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THERMAL INSULATION FOR BUILDINGS UNDER TROPICAL CLIMATIC CONDITIONS IN KUALA LUMPUR

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ABSTRACT

Thermal comfort is essential in a tropical climate, and air conditioning systems in buildings provide better thermal comfort than other systems. However, the building's air conditioning system consumes a significant amount of energy in order to meet the thermal comfort requirements of a tropical climate. In order to reduce the use of the cooling system, an efficient thermal insulation system in the building can increase energy efficiency. Thermal insulation is a technique used to keep heat from exiting or entering a space. However, it is not widely used in buildings since few people are aware of its benefits and effectiveness. Thus, several aspects of thermal insulation have been explored using journals, comprehensive observation from two buildings in Selangor and Negeri Sembilan, and a quantitative method including 45 respondents. According to the results of the questionnaires, guests prefer to stay in a building that has thermal insulation installed. It may be stated that essential criteria must be established for designers and building owners to follow during the design phase in order for the built environment to suit their needs.

Keywords: *Thermal insulation, Tropical climate, Thermal comfort, Energy consumption, Energy efficiency*

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INTRODUCTION

Governments worldwide are realising the need to reduce their reliance on energy imports as fuel reserves dwindle and supplies become concentrated in a few politically unstable countries. Thus, thermally insulating buildings is one effective approach to reduce energy demand. Thermal insulation keeps heat from exiting or entering an area, so keeping it warm or cool. In places where people use more energy for cooling, such as Malaysia, adding thermal insulation to buildings can dramatically reduce energy consumption. This reduction in energy demand has the potential to save up to 40% on electricity expenditures while also contributing to the country's energy conservation initiatives. Thermal insulation also contributes to a more pleasant living and working environment.

Furthermore, while using air conditioning to maintain comfort is prevalent in Malaysia, it can result in the production of chemical compounds that contribute to global warming. Thermal insulation can lower emissions from air conditioning equipment, resulting in a cleaner environment.

LITERATURE REVIEW

Concept of Thermal Insulation

The main purpose of installing thermal insulation material in a dwelling is to reduce energy consumption for cooling and heating by insulating the building envelope. (Chandra et al., 2019) Thermal insulation is defined as a material or combination of materials that slows the passage of heat, reduces certain sound transmission or slows the spread of fire. Thermal insulation materials can be adapted to any size, shape, or surface and a range of finishes can be applied to protect thermal insulation from mechanical and environmental damage while also improving the aesthetic of buildings. (Khandelwal, 2010)

Advantages of Thermal Insulation in Building

The primary reason for installing insulation in a building is to reduce total thermal energy losses in order to conserve energy. Other than that, thermal insulation installation also provides both immediate and long-term benefits such as it can save thousands of ringgits in electricity bills building owners does not have to invest their money in buying any cooling systems. (Barakat & Chamberlin, Inc. et al. 2014) Heat gains can be reduced by up to 25% by insulating your roof and walls. Installing thermal insulation provides stable indoor temperatures, reducing the need to run cooling system as frequently as before. (Monika Frontczak, 2011)

Methods and Types of Thermal Insulation

Insulation materials are well-known for its function to decrease the rate of heat loss or gain through the building envelope. Despite the fact that all insulations serve the same function, some materials perform a specific role. Hence, they are classified appropriately. (Benjamin Durakovic et al., 2020) All building insulation materials are divided into three categories such as inorganic, organic and new technology materials that includes dynamic materials and transparent materials. (Mohammad Fawaier et al., 2022)

Suitable Thermal Comfort in Malaysia

Thermal comfort is a state of mind that expresses fulfilment with the thermal environment and is evaluated subjectively. (ANSI/ASHRAE Standard 55, 2017) The primary parameters influencing thermal comfort are those that determine heat gain and loss, which include air temperature, mean radiant temperature, air speed, and relative humidity. It is difficult to achieve the right thermal comfort. The Health and Safety Executive (HSE) suggests that with proper design, construction, and maintenance, such as controlling the environment by improving air movement through natural ventilation, humidify or dehumidify the air and last but not least, installing thermal insulation that acts as a barrier.

METHODOLOGY

In order to have a better understanding of the guest's preferences on the thermal comfort in a building, a survey have been done to 45 respondents who came from various backgrounds, who visited and stayed at the two buildings that were chosen for the case study. i) The Kabin, Kuala Selangor and ii) Pilah Kontenastay, Kuala Pilah. This is also to compare their thermal insulation application. To obtain the rough guidelines of the questionnaire, some literature review has been conducted. The information for literature review were obtained from the articles, books, journals, and from the various websites

One significant limitation of this study is the lack of information on the specific type of thermal insulation used in The Kabin, Kuala Selangor. Although it is known that thermal insulation has been built in The Kabin, the lack of precise knowledge about the exact thermal insulation materials used in the analysed scenario limits the accuracy and breadth of the findings. Another limitation that should be mentioned is the small number of people that took part in this study. The lack of respondents may have an impact on the generalizability and robustness of the findings, necessitating caution in drawing broad inferences based on the findings.

