening are highly encouraged for air flow inside the house. Meanwhile, for the materials are preferred to use low thermal conductivity materials and a landscape that more exposed to the greenery for better natural ventilation to enter the house.

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