ANALYSIS AND FINDINGS

A total of 45 respondents were involved in this questionnaire. The results reflect a reasonably decent balance of male and female respondents, as well as a wide age range of respondents. Most of the respondents are either working full time or a student.

Data from The Kabin, Kuala Selangor

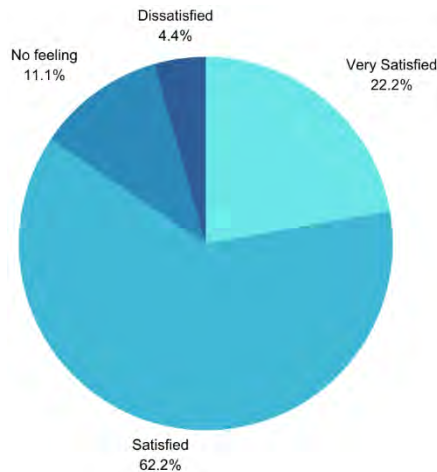


Figure 1: Pie Chart Showing the Guest's Satisfaction Towards the Temperature

Figure 4.1 above shows that the majority of respondents that are staying at The Kabin are content with the temperature in the building and have chosen not to change it. Individuals are pleased with the indoor temperature conditions because of the presence of thermal insulation in the building. The dissatisfaction of 4.4% of respondents is due to the incoming sun as well as cooling systems that do not respond quickly. When asked about how long they switch on the cooling system, only 14.3% of them answered "Most of the time" while the remaining percentage said "Sometimes". It demonstrates that the use of thermal insulation contributes in the decrease of energy usage.

Data from Pilah Kontenastay

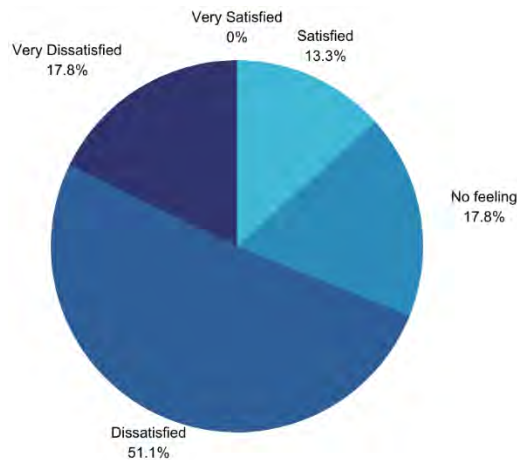


Figure 2 : Pie Chart Showing the Guest's Satisfaction Towards the Temperature

According to Figure 2 above, most of the respondents are not satisfied with their thermal comfort and with the indoor temperature of the building. The dissatisfaction of 68.9% of respondents is due to the incoming sun, hot surrounding surfaces, as well as cooling systems that do not respond quickly. This is due to the absence of thermal insulation in the building of Pilah Kontenastay. When asked about how long they switch on the cooling system, most of the respondents (77.1%) chose "Most of the time" while the remaining percentage said "Sometimes" which results in using a significant amount of energy in order to meet the thermal comfort requirements. Feedback from the questionnaire shows the result where 80% of respondents does not think the building is well insulated. This proves that this building does not meet the thermal comfort requirements.

CONCLUSION

A survey was conducted at two distinct buildings, The Kabin in Kuala Selangor and Pilah Kontenastay. Thermal insulation was installed in one building but not in the other. Thermal insulation effectively lowered energy usage while providing ideal thermal comfort, according to the findings. Respondents at The Kabin, which had thermal insulation, depended less on cooling systems than those at Pilah Kontenastay. This is due to the reduced heat flow achieved through thermal insulation installation. Overall, this research highlights the importance of comparing buildings with and without thermal insulation in order to determine the efficacy and benefits of installing such a thermal insulation material in a building.

However, this study includes a few limitations that may have an impact on the findings. Because of the low number of respondents, the results may be influenced. As a result, improving the number and qualities of respondents will be much more crucial in future research. It is intended that the findings of this study will help the designer in creating a better environment for those they serve. A comfortable environment can lead to happy and satisfied guests, who are more likely to become devoted customers of the business.

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Sekian, terima kasih.

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Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
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Setuju.

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